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Application of Computer and IT Tools in Improving Learning and Research Efficacy of Students

February :01-07,2022

TRAINING COMPENDIUM



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***STRENGTHENING INSTITUTIONAL CAPACITIES FOR DELIVERING
COMPETENT SKILLED PROFESSIONALS***



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Institutional Development Plan(IDP), SKUAST Jammu

Strengthening Institutional Capacities for Delivering Competent Skilled Professionals

One Week Vocational Course



**Application of Computer and IT Tools in Improving Learning and Research Efficacy of Students
(February 01-07, 2022))**



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Microsoft Office and its Components**Anil Bhat***Corresponding Author: drbhatanil@gmail.com*

There are many reasons for using computers today. Word processing is area which has proved computers to be powerful than ever. There are many different kinds of word processors available today, however, most share the same basic functions and do not require advanced computer or typing skills to use. These basic functions include typing, saving documents, opening documents, copying, pasting, cutting printing, checking spelling, etc. The commonly used word processors include Microsoft Word, ClarisWorks, Word Perfect, Word Pad, Apple Works, etc.

Microsoft Word**Introduction**

Microsoft Word, or Word as it is commonly known, is a software application that allows the user to perform word processing. The word processing means the creation, input, editing, and production of documents and texts by means of computers systems. Microsoft Word allow the user to format text with attributes such as bold, italics, font size, and margins. It is part of the Microsoft Office suite of applications and is a highly popular programme for the workplace.

Microsoft Word was first released in 1983 under the name Multi-Tool Word for Xenix systems. Versions were later written for several other platforms including IBS PCs running DOS in 1983, the Apple Macintosh in 1984 and Microsoft Windows in 1989. The latest release is Word 2010.

Many concepts and ideas of Word were brought from Bravo, which was created by Charles Simonyi, at Xerox PARC. Charles Simonyi left PARC to work for Microsoft in 1981. Simonyi and Richard Brodie, who had worked with him on Bravo, developed the programme, which was originally named Multi-Tool Word.

Microsoft released the programme Microsoft Word (old Multi-Tool Word) in October 1983, for the IBM PC. Free demonstration copies of the application were bundled with the November 1983 issue of PC World, making it the first programme to be distributed on- disk with a magazine.

Word was the first application with ability to display bold and italics text on an IBM PC and to make full use of the mouse.

Word 6.0 was the second attempt to develop a common codebase version of Word. The first, code-named Pyramid had been an attempt to completely rewrite the existing Word product. Later versions of Word had more capabilities than just word processing. The Drawing tool allowed simple desktop publishing operations such as adding graphics to documents. Word 2007 is the most recent version of Word.

This release includes numerous change, including a new XML-based file format, a redesigned interface, an integrated equation editor, bibliographic management, and support for structured documents. It also has contextual tabs, which are functionality specific only to the object with focus, and many other features like Live Preview, Mini Toolbar, Super-tooltips, Smart Art, etc.

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Features

Microsoft Word is a powerful word processor. Various features of Microsoft Word are explained hereunder:

- 1) **Insert Text.** It allows the user to insert text anywhere in the document.
- 2) **Delete Text.** It allows the user to erase characters, words, lines, or page.
- 3) **Cut and Paste.** It allows the user to remove a section of text from one place in a document and insert it somewhere also.
- 4) **Copy.** It allows the user to duplicate a section of text.
- 5) **Page size and Margins.** It allows the user to define various page size and margins.
- 6) **Search and Replace.** It allows the user search for a particular word or phrase. The user can also replace one group of characters with another everywhere that the first group appears.
- 7) **Print.** It allows the users to print a document as hardcopy.
- 8) **File Management.** It allows the user to print a document as hardcopy.
- 9) **Font Specification.** It allows the user to change fonts within documents, such as bold, italics, and underlying.
- 10) **Footness and Cross- References.** It automates the numbering and placement of footness and enables the user to easily cross-reference other sections of the document.
- 11) **Graphics.** It allows the user to embed illustrations and graphs into a document.
- 12) **Header, Footer and Page Numbering.** It allows the user to specify customised headers and footers to keep track of page numbers so that the correct number appears on each page.
- 13) **Layout.** It allows the user to specify different margins within a single document and to specify various methods for indenting paragraphs.
- 14) **Macro.** A macro is a character or word that represents a series of keystroke. The keystrokes can represent text or commands. Macros allow the user to save lot of time by replacing common combinations of keystrokes.
- 15) **Merges.** It allows the user to merge text from one file into another file. This is particularly useful for generating many files that have the same format but different data.
- 16) **Spell Checker.** It allows the user to check the spelling of words. It will highlight any words that it does not recognise.
- 17) **Tables of Contents and Indexes.** It allows the user to automatically create a table of contents and index based on special codes.
- 18) **Thesaurus.** A built-in thesaurus allows the user to search for synonyms without leaving the word processor.
- 19) **Window.** It allows the user to edit two or more documents at the same time. Each document appears in a separate window.
- 20) **What the User See Is What the User Get (WYSIWYG).** It is equipped with WYSIWYG, which means that a document appears on the display screen exactly as it will look when printed.

Creating a Document

To create a new document at any time, click the New button on the Standard toolbar. While creating a document such as memo, letter, report, or resume, one can often save time by using one of the default wizards or templates that come with Word.

A new document is opened and given a temporary name 'Document 1'. If another new document is opened, it would be named as 'Document 2' with the next document named as 'Document 3' and so on.

When a document is opened, it is placed on the top of any existing ones and becomes the active document.

Once a document is created, the user may then enter the text in the document.

The following procedure may be followed to create a new document from an existing wizard or template:

- (1) On the File menu, Click New
- (2) In the New Document task pane, under Templates, click one of the links, or type text, such as 'brochure' or 'calendar' into the Search online for box, and then click Go.
- (3) Choose the template or wizard as required.

Saving a Document

To save a document, click the save button on the Standard toolbar or click the File menu and select Save.

If a document is being saved for the first time, click on Save As under the File Menu. Save As dialog box appears. From the Save in field, select the drive, directory, or folder where the file needs to be saved. Type a name for the document in the File name field. Click Save.

For subsequent saves, click the File menu and select Save. The file is saved automatically to the location where the file was saved previously. When a document is saved, it remains open on the screen so that the user can continue working.

Word can protect the work by saving a temporary copy of a document periodically as the work is done.

If a document is to be saved under a different name or in a different format, click the File menu and select Save As. This allows the user to choose a new name, directory, or format to save the document as.

Opening a Document

Word keeps track of the documents the user has worked on most recently. The user can quickly open one of these documents by choosing it from the list at the bottom of the File menu.

As many as nine documents can be listed at the bottom of the file menu. To change the number of documents in this list:

- (i) Click the Tools menu and select Options.
- (ii) Select the General tab and type the number of documents to see in the Recently used file list field.

To edit or add to a document that has been saved previously, one can open it by clicking the File menu and selecting Open. The Open dialog box appears listing Word documents. In case the user is not sure where the document is located, click the Tools button and select Search. A file can be searched by its file name, some specific text in the document, or the date it was created or last modified.

Closing a Document

When finished working in Word close the active document and then quite Word by closing Exit from the File menu. To work on another document in Word, close the active document by choosing Close from the file menu and then open the other document.

Document Formatting

Word supports character, paragraph, and even document formatting. If a user doesn't want to take the time to format individual elements, Word can format the entire document automatically. One should always type the text before formatting it so that he get his thoughts in the document while they are still fresh.

Formatting of documents can be understood in the following two headings:

- (i) Paragraph Formatting; and
- (ii) Aligning Text and Paragraphs.

Paragraph Formatting

The format of entire paragraphs of text may be formatted through line spacing, justification, and indentation of text. The format may be applied to selected paragraphs or to all the paragraphs in the document. The following rules are applicable in this regard:

(1) Justifying Text. The most common way to format a paragraph is to justify it. When the text is justified, it determines the text's alignment in relation to the right and left margins. Word supports the following justification options:

- (i) Left-justification aligns (makes even) text with the left margin.
- (ii) Centre-justification centres text between the left and right margins.
- (iii) Right-justification aligns text with the right margin.
- (iv) Full-justification aligns text with both the left and right margins.

The simplest way to justify existing text is to click anywhere inside the paragraph and then click the toolbar's Align Left, Centre, Align Right, or Justify buttons.

(2) Setting Margins and More. In order to setup margins, display the page Setup dialog box, by selecting the File, Page Setup command. In addition, one can double-click the top gray area of the ruler. This dialog box enables the user to control the paragraph and page margins. Enter values for the top, bottom, left, and right margins so that the text does not extend past the margin limits.

(3) Using Tab Setting. A tab stop controls the horizontal placement of text on a line. When a tab stop is placed at a particular location on a line, Word moves the insertion point to that point at the press of the Tab key. To set tab-stop values, click the Tabs command button in the Format, Paragraph dialog box to display the Tabs dialog box.

(4) Using Leaders. A leader is a character that provides a path for the eye to follow across the page within a tab stop. By default, Word displays nothing (blanks only) for tab areas. The leaders can be removed or may be displayed as a series of hyphens or underlines between the tabs.

(5) Setting Indentation and Spacing. Indentation is the space between the page margin and where the text aligns while the line spacing is the amount of blank space between lines. To set indentation and spacing, select format, Paragraph to display the Paragraph dialog box. The Paragraph dialog box holds indentation and spacing values. Type a Left or Right indentation value or click the arrows to change the current values.

The Spacing section enables the user to specify exactly how many points are to be skipped before or after each paragraph. The user may use double-space, triple-space, and perform other multispace options by changing the value under Line Spacing.

(6) Making the Ruler Work. As the user specifies indentation and tab information, the ruler updates to indicate the new settings. Click anywhere on the ruler to add a tab stop after selecting the appropriate tab from the tab selection area. To remove a tab, drag the tab stop off the ruler into the document area

before releasing the mouse. By dragging an indentation handle, one can change a paragraph's indentation on-the-fly.

(7) Inserting Line and Page Breaks. Lines and pages do not always break the way the user needs them to because they break according to Word's default. The Format, Paragraph dialog box's Line and Page Breaks page enables the user to control the way the document's lines and pages start and stop. Click the Paragraph dialog box's Line and Page Breaks tab to display the settings.

Aligning Text and Paragraph

Word provides four options for aligning paragraphs text: left, right, centre and full (justify). Paragraphs are aligned by anyone, either by pressing the button of Formatting toolbar or by using short key like:

Left Align	Ctrl + L
Centre Align	Ctrl + R
Right Align	Ctrl + E
Justify	Ctrl + J

Left alignment is the most common alignment. In this, lines up with left margin and leaves an edge at the right margin. Left-aligned text is the easiest to read.

Centering of paragraph is used for heading, subheading and desktop publishing creations. Centered is equally, positioned between the left and right margin.

Right alignment is used in header and footers and other text that the user intends to be put to the side. In this text lines up with right margin and leaves edge at the left margin.


Justify text appears formal because, text lines up evenly with the left and right margins. Sometimes the paragraph looks unbalanced because too many spaces have to be inserted between character.

The Formatting options in detail in Word 2010 can be discussed as below

Add a heading

The best way to add headings in Word is to apply styles. The built-in styles can be used or customization can be done.

Apply a heading style

1. Type the text of heading and then select it.
2. On the **Home** tab, in the **Styles** group, click the heading style that is required. If the style that is required is not present, click the **More** button  to expand the **Quick Styles** gallery.

Customize a heading style

The font and formatting of a heading style can be changed.

1. Select the heading text that is to be customized.
2. On the **Home** tab, in the **Styles** group, click the heading style.
3. Make the changes that are required.
For example, the font, the size, or the color can be changed.
4. On the **Home** tab, in the **Styles** group, right-click the heading style that is customized, and then click **UpdateHeading to Match Selection**.

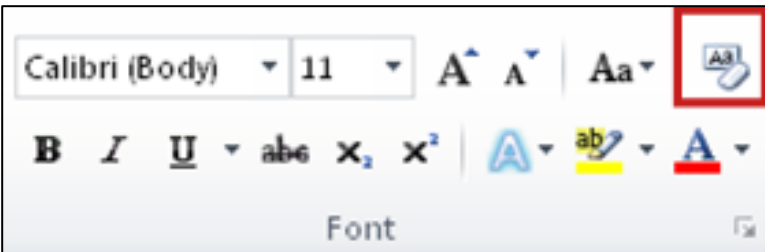


Every time we apply that heading style in our document, the heading style will include our customizations.

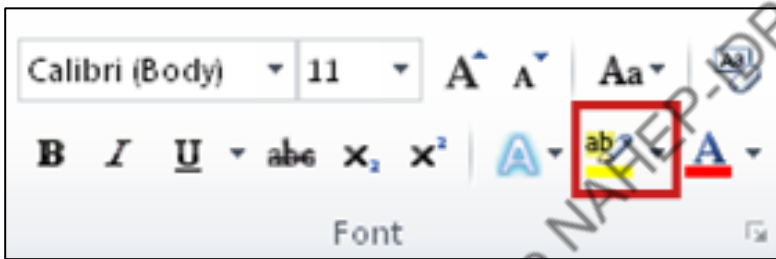
Clear formatting

To get rid of all the styles, text effects, and font formatting in document, do the following:

1. Select the text that is to be cleared the formatting from. Or press CTRL+A to select everything in the document.
2. On the **Home** tab, in the **Font** group, click **Clear Formatting**.



The **Clear Formatting** command will not remove highlighting from text. To clear highlighting, select the highlighted text, and then click the arrow next to **Text Highlight Color** and click **No Color**.

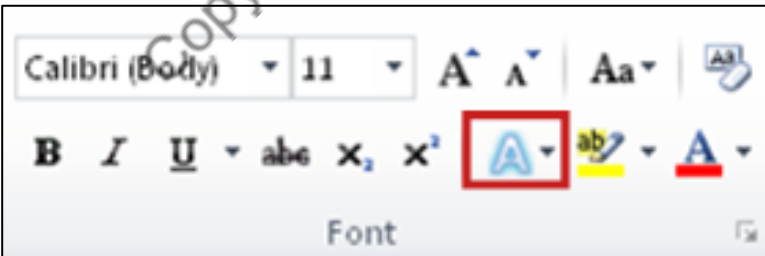


Add or remove text effects

The look of text can be changed by changing its fill, changing its outline, or adding effects, such as shadows, reflections, glows, or three-dimensional (3-D) rotations or bevels.

Add an effect to text

1. Select the text to add an effect to.
2. On the **Home** tab, in the **Font** group, click **Text Effect**.



3. Click the effect that is needed.
For more choices, point to **Outline**, **Shadow**, **Reflection**, or **Glow**, and then click the effect of choice to add.

Remove an effect from text

1. Select the text to remove an effect from.

2. On the **Home** tab, in the **Font** group, click **Text Effect**, and then click **Clear Text Effects**.

Adjust the spaces between lines or paragraphs

Line spacing determines the amount of vertical space between the lines of text in a paragraph. Paragraph spacing determines the amount of space above or below a paragraph.

Line spacing in Word 2010

In Microsoft Word 2010, the default spacing for most Quick Style sets is 1.15 between lines and a blank line between paragraphs. The default spacing in Office Word 2003 documents is 1.0 between lines and no blank line between paragraphs.



Fig. 1. 1.0 line spacing and no space between paragraphs

Fig. 2. 1.15 line spacing and a blank line between paragraphs

Change the line spacing

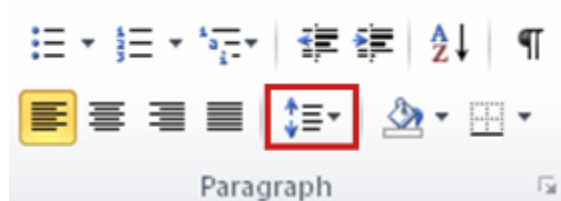
The easiest way to change the line spacing for an entire document is to apply a Quick Style set that uses the spacing that you want. To change the line spacing for a portion of the document, select the paragraphs and change their line spacing settings.

Use a style set to change line spacing for an entire document

1. On the **Home** tab, in the **Styles** group, click **Change Styles**.
2. Point to **Style Set**, and point to the various style sets. Using the live preview, notice how the line spacing changes from one style set to the next.
For example, the Traditional and Word 2003 style sets use single-spacing. The Manuscript style set uses double spacing.
3. When you see spacing that you like, click the name of the style set.

Change the line spacing in a portion of the document

1. Select the paragraphs for which the line spacing is to be changed.
2. On the **Home** tab, in the **Paragraph** group, click **Line Spacing**.



3. Do one of the following:
 - Click the number of line spaces that is to be required.

For example, click **1.0** to single-space with the spacing that is used in earlier versions of Word. Click **2.0**, to double-space the selected paragraph. Click **1.15** to single-space with the spacing that is used in Word 2007.

- Click **Line Spacing Options**, and then select the option that is needed under **Spacing**. See the following list of available options for more information.

LINE SPACING OPTIONS

Single: This option accommodates the largest font in that line, plus a small amount of extra space. The amount of extra space varies depending on the font that is used.

1.5 lines: This option is one-and-one-half times that of single line spacing.

Double: This option is twice that of single line spacing.

At least: This option sets the minimum line spacing that is needed to fit the largest font or graphic on the line.

Exactly: This option sets fixed line spacing, expressed in points.

Multiple: This option sets line spacing that can be expressed in numbers greater than 1. For example, setting line spacing to 1.15 will increase the space by 15 percent, and setting line spacing to 3 increases the space by 300 percent (triple spacing).

NOTE: If a line contains a large text character, graphic, or formula, Word increases the spacing for that line. To space all lines evenly within a paragraph, use exact spacing and specify an amount of space that is large enough to fit the largest character or graphic in the line. If items appear cut off, increase the amount of spacing.

Change the spacing before or after paragraphs

The easiest way to change the spacing between paragraphs for an entire document is to apply a Quick Style set that uses the spacing that is needed. If the spacing is to be changed between paragraphs for a portion of the document, we can select the paragraphs and change their spacing-before and spacing-after settings.

Use a style set to change paragraph spacing for an entire document

1. On the **Home** tab, in the **Styles** group, click **Change Styles..**



2. Point to **Style Set**, and point to the various style sets. Using the live preview, notice how the line spacing changes from one style set to the next.

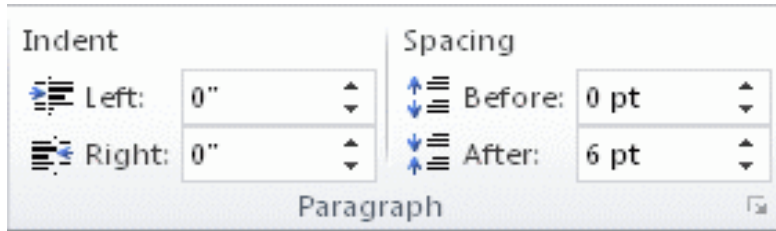
For example, the Word 2003 style set inserts no extra space between paragraphs and a small amount of space above headings. The Word 2007 style set uses a double space between paragraphs and adds more space above headings.

3. On seeing spacing that is liked, click the name of the style set.

Change the spacing before and after selected paragraphs

By default, paragraphs are followed by a blank line, and headings have extra space above them.

1. Select the paragraph before or after which the spacing is to be changed.
2. On the **Page Layout** tab, in the **Paragraph** group, under **Spacing**, click the arrow next to **Before** or **After** and enter the amount of space that is needed.

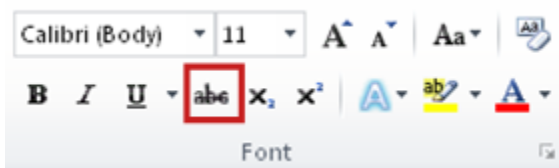


Apply strikethrough formatting

The following procedure can be used to apply strikethrough formatting to text in a document.

Apply single-line strikethrough formatting

1. Select the text that is to format.
2. On the **Home** tab, in the **Font** group, click **Strikethrough**.



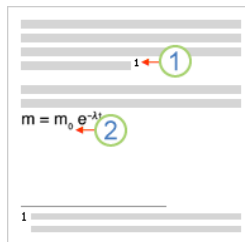
Apply double-line strikethrough formatting

1. Select the text that is to format.
2. On the **Home** tab, click the **Font** Dialog Box Launcher, and then click the **Font** tab.



3. Select the **Double strikethrough** check box.

Superscript and subscript refer to numbers that are positioned slightly higher or slightly lower than the text on the line. For example, a scientific formula might use subscript text.



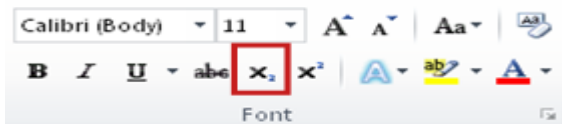
1. Superscript 2. Subscript

Make text superscript or subscript

1. Select the text that is to format as superscript or subscript.
2. Do one of the following:
 - On the **Home** tab, in the **Font** group, click **Superscript**. Or press CTRL+SHIFT+=.



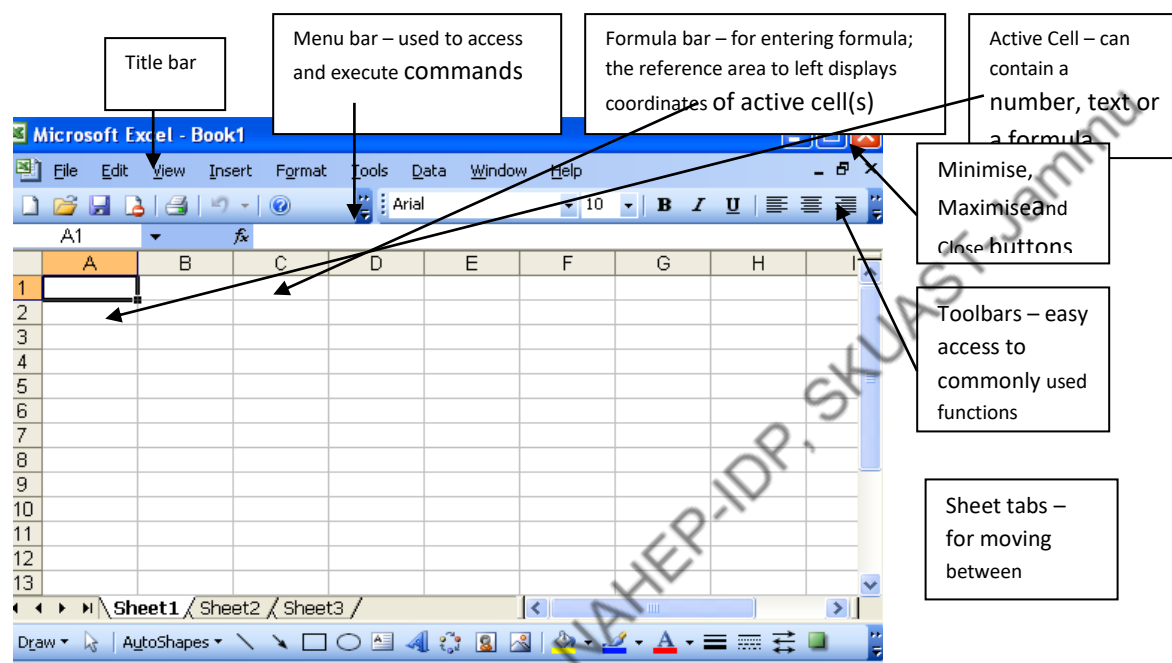
- On the **Home** tab, in the **Font** group, click **Subscript**. Or press CTRL+=.



Microsoft-Excel

The excel screen

Microsoft Excel (MS – Excel) is a powerful spreadsheet that is easy to use and allow you to store, manipulate, analyze, and visualize data. It also supports database, graphic and presentation features. It is a powerful research tool and needs and minimum of teaching.



Features of Excel

A new work book window is displayed each time excel is started. A work book is a collection of individual worksheet each of which can hold data. All actions and operations of excel take place in a worksheet some of the important features of excel are:-

- (i) Excel contains 65536 rows numbered 1,2,3 , 65536 and 256 columns lettered A to Z, AA to AZ, BA to BZ and continuing to IA to IZ. 1048576 rows numbered 1,2 1048576 and XF1 columns lettered A to Z, AA to AZ, AAA to AAZ up to XFA to XF1 MS – 2007.
- (ii) It supports what if analysis to help predict the future value if there is a change in the cell content which is referred in the formula.
- (iii) Based on data, graphs and charts can be created for quick assessment of situation.
- (iv) Excel, allows to define macros which are useful to combine a series of actions to automate the calculation work.

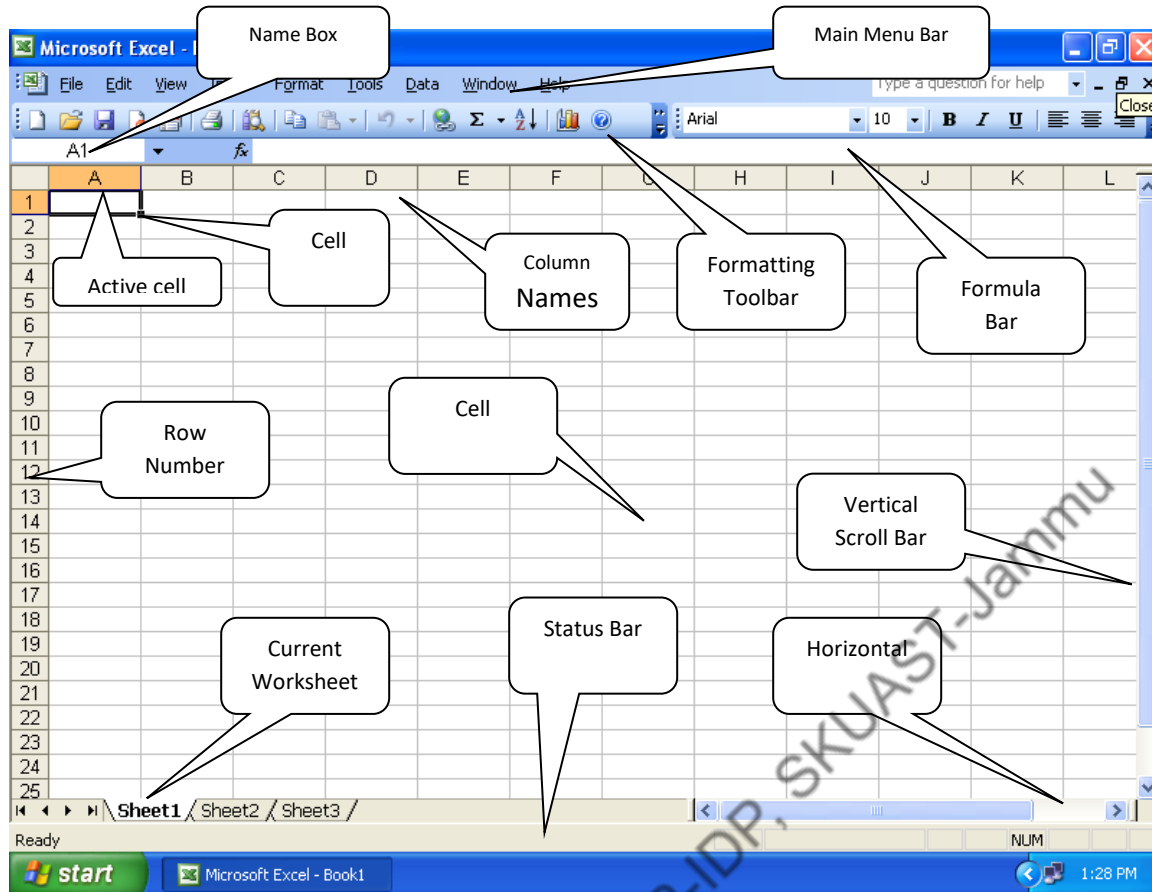
Components of an Excel

Excel is windows based application and has toolbars, shortcut menus, etc, which makes it easier. The Excel has all the standard features of any of the other Windows software like Word and Power Point,

and has its specific features also. The main components of an Excel spreadsheet are indicated in Fig.1.3 and described below in brief:

- Workbook** -The Excel file, in which we work and store our data, is called a workbook. Like a Power Point file that has many slides, a workbook can have many worksheets, which are the individual spreadsheet we will be working on.
- Worksheets** -A worksheet is always stored in a workbook. It is also known as a spreadsheet. It consists of cells that are organized into columns and rows.
- Cell** -it is the intersection area of a row and a column. Data will be entered in the cells. Each cell having a unique address comprises of column letter and row number, e.g. A1, D2 etc.
- Cell pointer** -Indicates the cell currently active. An entry made in a worksheet automatically goes into the current or active cell.
- Active Cell** -The cell indicated by the cell pointer.
- Row / Column Names** -These are used to reference a cell. For example the cell at the intersection of row 1 and column A is referred to as cell A1.
- Mouse Pointer** -It is shaped like a white plus sign and changes to an arrow sign outside the spreadsheet area.
- Scroll Bars** -The scroll bars can be used to move around in a large sheet.
- Status Bar** -Displays the current status of the spreadsheet. During data entry and edit modes it displays the “Enter” and “Edit” messages on the bottom left. On the bottom right it shows the Num Lock and Caps Lock keys status, etc.
- Toolbars** -These are generally the rows above the formula bar. Toolbars are collection of buttons and images, called icons, which help to give Excel many instructions quickly. There are different toolbars that can be shown or hidden as needed. Toolbars can be selected from the toolbar option in the View Menu options. Placing toolbars on the window is called docking. By default, the standard and formatting built – in toolbars are docked below the Main Menu bar, i.e. the one with the File, Edit, View, etc. options. Toolbars can be moved and undocked. The drawing toolbar is generally placed at the bottom of the spreadsheet just above the Status bar. Modules to load, at the end of the software setup process Windows will do a shutdown and restart procedure to install all its components.

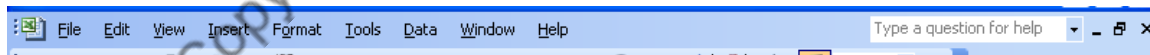
To run the Excel spreadsheet program, click on the Excel icon on the desktop or select Microsoft Excel from the program option of the start menu.



Excel opens a window with a blank spreadsheet format called a workbook. Fig. 1.3 shows a typical view. Our work starts from here.

Name box and Formula Bar:-It is just below the formatting bar. Name box indicates the name of active cell. While formula bar is used to enter data as well as formula in the active cell. It is one of the prime areas of our interest.

Menu Bar in Excel:- The top of the excel screen contains a menu bar and by clicking on the desired command in a menu tells the computer to execute that command. Various categories of menu are as

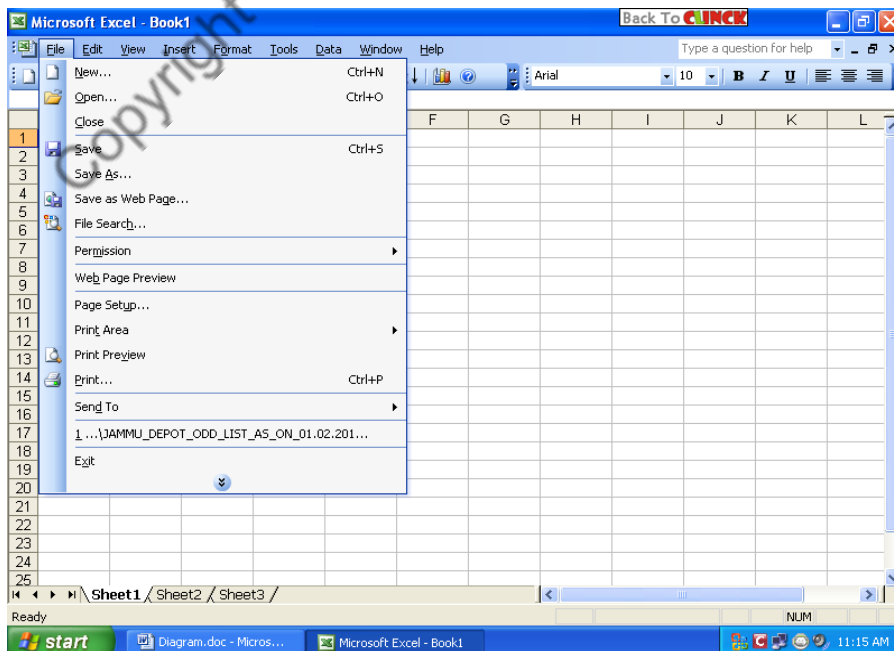


File menu

The file menu is used to open, save and print files

S. No.	Command	Key Shortcut	Function
1)	New	Ctrl + N	Creates a new blank file
2)	Open	Ctrl + O	Opens or finds existing file.
3)	Close	ctrl + W	Closes the active file without exiting the application.
4)	Save	Ctrl + S	Saves the active file with its

- | | | |
|-----|----------------|---|
| 5) | Save As | Current file name, location and file format.
Saves the active file with a different file name, location or file format. |
| 6) | Save As HTML | Runs an add in program or a custom macro. |
| 7) | Save Workspace | Saves a list of the active workbooks, to a workspace file so that the screen will look the same the next time the files are opened. |
| 8) | Page Setup | Sets margins, paper source paper size, page orientation and other layout options for the active file. |
| 9) | Print Area | Sets or clears the print area in the active sheet. |
| 10) | Print Preview | Shows how a file will look when it is printed. |
| 11) | Print | Ctrl + P
Prints the active file or selected items. |
| 12) | Properties | Displays the property sheet for the active file. |
| 13) | Exit/ Close | Ctrl + W
Closes this program after prompting the user to save any unsaved opened file. |

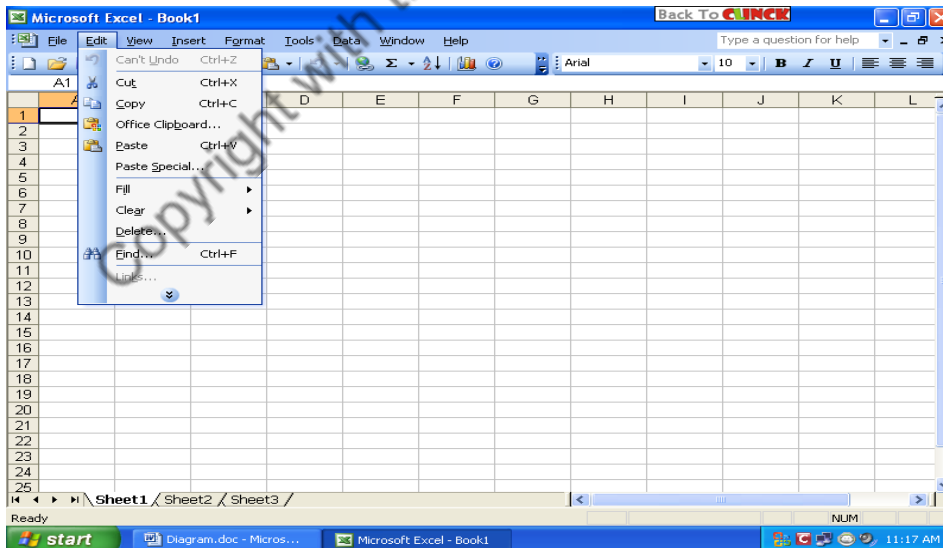


Edit Menu

This menu can be used to edit a file by using cut, paste, copy.

S. No.	Command	Key Shortcut	Function
1)	Undo	Ctrl + Z	Reverses the last command deletes the last typed entry.
2)	Redo	Ctrl + Y	Reverse the action of the undo button, use the pull- down menu to redo several steps.
3)	Cut	Ctrl + X	Removes the selection from the active document and places it on the clipboard.
4)	Copy	Ctrl + C	Copies the selection to the Clipboard.
5)	Paste	Ctrl + V	Inserts the contents of the clipboard (after cut or copy commands) at the insertion point, and replaces any selection.
6)	Paste Special		Pastes the contents of the Clipboard (after cut or copy commands) in the current file in the specified format.
7)	Paste as Hyperlink		Inserts the contents of the clipboard (after cut or copy commands) as a hyperlink at the insertion point, replacing any selection.
8)	Fill		Copies the currents and format of the cells of a selected range into the cells below, up right left and across the worksheet.
9)	Clear		Removes the cell contents or formatting, such as, comments and hyperlinks from selected cells.
10)	Delete		Removes the selected object.
11)	Delete Sheet		Deletes the selected sheets

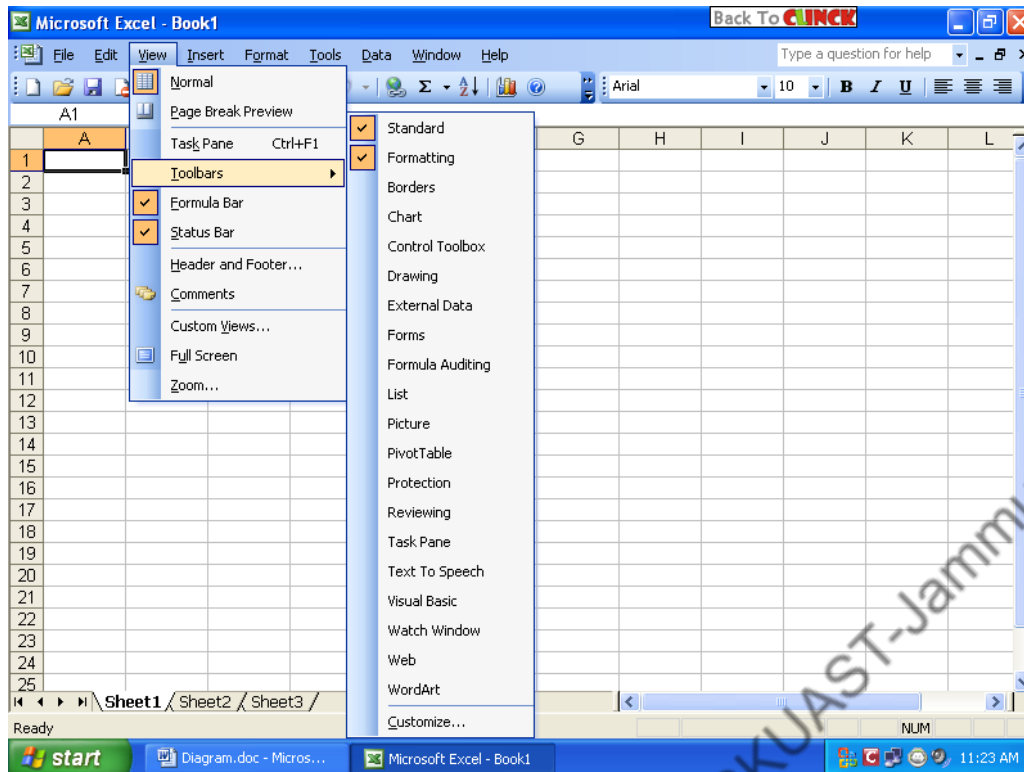
- | | | | |
|-----|--------------------|----------|---|
| 12) | Move or Copy Sheet | | From the workbook.
Moves or copies the selected to another workbook or to a different location within the same workbook. |
| 13) | Find | Ctrl + F | Searches selected cells or sheets for the specified characters in the active worksheet. |
| 14) | Replace | Ctrl + H | Searches for and replaces specified text, formatting, footnotes, endnotes, or comment marks in the active worksheet. |
| 15) | Go to | Ctrl + G | Scrolls through the worksheet and selects the cell range, or cells with specified characteristics. |
| 16) | Links | | Displays or changes information for each link in the current file. |
| 17) | Object | | Activates the application in which the selected object is created. |



View Menu

The menu is used to customize the view of the screen and the worksheet.

S.No.	Command	Function
1)	Normal	Switches to normal view of the worksheet.
2)	Page Break	Switches the active worksheet to page break preview, which is an editing view that displays how the worksheet will print.
3)	Toolbars	Displays or hides the format bar.
4)	Formula Bar	Displays or hide the formula bar.
5)	Status Bar	Displays or hides the status bar.
6)	Header and Footer	Adds or changes the text that appears at the top and bottom of every page.
7)	Comments	Turns displays of comments on the worksheet on or off.
8)	Custom Views	Creates different views to see the worksheet data with different displays options.
9)	Full Screen	Hides most screen elements so that one can view more of the document.
10)	Zoom	Controls the size of the worksheet on the screen.

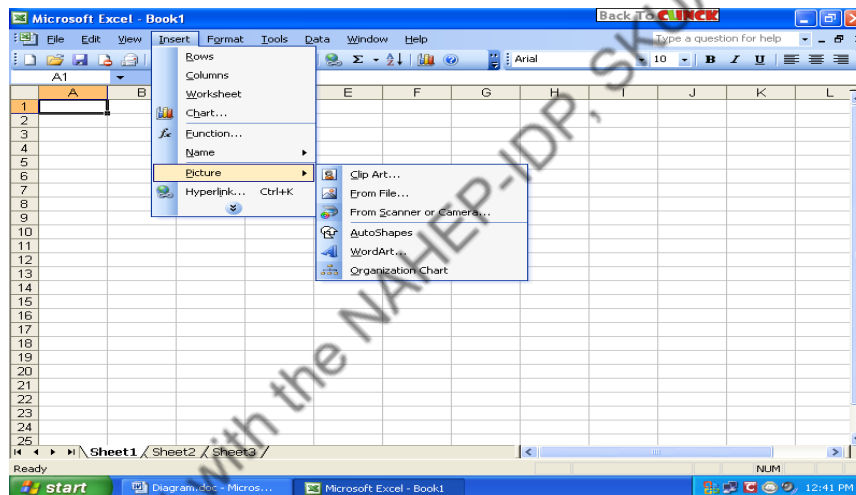


Insert Menu

The menu is used to insert rows, columns, sheets function, objects. In the active worksheet.

S. No.	Command	Function
1)	Cells	Inserts the number of cells, rows, or columns in the worksheet.
2)	Rows	Inserts a complete row in the worksheet.
3)	Columns	Inserts a complete column in the worksheet.
4)	Worksheet	Inserts a new worksheets to the left of the selected sheet.
5)	Chart	Inserts a chart after asking the user certain questions.
6)	Page Break	Inserts a page break above a selected cell.
7)	Function	Displays a list of functions and their formats and allows the user to set values for arguments.
8)	Name	Creates pastes applies and labels a name for a cell,

- | | | |
|-----|---------|---|
| 9) | Comment | range or constant or computed value that can be used to refer to the cell, range or value.
Inserts a comment at the insertion point. |
| 10) | Picture | Inserts an image or picture, shape, chart etc. in the active worksheet at the insertion point. |
| 11) | Map | creates a map based on the selected geographic references. |
| 12) | Object | Inserts an object, such as a drawing, word art text effect or an equation at the Insertion point. |

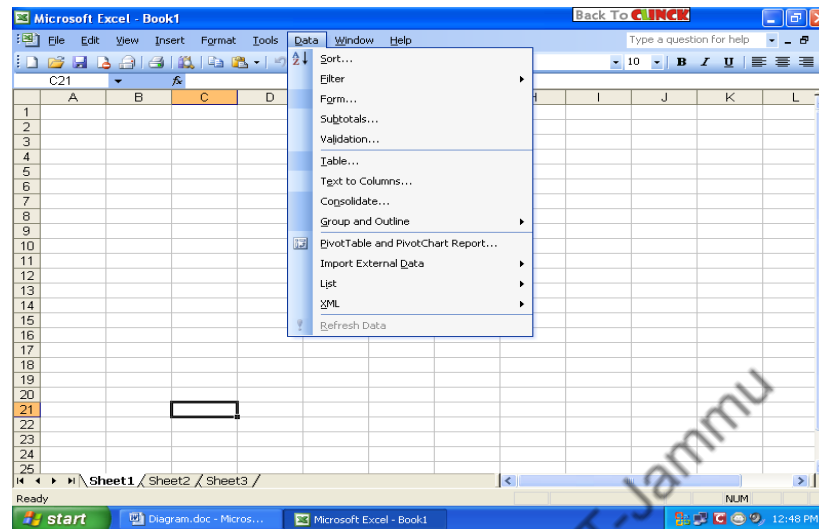


Format Menu

The menu is used to format the contents of cell in a worksheet.

- | S. No. | Command | Function |
|--------|---------|---|
| 1) | Cells | Applies formats to the selected cells. |
| 2) | Row | Adjust the height of a row.
Also hides and unhide row. |
| 3) | Column | Changes the width of the selected columns to the specified measure. Also hides and unhide the selected columns. |

Sort	Sort a range of data in specific order.
Validation	Set ranges or limits to data to be entered.



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Ms-Excel Analysis Tool Pack for Analysis of Agricultural Data

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Microsoft Excel is a spreadsheet for record and analyse numerical data. Spreadsheet is a collection of columns with alphabetical letters and rows with numbers that form a table. The concurrent point of column and row is called a cell. The address of a cell is given by the letter and the number which represent about the column and row respectively. Microsoft Excel is part of the Microsoft Office. Microsoft Excel has been around since 1982, first introduced as Multiplan, a very popular CP/M (Control Program for Microcomputers), but lost popularity on MS-DOS systems to Lotus 1-2-3. In 1987, Microsoft introduced Excel v2.0 for Windows and by 1988 began to outsell Lotus 1-2-3 and the emerging QuatroPro. In 1993, Microsoft released Excel v5.0 for Windows which included VBA (Visual Basic for Applications), aka Macros. This opened up almost unlimited possibilities in automation of repetitive tasks for crunching numbers, process automation, and presenting data for businesses. Flash forward to present day with the latest release of Excel 2019 and Excel365, Microsoft Excel is the most familiar, flexible, and widely used business application in the world due to its capability to adapt to almost any business process. The most popular and powerful built-in Excel features:

- Efficiently model and analyze almost any data
- Zero in on the right data points quickly
- Create data charts in a single cell
- Access your spreadsheets from virtually anywhere
- Connect, share, and accomplish more when working together
- Take advantage of more interactive and dynamic Pivot Charts
- Add more sophistication to your data presentations
- Do things easier and faster
- Harness more power for building bigger, more complex spreadsheets
- Publish and share through Excel Services

It is having features like calculation, graphing tools, pivot tables, and macro programming language called Visual Basic. It is compatible with multiple OS like Windows, macOS, Android and iOS. The **ANALYSIS TOOLPAK** is an Excel add-in program that provides data analysis tools for financial, statistical and mathematical data analysis. In order to develop complex statistical analyses, we can save steps and time by using the Analysis ToolPak. One just need to provide the data and parameters for each analysis, and the tool uses the appropriate statistical functions to calculate and display the results in an output table. Some tools generate charts in addition to output tables.

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To access these tools, click **Data Analysis** in the **Analysis** group on the **Data** tab. If the **Data Analysis** command is not available, you need to load the Analysis ToolPak add-in program. To load the Analysis ToolPak add-in, execute the following steps.

- i. On the File tab, click Options.
- ii. Under Add-ins, select Analysis ToolPak and click on the Go button.
- iii. Check Analysis ToolPak and click on OK.
- iv. On the Data tab, in the Analysis group, you can now click on **Data Analysis**.

The Excel uses standard arithmetic operators for formulas, such as a plus sign for addition (+), a minus sign for subtraction (-), an asterisk for multiplication (*), a forward slash for division (/), and a caret (^) for exponents. All formulas in Excel must begin with an equals sign (=). This is because the cell contains, or is equal to, the formula and the value it calculates.

The Common Excel Mathematical Functions: Before describing this we have to understand the formula Palette which can be activated by clicking on the equals sign in the formula bar a drop – down panel called the formula palette appeared. Consider an example, type number 25 in cell A1 and move the cell pointer to cell B2. Type or click the equal sign in the formula bar. A drop – down panel will display formula result = and wait for further inputs. Enter sqrt result to 5 at B2. The dialog box divides into parts as

- (a) Name of the function at the top left of the argument entry box.
- (b) Below of this there is the definition or description of the function.
- (c) Next, there is an entry explanation.
- (d) Formula result.

a. The sum function (Σ) or Auto Sum for the calculation of sum.

The syntax is

= SUM (Cell range), where cell range is the range of cells containing the numbers whose sum is to be calculated. On the other hand select the range of adjacent cells and go to the next empty cell in a row or column of numbers and click on the Σ icon. This will immediately insert the sum function in the cell with the argument showing the range of the adjacent cells containing the row or column of numbers then enter result to sum.

b. Exponential function

The syntax is

= EXP (number) here number is whose exponential need to be calculated. Like 2 for e^2 and 3 for e^3 .

c. Natural logarithm function

The syntax is

= LN (number) here number is a real positive number whose natural log is required, **Log to the Base 10** is =LOG10 (number) and **log to any base** is = log (number, base).

d. Square root function

The syntax is

= SQRT (number) here number is a real positive number and function result to the square root of the number.

e. Factorial functions

The syntax is= FACT (number). FACT (5) results to 120

f. Determinant of a matrix:

The syntax is= MDETERM (array),here array is the range of cells that contains the element of a square matrix.

g. The Transpose of matrix

The syntax is= TRANSPOSE (array) and the array is the cell range or array of numbers which is to be transposed. The area for the required matrix should be selected in advance then type the syntax and Press Ctrl + Shift + Enter keyssimultaneously. It can also be done through Paste Special command through following steps

- (i) Copy the array of Matrix say of order 3x4.
- (ii) Select the area of order of 4x3
- (iii) Go to Edit---- Paste Special ---- Transpose ----- ok.

h. Matrix Multiplication

The syntax is

= MMULT (array A, array B)here array A and array B are the two matrices that are to be multiplied. It must be noted that the number of columns of matrix A is equal to the numbers of rows of Matrix B. The followingsteps are required for getting the resultant matrix:

- Select two matrices, the number of columns of 1st matrix must be equal to the no. of columns 2nd matrix.
- Select the area for resultant matrix.
- Type = MMULT (array of 1st matrix, array of 2nd matrix)
- Press the keys Ctrl + Shift + Enter simultaneously.

i. Matrix Inverse

The syntax is

= MINVERSE (array) here array is the cell range specifying the original matrix. The matrix must be square means No. of rows and no. of columns of matrix must be same. Steps while calculating matrix inverse are as.

- Consider a square matrix.
- Select the area for resultant matrix same as the original matrix.
- Type = MINVERSE (array).
- select array i.e. matrix whose inverse is to find.
- Press the keys Ctrl + Shift + Enter simultaneously.

Statistical functions

a. Average:

The syntax is

=AVERAGE (cell range)here cell range is the range of cells containing the numbers whose average is need to be calculated.

b. Geometric mean:-

The syntax is

=GEOMEAN (cell range)here cell range refers to the cells that contain the number whose geometric mean is to be calculated.

c. Harmonic Mean:-

Its syntax is

= HARMEAN (number 1, number2,)here number 1, number 2,for which Harmonic mean is to be calculated.

d. Outliers Corrected average

The syntax

=TRIMMEAN (array, percent) here array is the range of cells containing values for which the selected average is required; percent is the fractional number of data points to be excluded from the calculations.

e. Standard Deviation

The syntax of the standard deviation is

= STDEV (Cell range).

One the important part of the excel worksheet is the Cell referring or addressing. If a user needs to copy a formula from one cell to another, he should be aware of references. **Relative references** tell excel how to find another cell, starting from the cell, containing the formula. References such as A1 and A2 are relative references. When formulas and functions are copied, Excel automatically adjusts relative references so that the formula works correctly. If a formula A1 and B1 is created in Cell C1 and then is copied to cell C₂ (i.e. one cell to the right and one cell down) the formula in cell C₂ will automatically become A₂ and B₂. Each of the references in the formula, in a such can shall move one cell to the right and one cell down as well. The **Absolute Referencing** tells excel how to find a cell based on the exact location of that cell in the worksheet. These references have dollar sign (\$) in their names. For example, if the user creates the formula \$A\$1+\$B\$1 in the Cell C1 and then copies that formula to cell D2, the formula in cell D₂ will still be \$A\$1+\$B\$1. Strictly speaking, the dollar sign Force the row number and column letter to freeze in place, and not change. The **Mixed Reference** is mixture of the both as discussed i.e. one can refer to cells A\$3 or \$B4. This means that, if the user copies a formula with mixed references, their will only update the part of the reference without the dollar sign. & the formula A\$3 is copied one cell down, and one cell to the right, the new formula will be B\$3. The \$3 did not change but the A did. The Common problems with **formula** and **values** while using function and formulas care must be taken to ensure that the proper syntax is maintained or else excel will return an error.

Nor Value	Implication	Suggestion action
# DIV / 0	Formula is trying to divide by zero or the cell which the formula is referencing to has no value.	Check the divisor to ensure that this type of error is corrected.
# N / A	Formula refers to a value that is not available.	Check the ranges referenced by the formula have the same no. of rows and columns in case & finding the inverse of matrix
# NAME ?	Formula uses a name that excel doesn't recognize	Correct the spelling or insert the correct function name into the formula.

# NULL !	Formula specifies an invalid intersection of two areas.	Make sure a comma & equates the two areas or ranges
# REF !	Formula refers to a cell that is not valid.	Change the formulas, or restore the cells on the worksheet by undo after delete or paste the cells.
# Value !	Formula uses an incorrect argument or operand	Make sure the formula in functions is correct for the required operand argument, and that the cells that are referenced by the formula contain valid values.
#####	Result of formula that is too long to fit in a cell.	For example, A1 contain text and A2 contain a number then the action = A1 + A2 will result to # value

1. Descriptive Statistics

The data of yield (q/ha) of 50 varieties of paddy for some breeding trails has been obtained as:

53	54	32	61	64	88	64	58	48	93	60	84	87	79	59	43	33	32	61	63	62	54	31	77	39
63	65	77	68	79	69	91	47	38	81	45	95	28	80	62	87	36	75	47	69	91	78	81	51	59

Solution: The summary statistics of the data using MS – excel can be obtained / analyzed through following steps:

Step 1: Open Excel sheet.

Step 2: Go to data menu and select Data Analysis. (see fig. 1)

Step 3: Select analysis tool from Data Analysis dialog box.

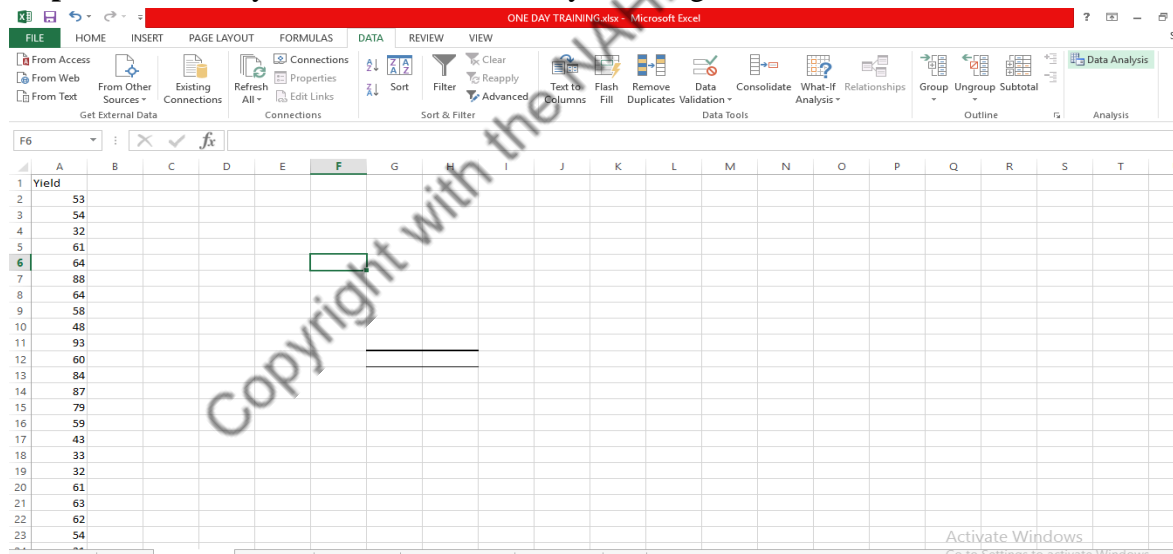


Figure 1: Selection of data analysis tools pack from MS –excel sheet.

Step 4: Give input range in descriptive statistics dialog box. (see fig.2)

Step 5: Give output range in Output options for getting output in specific range of cells.(see fig.2)

Step 6: Check Summary statistics check box. (see fig.2)

Step 7: Click on OK command button and output will be obtained. (see fig.3)

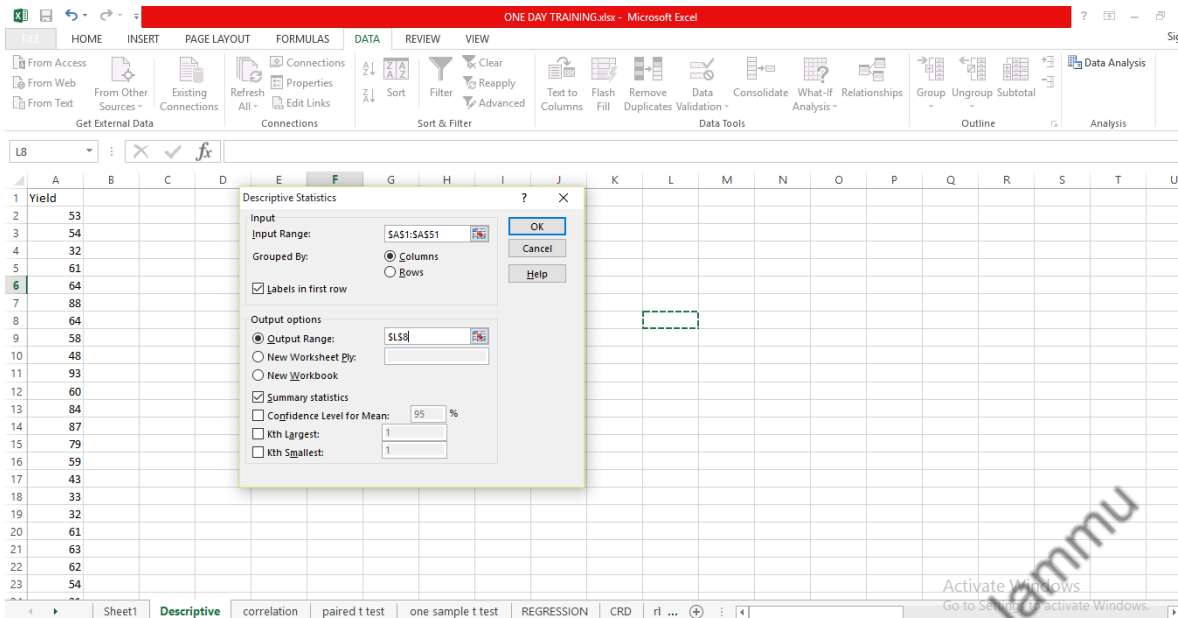


Figure 2: Input of the data, check of summary statistics and selection of output cell.

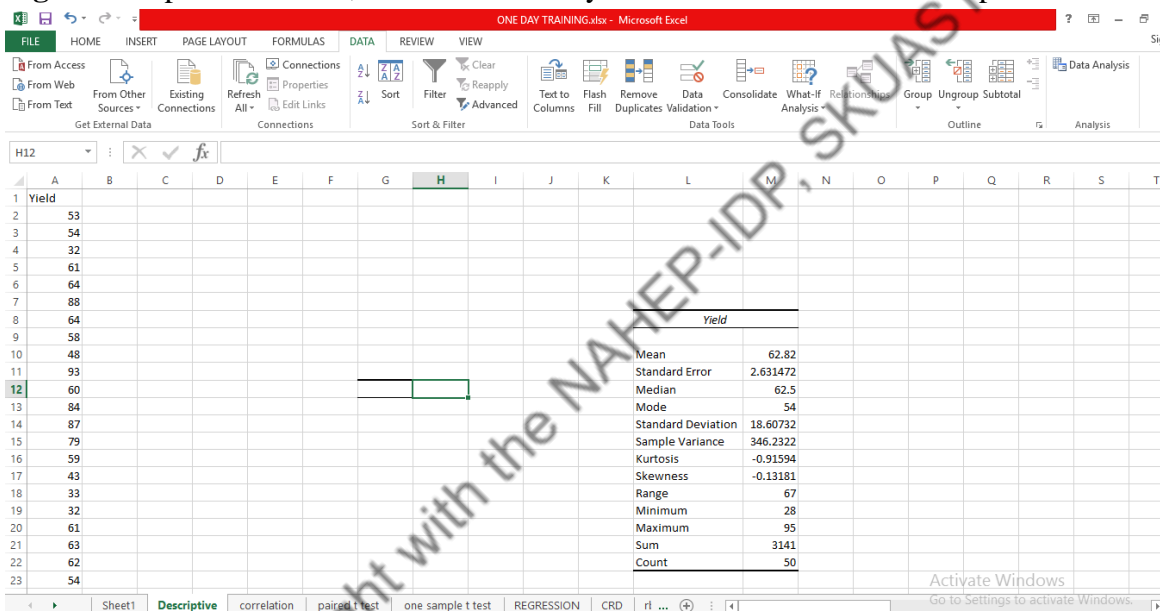


Figure 3: Output of the data, through MS-excel.

2. Coefficient of variation

Which of the following series is more consistent?

Series

A 192 236 184 231 148 296 250

Series

B 89 98 78 90 117 102 178

Solution: Steps used for analyzing the data are as:

Step 1: Open Excel sheet.

Step 2: Go to data menu and select Data Analysis. (see fig. 1)

Step 3: Select analysis tool from Data Analysis dialog box. Calculate summary statistics. (Fig. 1 to Fig 4)

Step 4: Give input range in descriptive statistics dialog box. (see fig.2)

Step 5: Give output range in Output options for getting output in specific range of cells (see fig.2)

Step 6: Check Summary statistics check box. (see fig.2)

Step 7: Click on OK command button and output will be obtained. (see fig.3)

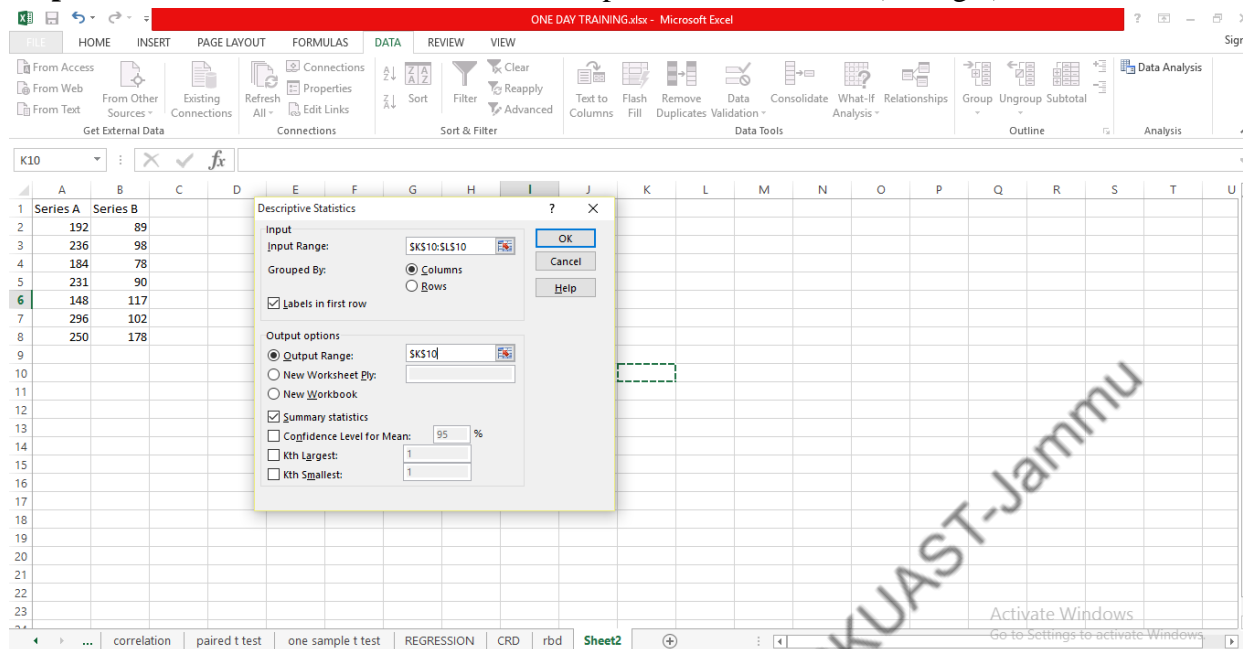


Figure 4: Input of the data, check of summary statistics and selection of output cell.

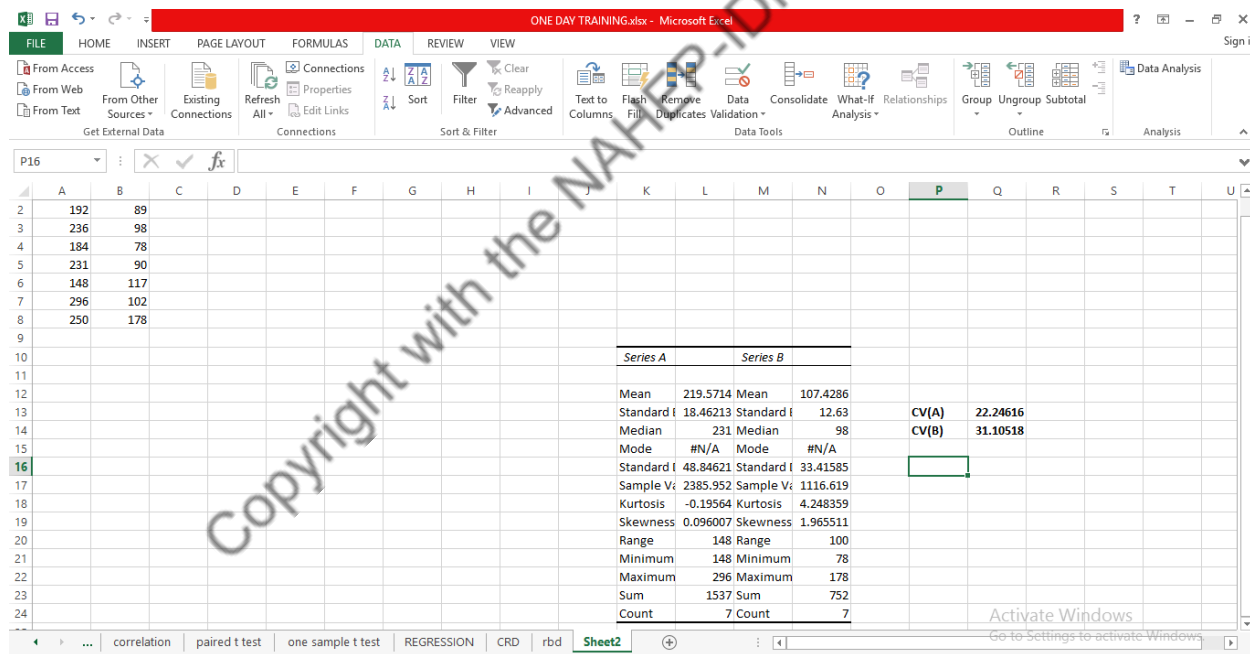


Figure 5: Output of the data, through MS-excel.

Calculate summary statistics. (Fig. 1 to Fig 4)

The central tendency measured in terms of arithmetic mean for the above varieties are same. Therefore, we will use coefficient of variation (CV) in order to find the consistent variety. This is nothing but it is concept of coefficient of dispersion expressed in percentage form i.e. (Standard Deviation/Mean)*100. It can seen from the results obtained that the coefficient of variation of Series B is more than the Coefficient of Variation of Series A. Therefore, Series A is more consistent variety.

Note: Use the following formulate in the cell options for the calculations of SD/value of mean *100. $CV = \left(\frac{SD}{Mean}\right) \times 100$ firstly, type = sign in the cell then $\frac{L16}{L12} * 100$ in order to calculate CV (A). Similarly CV (B) can be calculated.

3. Correlation

Calculate the correlation coefficient between the variable X and Y from the following bi-variate data:

X	69	75	96	56	42	75	79	48
Y	78	65	92	70	79	71	69	73

Step 1: Open Excel sheet.

Step 2: Go to data menu and select Data Analysis.

Step 3: Select correlation tool from Data Analysis dialog box. (see fig.7)

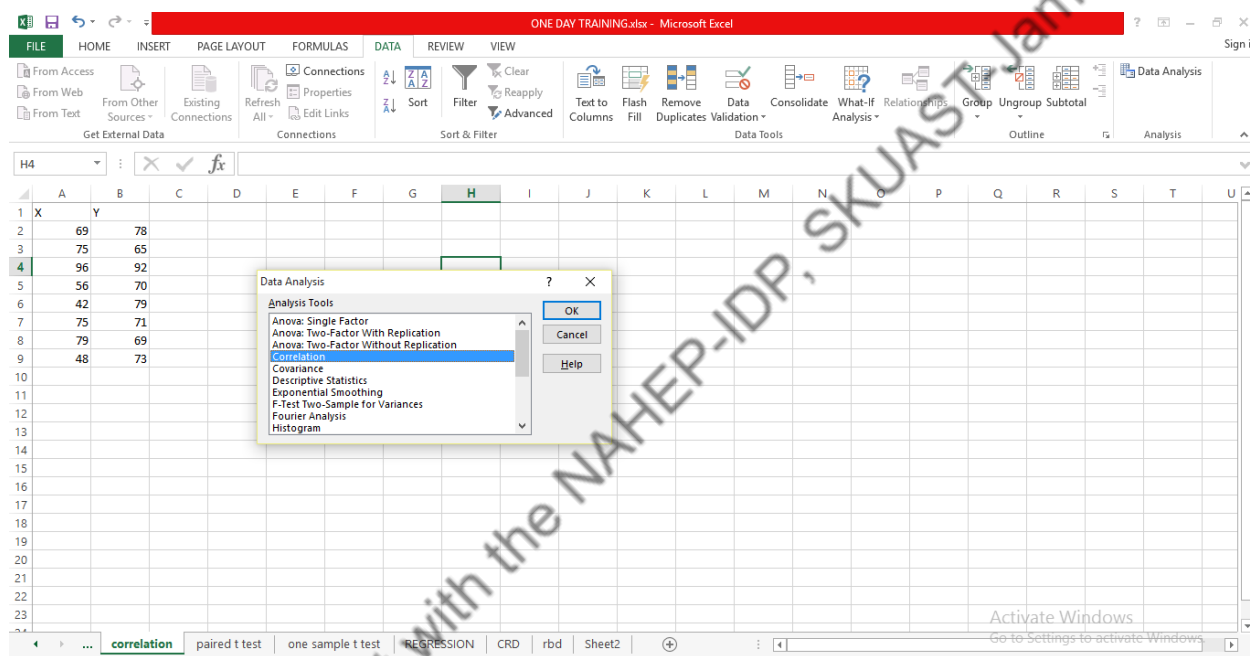


Figure 6: Selection of correlation analysis tool from data analysis dialog box.

Step 4: Give input range in Correlation dialog box. (see fig.7)

Step 5: Give output range in Output options for getting output in specific range of cells.(see fig.2)

Step 6: Click on OK command button for output. (see fig.8)

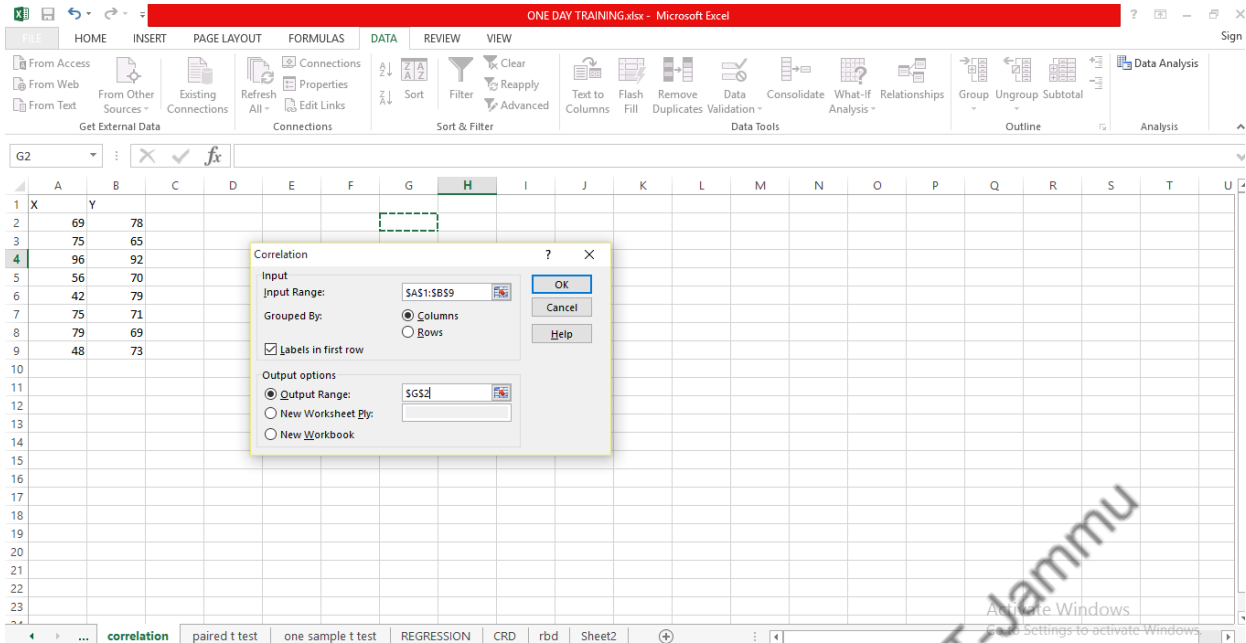


Figure 7: Correlation dialog box with input and output range.

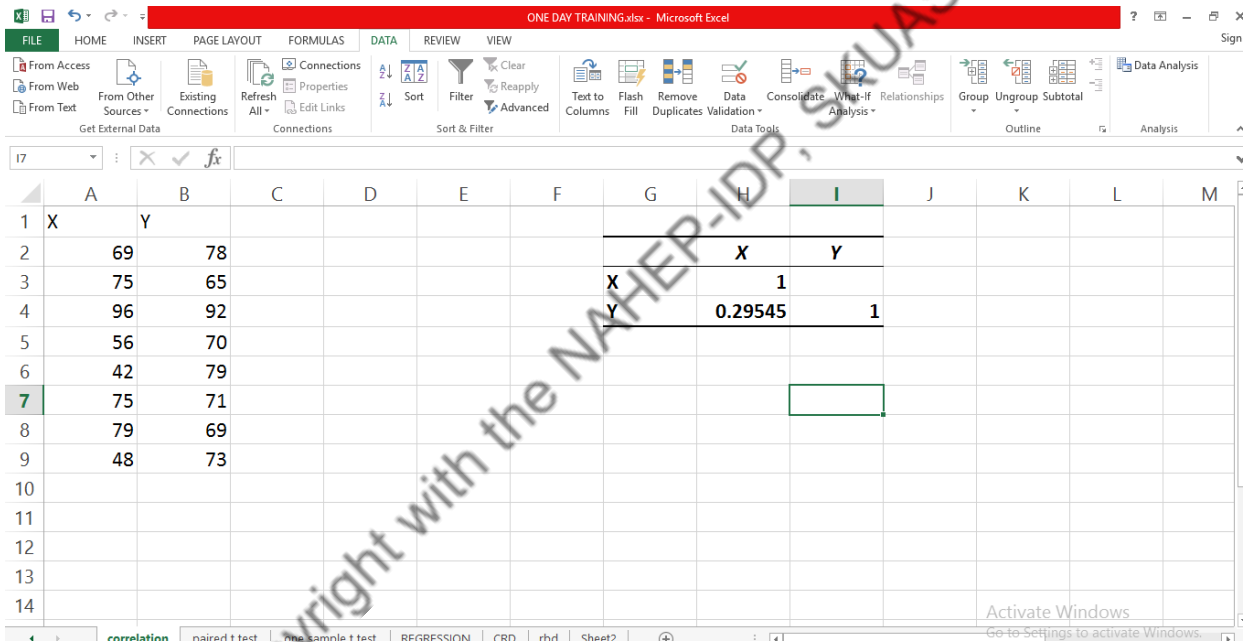


Figure 8: Correlation Matrix output.

4. Regression

The following data has been obtained on three certain variables Y, X₁ and X₂

y	26	32	32	12	10	10	26	10	24	22	22	20	22	18	22
x ₁	16	16	24	2	6	2	22	3	13	2	4	14	4	22	16
x ₂	5.26	4.16	5.5	4.63	5.12	5.32	4.79	4.95	5.21	7.39	6.45	6.87	4.65	4.16	6.23
y	20	23	30	22	19	18	17	16	18	16	24	23	24	22	14
x ₁	15	12	13	15	14	16	18	25	23	19	21	23	14	15	13
x ₂	5.32	5.98	6.15	7.51	3.59	4.56	5.98	4.26	5.75	5.57	4.19	4.68	6.49	5.26	4.63

Find the regression of Y on X₁ and test its significance.

Solution: The regression analysis output can be obtained through following steps.

Step 1: Open Excel sheet.

Step 2: Go to data menu and select Data Analysis.

Step 3: Select Analysis tools form Data Analysis dialog box.(see fig.9)

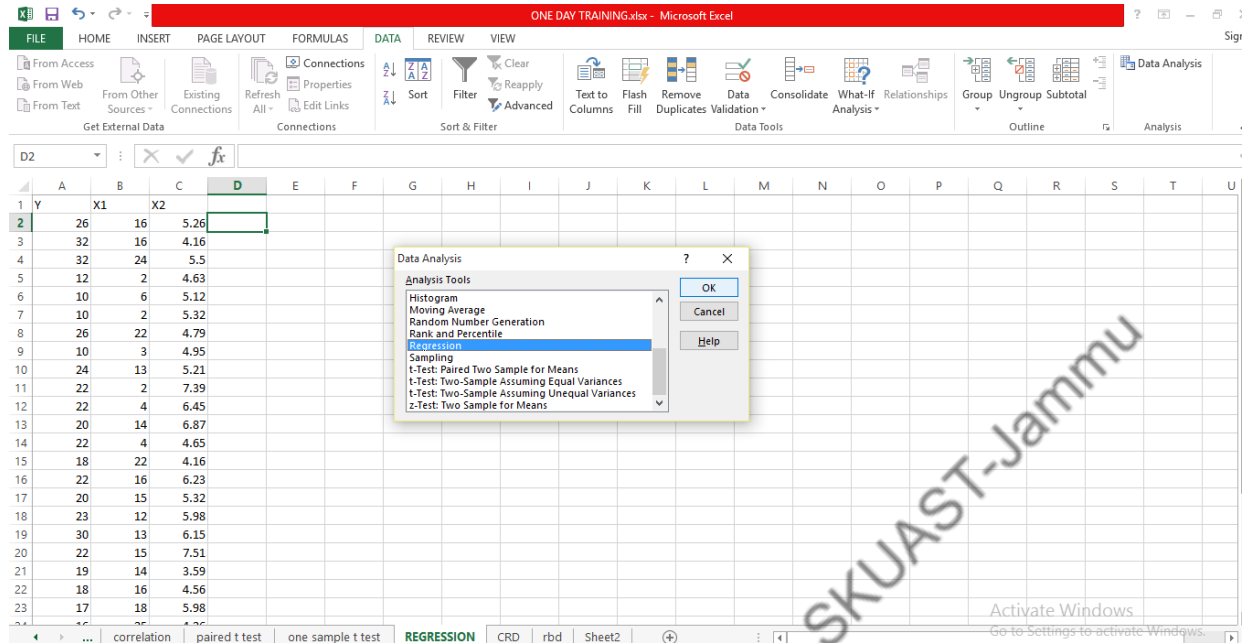


Figure 9: Selection of regression analysis tool from data analysis dialog box.

Step 4: Give input range in regression dialog box. (see fig.10)

Step 5: Give output range in Output options for getting output in specific range of cells. (see fig.2)

Step 6: Click on OK command button for output. (see fig.11)

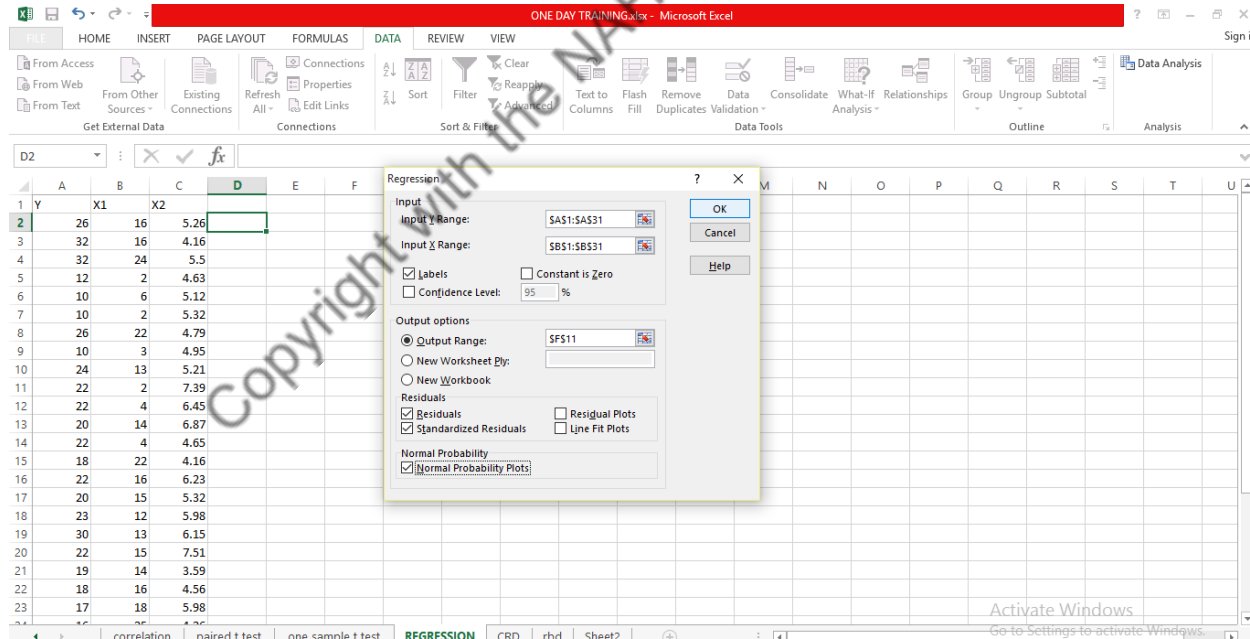


Figure 10: Selection of input and output range in dialog box for regression.

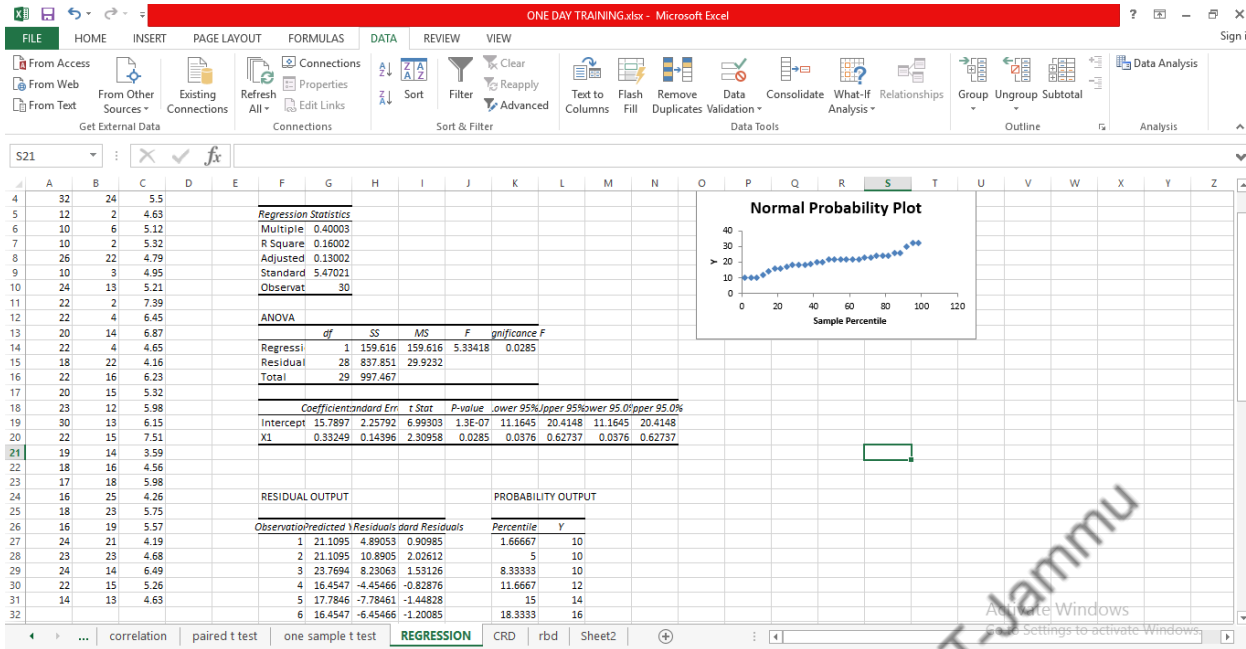


Figure 11: Output of regression analysis.

Conclusion: From the output it is found that the regression model was adequate as compared to the mean model. Further it is observed that R^2 was 0.16 which indicate that there is 16% variation in Y is due to change in X_1 . The estimated regression equation is $\hat{Y} = 15.78** + 0.33*X$.

5. t-test and F-test

The rate of diffusion of carbon dioxide through two soils of different porosity are given below:

fine soil	20	31	18	23	28	23	26	27	26	12	17	25
coarse soil	19	30	32	28	15	26	35	18	25	27	35	34

Test the significance of the difference in the rates of diffusion through two types of soils.

Solution: According to the problem, we would like to test

$$H_0: \mu_1 = \mu_2 \text{ vs } H_1: \mu_1 \neq \mu_2$$

It can be done through the t-test. In analysis tool pack there are two options (i) t-test with equal variances (ii) t-test with unequal variances. Therefore we have to examine which t-test is to be used. This can be tested through the F-test (Levene's test) with the following hypothesis

$$H_0: \sigma^2_1 = \sigma^2_2 \text{ vs } H_1: \sigma^2_1 \neq \sigma^2_2$$

Case I: F-test for testing the equality of populations' variances

Step 1: Open Excel sheet and select data from data menu and click on data analysis.

Step 2: Select F-test Analysis tool from Data Analysis dialog box. (see fig. 12).

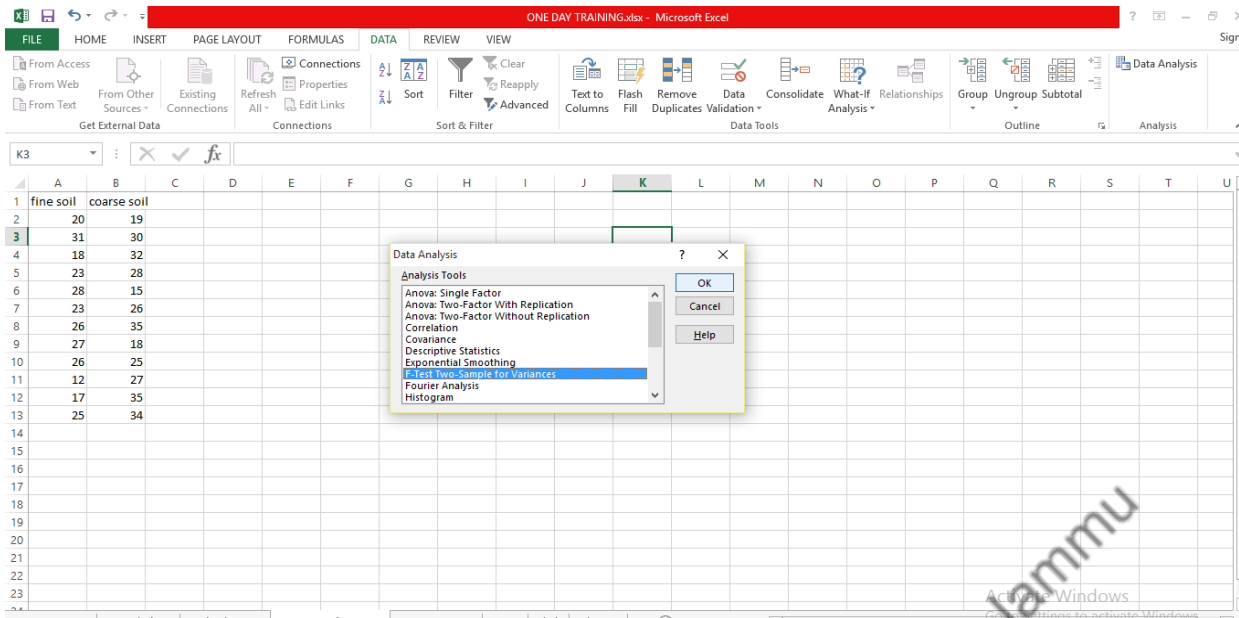


Figure 12: F-test analysis tool from data analysis dialog box.

Step 3: Give input range in F-test: two samples for variance dialog box. (see fig. 13)

Step 4: Give output range in output options for getting output in specific range of cells.(see fig. 13)

Step 5: Click on OK command button. (see fig. 14)

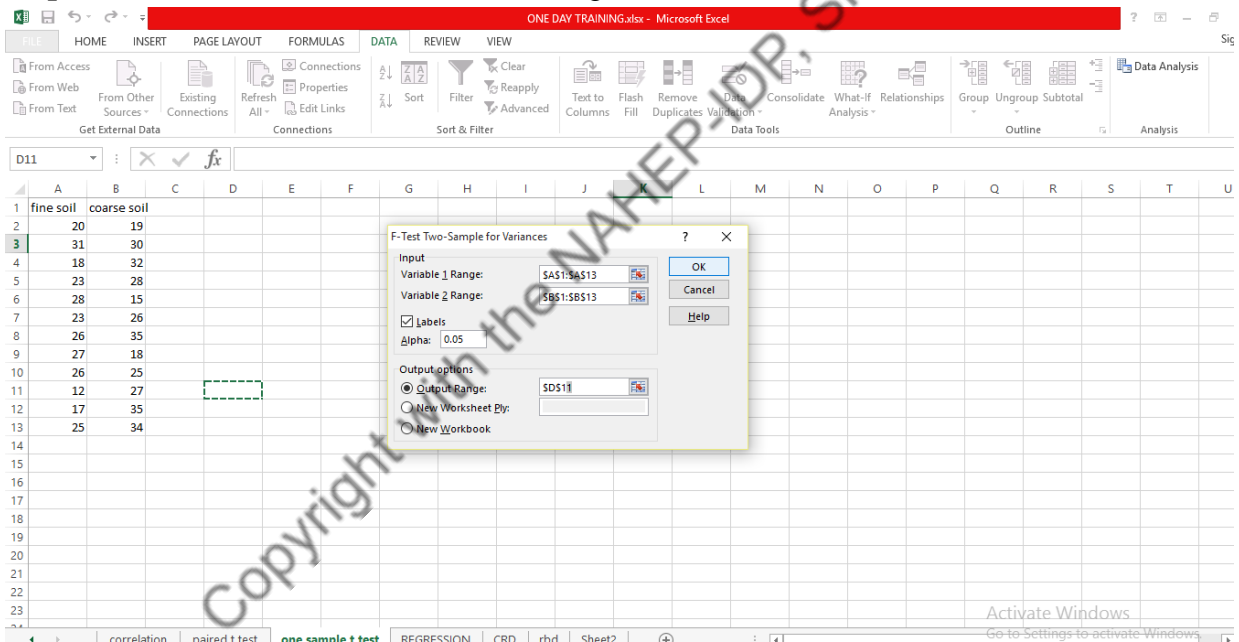


Figure 13: Selection of input range and output range in the dialog box.

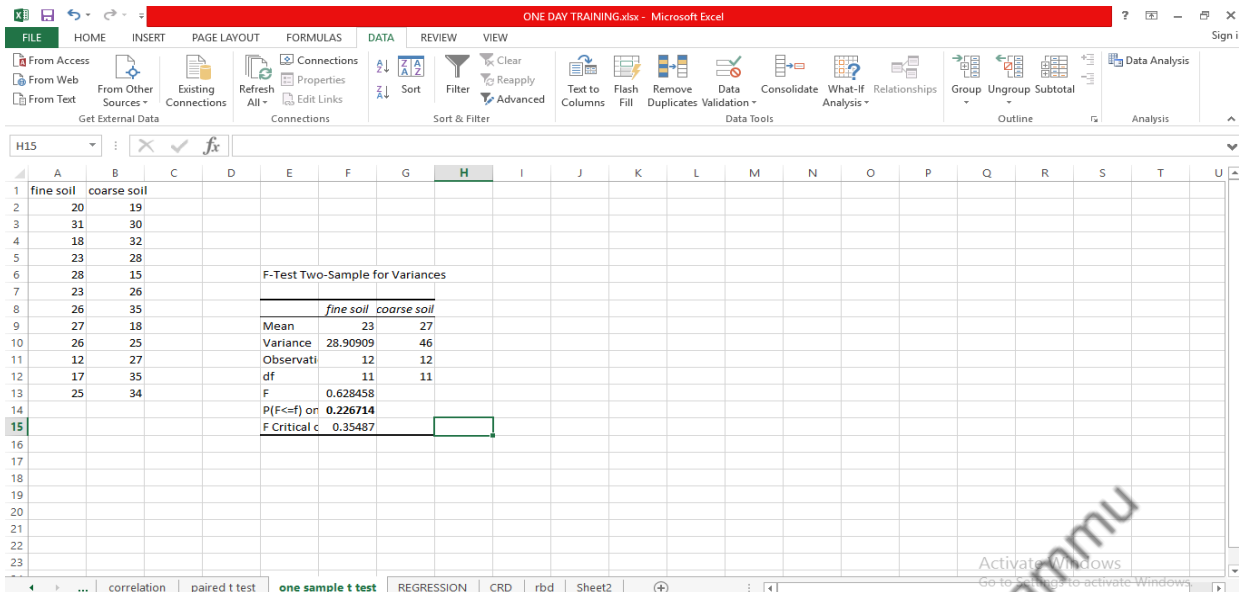


Figure 14: Output of the test.

It is observed from the output that the p-value of the F-test is greater than 0.05. Thus the test is not significant means accept the null hypothesis. Therefore, we will apply the t-test with equal variances otherwise t-test with unequal variances.

Now, Case II: t-test with equal variances for testing the equality of rate of diffusion of two types of soils

Step 1: Open Excel sheet.

Step 2: Go to data menu and select Data Analysis.

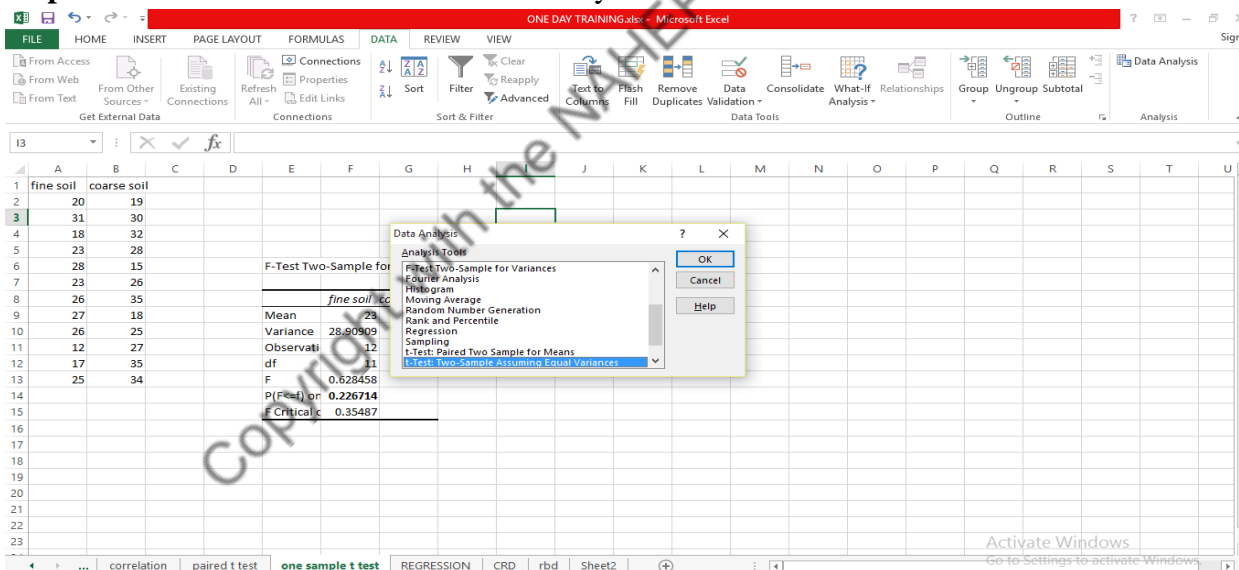


Figure 15: Selection of t-test: two sample assuming unequal variances analysis tools from data analysis tool packs.

Step 3: Select t-test: two sample assuming unequal variances analysis tools from Data Analysis dialog box. (see fig.14)

Step 4: Give input range in t-test: two sample assuming unequal variances dialog box. (see fig.15)

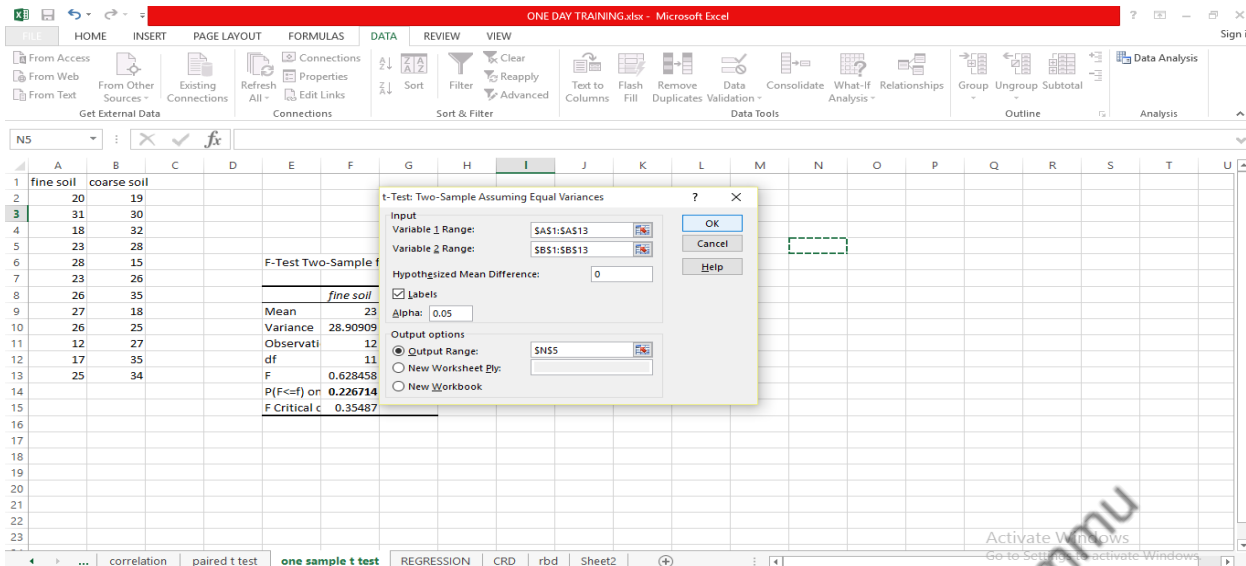


Figure 16: Selection of input and output range in the dialog box

Step 5: Give output range in Output options for getting output n specific range of cells. (see fig. 16)

Step 6: Click on OK command button.

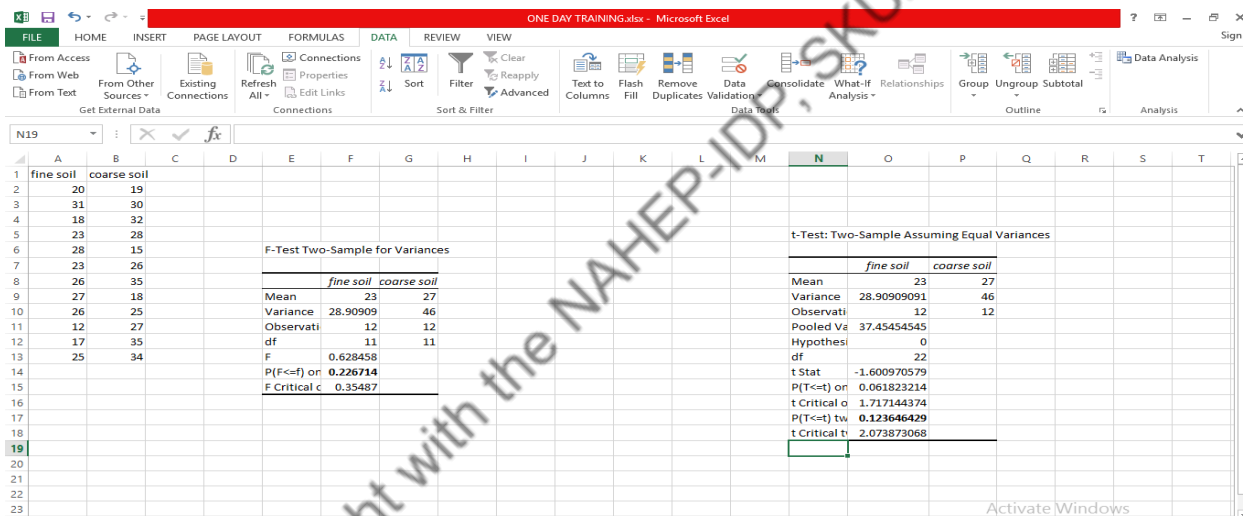


Figure 17: Output of the data

From the output it is observed that the p-value of the t-test is more than 0.05 so the test is insignificant means accept the null hypothesis. The two soil types have same rate of diffusion of carbon dioxide.

6. Paired t-test

Two laboratories carry out independent estimates of fat content for ice cream made by a certain firm. A sample is taken from each batch, halved, and separate have sent to two laboratories. They obtain the following results

Percentage of fat content in ice cream

batch no	1	2	3	4	5	6	7	8	9	10
Lab A	7	8	7	3	8	6	9	4	7	8
Lab B	9	8	8	4	7	7	9	6	6	6

Solution: Here the observations are from the homogenous material hence paired t-test is to be used and the hypothesis is as follow:

$$H_0: \bar{x} - \bar{y} = 0 \text{ OR } d = 0$$

This is to be tested against the alternative hypothesis as:

$$H_1: \bar{x} - \bar{y} \neq 0 \text{ OR } d \neq 0$$

Step 1: Open Excel sheet.

Step 2: Go to data menu and select Data Analysis.

Step 3: Select t-test: paired two sample for means analysis tool from Data Analysis dialog box. (see fig. 18)

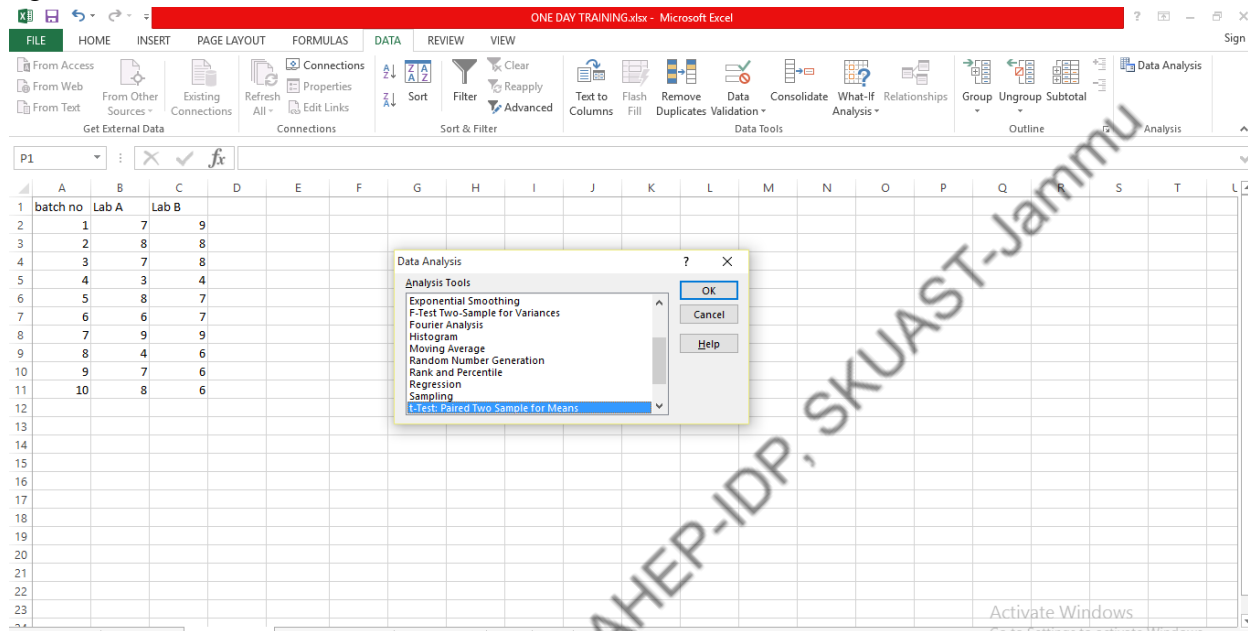


Figure 18: Selection of t-test: Paired two sample for means analysis tool from data analysis dialog box.

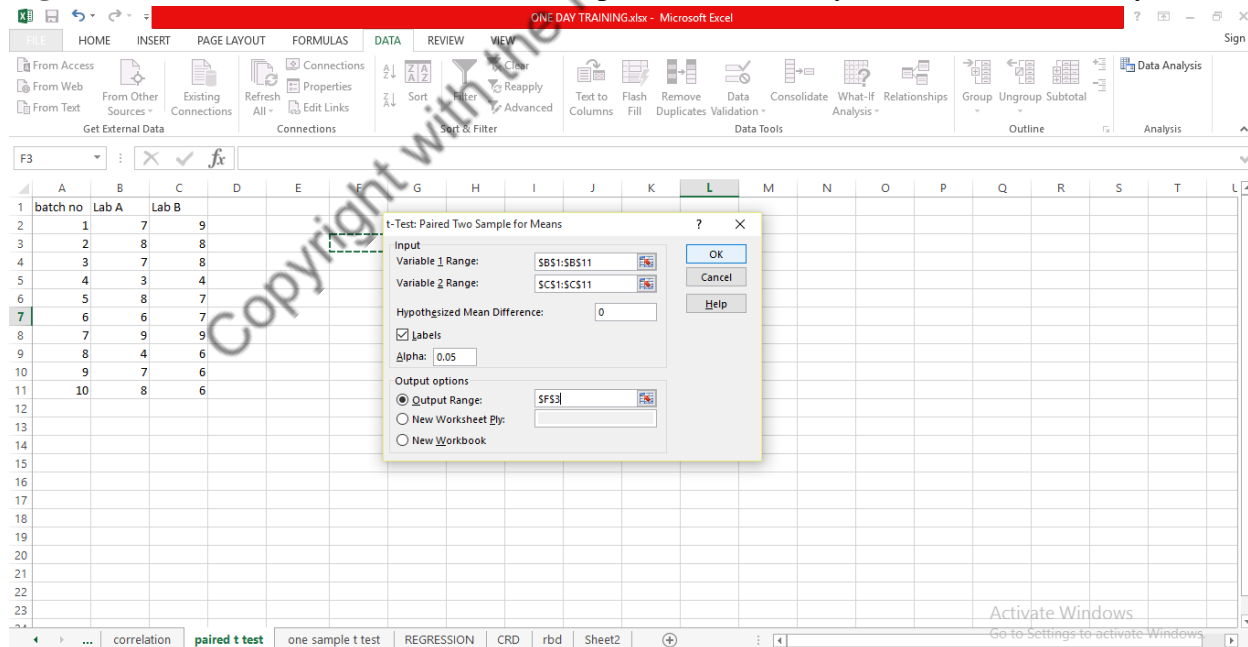


Figure 19: Selection of input and output range for paired t-test.

Step 4: Give input in t-test: paired two sample for means analysis dialog box. (see fig. 19)

Step 5: Give output range in Output options fir getting output in specific range of cells. (see fig. 19)

Step 6: Click on OK command button.

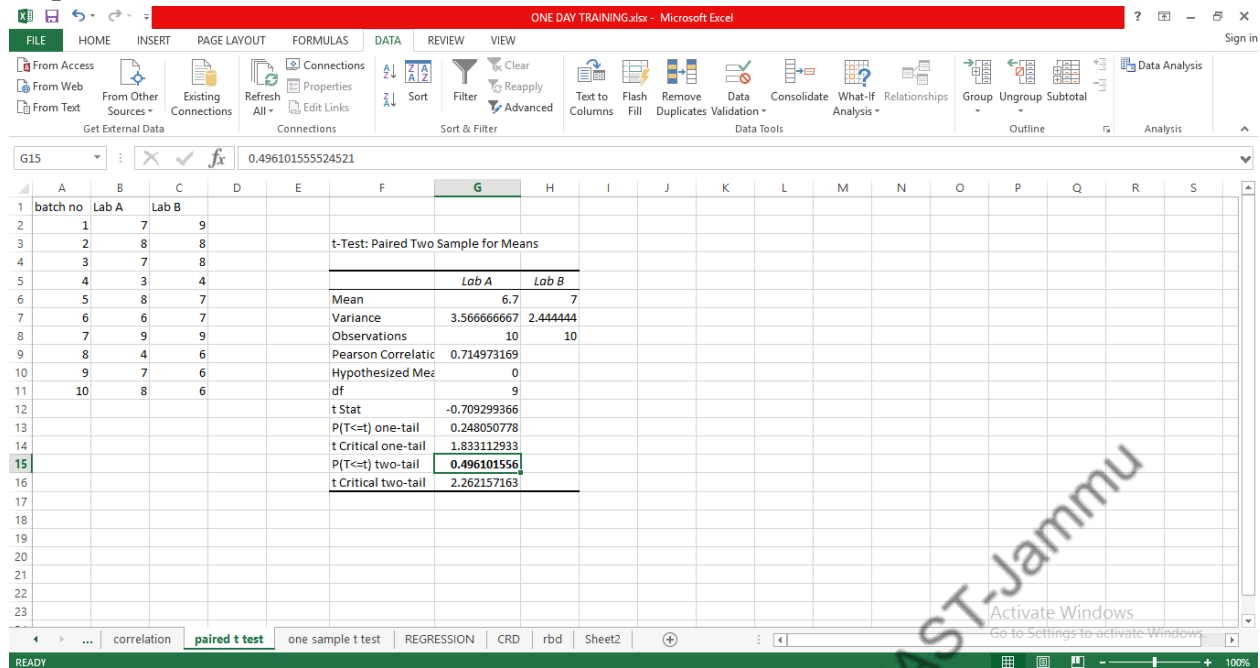


Figure 20: Output of the paired t-test

From fig 3, it can be observed from the output that the $t_{cal} < t_{(10,0.05)}$, therefore, null hypothesis is accepted and we concluded that mean difference of the two samples sent to Laboratories A and B ia significant.

7. One way ANOVA

The following table shows the yield in pounds per plot of five varieties of wheat after being applied to each of 4 plots, completely randomized.

varieties	yields			
A	8	7	10	10
B	19	16	14	9
C	8	9	12	18
D	4	11	9	11
E	12	13	7	6

Perform the analysis of variance.

Solution: This is a fixed effect model can be written as:

$$Y_{ij} = \mu + \alpha_i + e_{ij}$$

The null hypothesis will be

$$H_0: \mu_1 = \mu_2 = \mu_3 = \mu_4 = \mu_5$$

H_1 : At least one variety differs from other.

Through following steps the result can be obtained:

Step 1: Open Excel sheet.

Step 2: Go to data menu and select Data Analysis.

Step 3: Select Anova single factor analysis tool from Data Analysis dialog box. (see fig. 21)

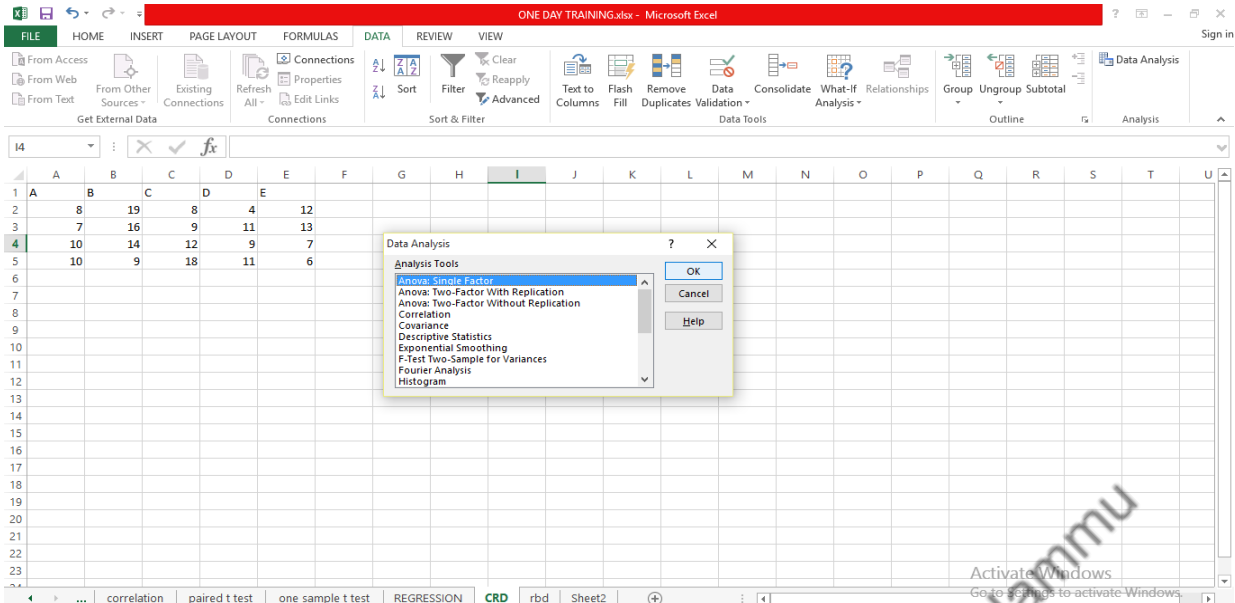


Fig. 21: Selection of one way anova from data analysis dialog box.

Step 4: Give input range in Anova single factor analysis dialog box. (see fig.22)

Step 5: Give output range in Output options for getting output in specific range of cells.(see fig.22)

Step 6: Click on OK command button.

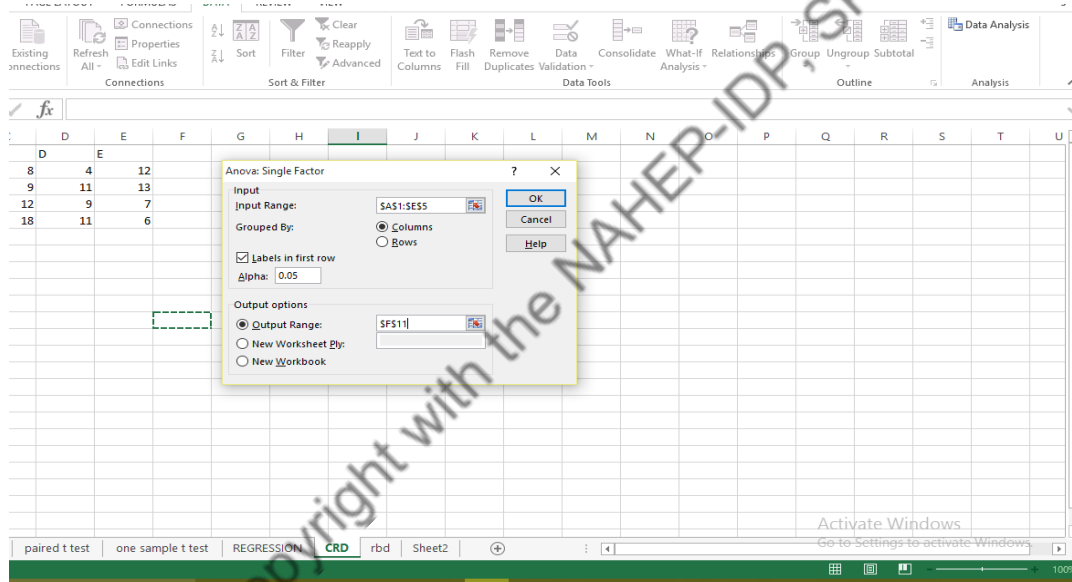


Figure 22: Selection of input and output range in the dialog box for ANOVA, single factor

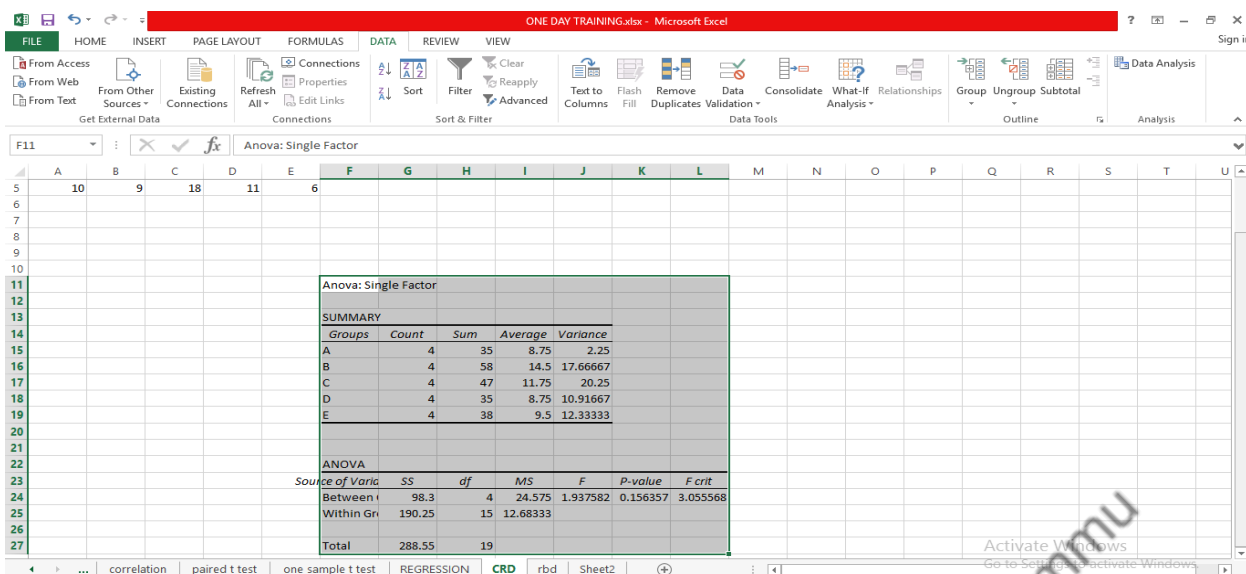


Figure 23: Output of the one way anova.

From the output (see fig 23) it can be observed that $F_{cal} < F_{(4.15, 0.05)}$, therefore the null hypothesis accepted which means that the yield of all the varieties are same statistically.

Note: Completely Randomized design (CRD) is a special case of one – way anova. CRD for equal and unequal replications can be done through the same way as above mentioned.

8. Two way ANOVA

The yield of 4 varieties of wheat per plot (in lbs) obtained from an experiment in randomized block design are given below:

varieties	I	II	III	IV	V
A	15	9	16	15	19
B	7	13	12	11	20
C	17	13	17	12	13
D	11	13	7	11	7

Analyze the data.

Solution: This can be tested through fixed effect model which can be written as:

$$Y_{ij} = \mu + \alpha_i + \beta_j + e_{ij}$$

The null hypothesis will be

$$H_0: \mu_1 = \mu_2 = \mu_3 = \mu_4$$

H_1 : At least one treatment differs from other

The following steps will be used

Step 1: Open Excel sheet.

Step 2: Go to data menu and select Data Analysis.

Step 3: Select anova single two factor without replications tool from Data Analysis dialog box. (see fig.24)

Step 4: Give input range in two factor without replications analysis dialog box. (see fig.25)

Step 5: Give output range in Output options for getting output in specific range of cells.(see fig.25)

Step 6: Click on OK command button.

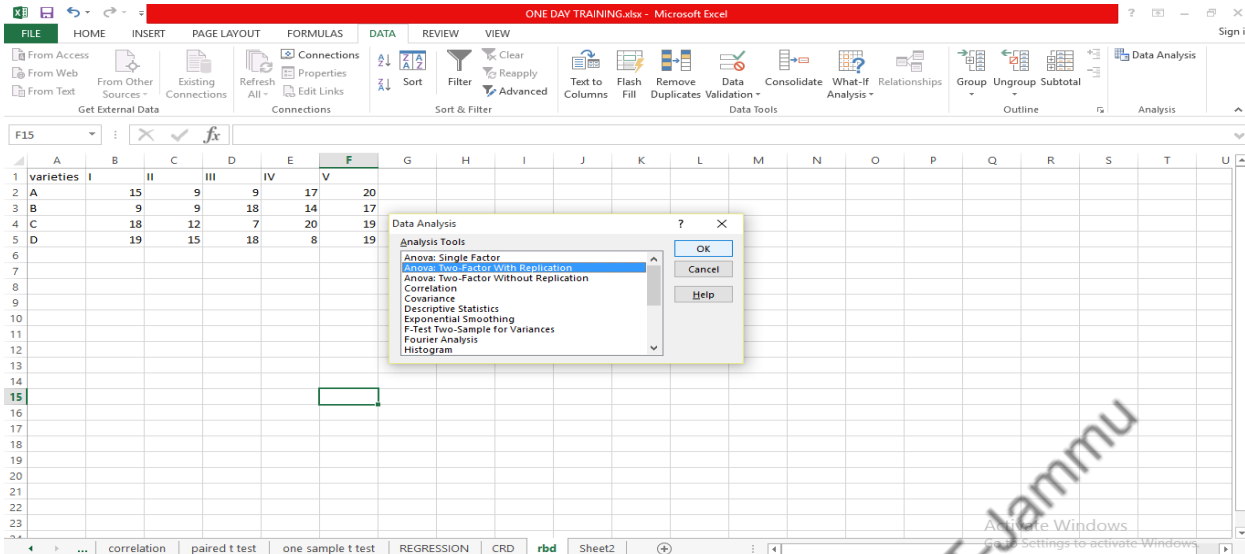


Figure 24: Selection of ANOVA two factor without replication from data analysis tool pack.

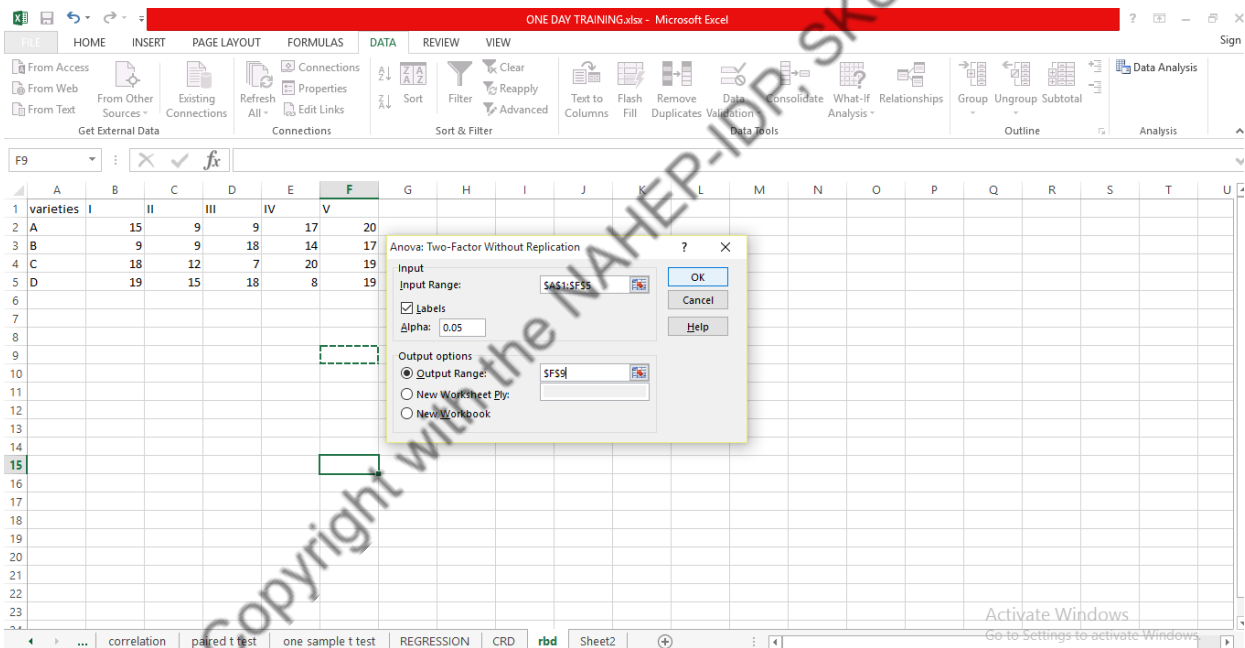


Figure 25: Selection of input and output range for two factor without replication.

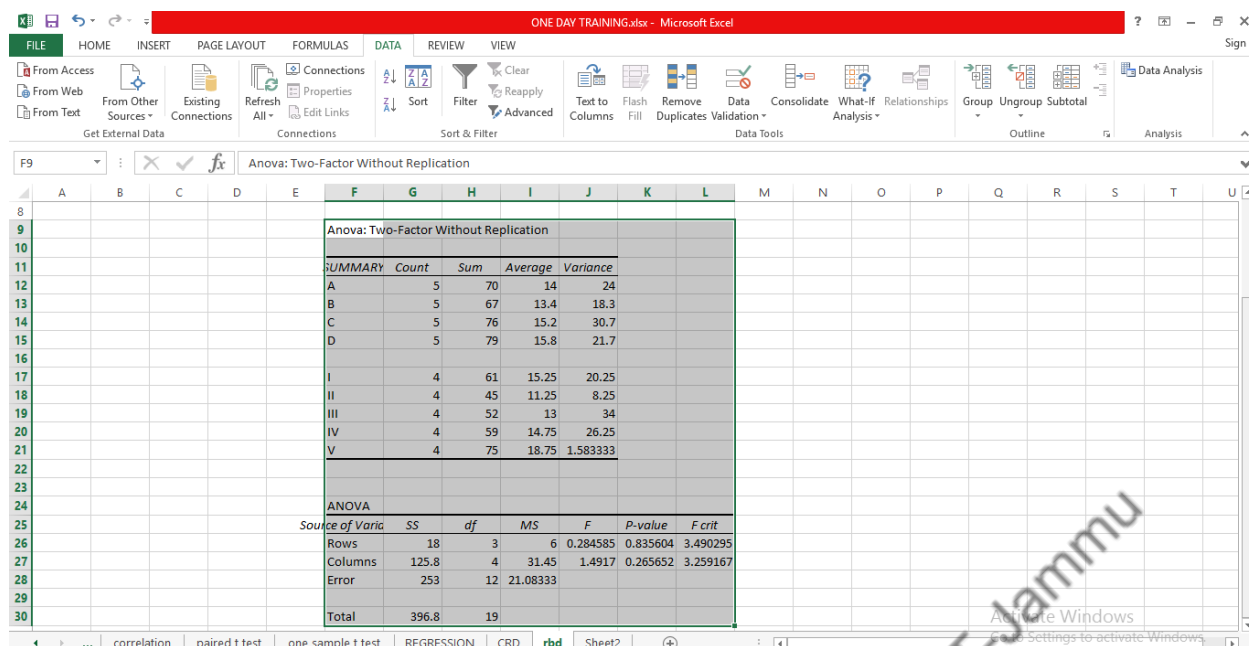


Figure 26: Output of the two way anova data.

From the output (figure 26) it can be observed that the $F_{cal} < F_{(3, 9, 0.05)}$, therefore the null hypothesis accepted which means that the effect of all herbicides on the spike weight are same statistically.

Note: It is similar to Randomized block design.

The Important Excel shortcuts

Ctrl + P	used to open the print dialogue window
Ctrl + N	creates a new workbook
Ctrl + S	saves the current workbook
Ctrl + C	copy contents of current select
Ctrl + V	paste data from the clipboard
SHIFT + F3	displays the function insert dialog window
SHIFT + F11	Creates a new worksheet
F2	Check formula and cell range covered

Acknowledgement : The examples and materials used in this chapters are from different books and online is for teaching purposes.

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AI Application in Image Analysis: Case Study in Phenomic Parameter Estimation

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Introduction

Artificial Intelligence is a technique that allows machines to act like humans by replicating their behaviour and nature. Artificial Intelligence makes it possible for machines to learn from their experience. The machines adjust their response based on new inputs thereby performing human-like tasks by processing large amounts of data and recognizing patterns in them. Machine Learning is naturally a subset of AI. It provides the statistical methods and algorithms and enables the machines/computers to learn automatically from their previous experiences/data and allows the program to change its behavior accordingly. Machine Learning provides many different techniques and algorithms to make the computer learn. *Decision trees, Random Forests, Support Vector Machines, K Means clustering* – these are just to name a few. Deep Learning can be thought of as the evolution of Machine Learning which takes inspiration from the functioning of the human brain. Deep Learning is used to solve complex problems where the data is huge, diverse, less structured. Deep learning models are built on top of Artificial Neural Networks, which mimic how the human brain works.

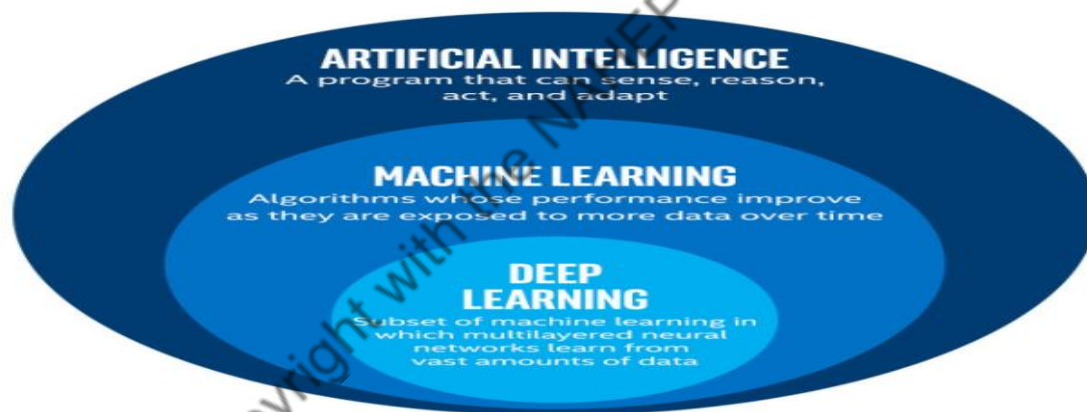


Fig 1: AI vs ML vs DL (Source -Towards Data Science<https://towardsdatascience.com/>)

Deep Learning is a particular kind of machine learning inspired by the functionality of our brain cells called neurons which lead to the concept of Artificial Neural Network(ANN). ANN is modeled using layers of artificial neurons or computational units to receive input and apply an activation function along with threshold.

In simple model the first layer is input layer, followed by a hidden layer, and lastly by an output layer. Each layer contains one or more neurons (Fig 2).

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Deep learning is all about using neural networks with more neurons, layers, and interconnectivity. Deep Learning is used to extract features.

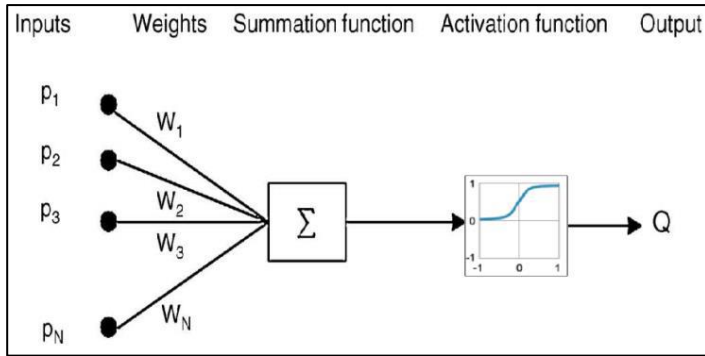


Fig 2: Simple architecture of ANN

Image Analysis

Image analysis deals with manipulating an image in order to enhance it or extract information from it. Image analysis is widely used in visualization of medical images, biometrics, self-driving vehicles, gaming, surveillance, law enforcement, agriculture and almost all spheres of life. Here are some of the main purposes of image analysis:

- **Visualization** — Represent processed data in an understandable way, giving visual form to objects that aren't visible, for instance
- **Image sharpening and restoration** — Improve the quality of processed images
- **Image retrieval** — Help with image search
- **Object measurement** — Measure objects in an image
- **Pattern recognition** — Distinguish and classify objects in an image, identify their positions, and understand the scene.

AI Applications in Image Analysis

Machines can be taught to interpret images the same way our brains do and to analyse those images much more thoroughly than we can. Image processing with artificial intelligence can power face recognition and authentication functionality for ensuring security in public places, detecting and recognizing objects and patterns in images and videos, and so on.

AI based image analysis can be used in agricultural applications for many purposes, some are given below:

- To detect diseased leaf, stem& fruit
- To quantify affected area of disease.
- To find shape of affected area.
- To determine colour of affected area.
- To determine size and shape of fruits.
- Livestock disease detection and estimation

In this chapter, we have covered two case studies on image analysis using AI techniques in the area of plant phenomics.

Plant phenomics is the study of plant growth and performance based on morphology, physiology and phenotypic traits or characteristics of the plant. Plant phenotypic traits like Senescence in leaf/plant, number of spikes/panicle plays a vital role in the study of functional plant biology, growth analysis and are considered as determining factor of net primary production of the crop. Conventional measurements

of these traits are recorded either manually or visually which is not only time-consuming and labor-intensive but also error prone to acquire large amount of dataset. With the advancement of image analysis and deep learning techniques, focus has been shifted on precise, accurate and rapid phenotyping in the recent years.

Case Study 1: Plant Senescence Quantification and Estimation

Plant senescence is an integral response of cells to the regular ageing process but also due to unfavourable conditions. Senescence results in observable leaf colour changes from the usual deep green to pale green, to yellow and finally to brown. Current methods for phenotypically measuring senescence are completely visual and labour-intensive. Visual scoring depends on the subjectivity of the senescence rater. Human eye get tired after long hours of visual scoring, which can produce large intra-rater variability in rating scores. Using high definition, high resolution RGB images, one could attribute plant image colour into a few categories of senescence and green portion. Based on pixel values, it is possible to train a machine learning algorithm that can classify each pixel belongs to either green or senescence portion.

Methodology:

1. Wheat plant data was collected from NDPPC, IARI New Delhi.
2. 540 images of 30 wheat plants, grown in controlled environment, were taken from initial stage to maturity stage(18 stages)
3. Following 6 Machine Learning algorithms was trained to the collected data
 - a) Naïve Bayes
 - b) K-Nearest Neighbours (KNN)
 - c) Decision Tree
 - d) Random Forest
 - e) Gradient Boosted regression trees
 - f) Artificial Neural Network (ANN)
4. 5 classes were chosen for senescence and green-ness.
5. Brown (Dry), Yellow, Pale yellow, Dark Green, Light Green.
6. For each class, RGB pixel values were sampled from the acquired image data, using image J software.

Table 1: Sampled pixel values

Class	Sampled values	Pixel
Brown (0)	999	
Yellow (1)	999	
Pale Yellow (2)	999	
Dark Green (3)	999	
Light Green (4)	999	
BG-1 (5)	995	
BG-2 (6)	1225	

Total	7215
-------	------

Six machine learning based algorithms were trained on this dataset using 75:25% ratio for training and testing respectively. After training, Table 2, shows the achieved accuracy on test dataset. These algorithms are trained to predict the class of the input pixel.

Table 2: Accuracy for trained classifiers

S. No	Machine learning Model	Accuracy
1	Naïve Bayes	89.3%
2.	Decision Tree	92.2%
3.	K-Nearest Neighbours (KNN)	94.9%
4.	Gradient Boosting	95.6%
5.	Random Forest	96.23%
6.	ANN	96.66%

Senescence Quantification: Figure 3 presents the algorithm developed for senescence quantification. This algorithm takes input image and outputs the senescence percentage. It calculates the percentage of the pixels in each class.

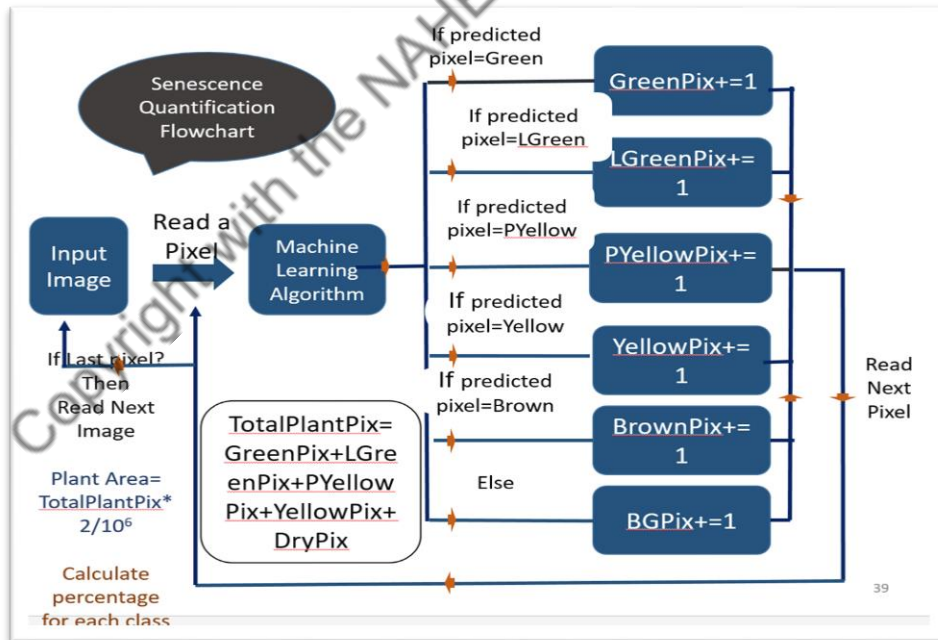


Figure 3: Senescence Quantification flowchart

A	B	C	D	E	F	G	H
File Name	Dry pix Percentage	Yellow Pixels Perce	Pale Yellow Pix P	Light Green Pi	Green Pix Per	Total Plant Pix	Plant Area
Wheat_2017_001_C_RIL_R1	0.85303186	0.020554985	0.246659815	41.8088386	57.0709147	9730	0.01946
Wheat_2017_001_C_RIL_R1	0.583950046	0.040471785	0.173450509	35.435939	63.7661887	17296	0.034592
Wheat_2017_001_C_RIL_R1	0.123109391	0	0.008793528	26.8202603	73.0478368	45488	0.090976
Wheat_2017_001_C_RIL_R1	0.156958274	0.005022665	0.114265624	18.7521189	80.9716345	79639	0.159278
Wheat_2017_001_C_RIL_R1	0.406435109	0.018320113	0.12213409	16.2757245	83.1773862	147379	0.294758
Wheat_2017_001_C_RIL_R1	0.368751656	0.005225226	0.086589458	10.9386372	88.6007965	267931	0.535862
Wheat_2017_001_C_RIL_R1	0.507496625	0.017307073	0.265996395	8.52732787	90.681872	375569	0.751138
Wheat_2017_001_C_RIL_R1	1.291931428	0.050500308	0.574075813	12.6553354	85.4281571	479205	0.95841
Wheat_2017_001_C_RIL_R1	2.284221481	0.43072022	1.769819575	22.172569	73.3426698	519827	1.039654
Wheat_2017_001_C_RIL_R1	3.451494698	0.550457735	1.580472824	22.4383674	71.9792073	561351	1.122702
Wheat_2017_001_C_RIL_R1	4.898560553	0.822221495	2.932251496	28.2734381	63.0735283	580987	1.161974
Wheat_2017_001_C_RIL_R1	6.094479696	1.360263451	3.774193492	31.9271728	56.8438905	576653	1.153306

Figure 4: Senescence Quantification output. Here percentage of each class are predicted

For senescence estimation, a desktop application “m-senescenca” has been developed.

Case Study 2: Spike segmentation and counting in wheat Plant for controlled condition

Image acquisition: Wheat plants were grown in pots in the climate-controlled greenhouse in Nanaji Deshmukh Plant Phenomics Centre, ICAR-Indian Agricultural Research Institute, New Delhi, India. Three different side view images (angles: 0°, 120°, 240°) of the plants were recorded using the automated turning and lifting unit present inside the imaging unit. The side views were considered, as it is hypothesized that the image from one direction cannot cover all the spikes of the plant; besides, it helps in increasing the data points corresponding to one plant.

Approach for detection and counting of spikes in a single plant: The proposed approach consists of two broad stages of analysis. First stage deals with identification or detection of spike regions from the whole wheat plant image and the second stage consists of counting of the number of spikes of the plant. For identification of spike, convolution encoder-decoder deep-network technique has been applied and a deep learning model Spike Seg Net has been developed for spike identification.

Architecture of Spike Seg Net network: The network is developed for pixel-wise segmentation of objects (or spikes) from the wheat plant. The architecture of Spike Seg Net is inspired by UNet convolution network (Ronneberger et al., 2015) and the backbone of network is based on convolution encoder-decoder deep-learning technique. Encoder takes input patch image to give feature map representation that holds the contextual and spatial information. The Decoder takes the information as input and produces corresponding segmentation masks as output. In this 3 encoders and 3 decoders are used.

Each encoder block consists of convolution layer to produce a set of feature maps with Rectified Linear Unit (ReLU) activation function. Then these feature maps were batch normalized to improve the performance and stability of the network. Followed by max-pooling with 2*2 window was used with stride 2 (non-overlapping) for sub-sampling or down-sampling the features by factor of 2. For decoding, convolution 2D transpose (or, de-convolution) was used to up-sample the feature maps by a factor of 2 as opposite to the max-pool. Each decoder block consists of convolution layer with “ReLU” activation function to produce features and followed by batch normalization was done to the each produced feature.

Output of the final decoder was fed into $3 \times 3 \times 1$ convolution layer with “softmax” activation function to classify the object (*i.e.*, spike). “Adam” optimizer (Kingma & Ba, 2014) was used to update the weights while training was done. “Binary cross-entropy” (Hagenauer *et al.*, 1996) loss function has been used in this study to predict binary class label (*i.e.*, spikes and non-spikes).

The numbers of encoder blocks and decoder blocks are estimated empirically to yield the best results with optimum performance. The fitted architecture is given in Fig 5.

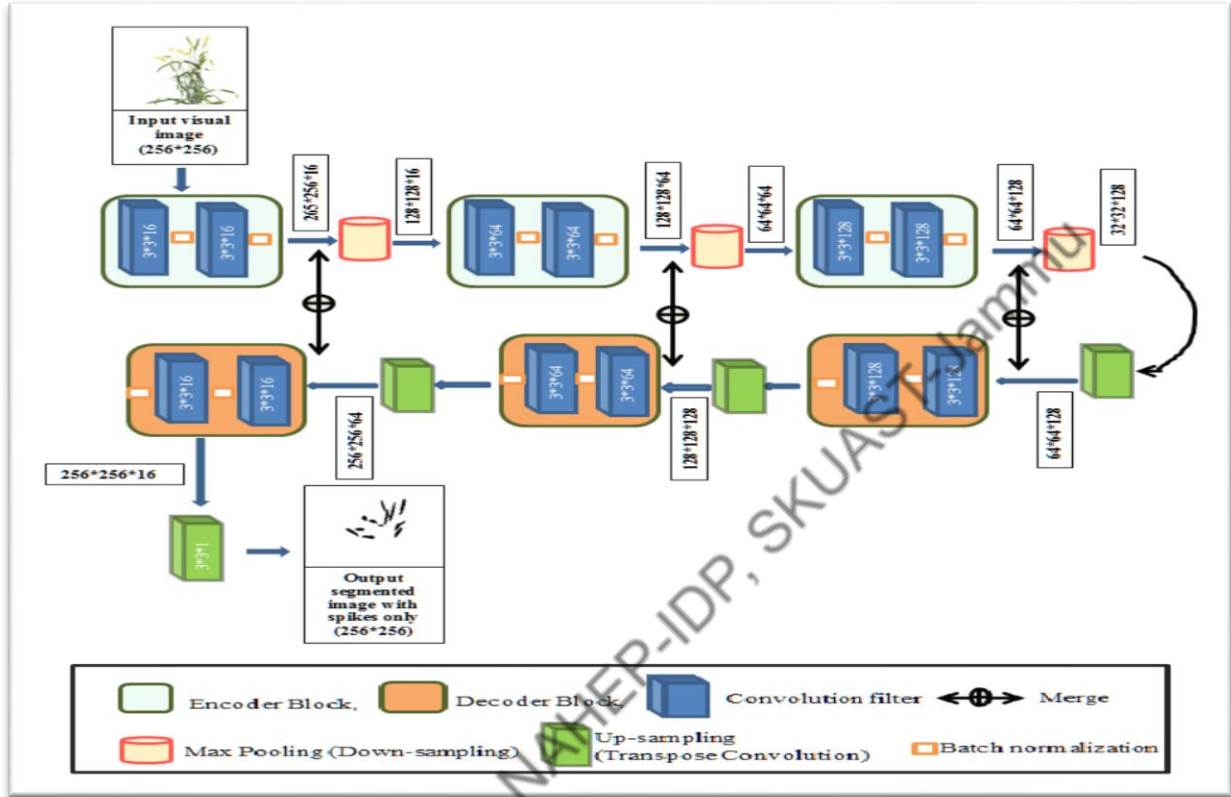


Figure 5: Spike Seg Net Architecture

The developed model was tested on test image dataset (*i.e.*, image dataset of randomly selected 15% of the total plant) for detecting spike in a wheat plant. The performance of spike identification is calculated at pixel level, by different performance parameters (E_1 , Accuracy, Precision, Recall, and F-measure) and the average values of these parameters are shown in Table 3.

Table 3: Performance of SpikeSegNet in spike segmentation

E_1	Accuracy	Precision	Recall	F-measure
0.03061	0.94669	0.94561	0.94786	0.94887

Output of the proposed encoder decoder network is a predicted mask image and was used to count the number of spikes of the plant. For this purpose, flood-fill technique (Asundi & Wensen, 1998) has been explored to count number of objects. “Analyze particle” module of imageJ software has been used for this purpose. For counting number of spikes in a single plant, visual images of three directions (0^0 , 120^0 , 240^0) of the plant were used as input to the developed encoder-decoder model and the predicted output

mask images of the 3 directions were used to detect and count no of objects (or, spikes).The maximum count of objects among the three directions was selected as final spikes count per plant (Fig 6).

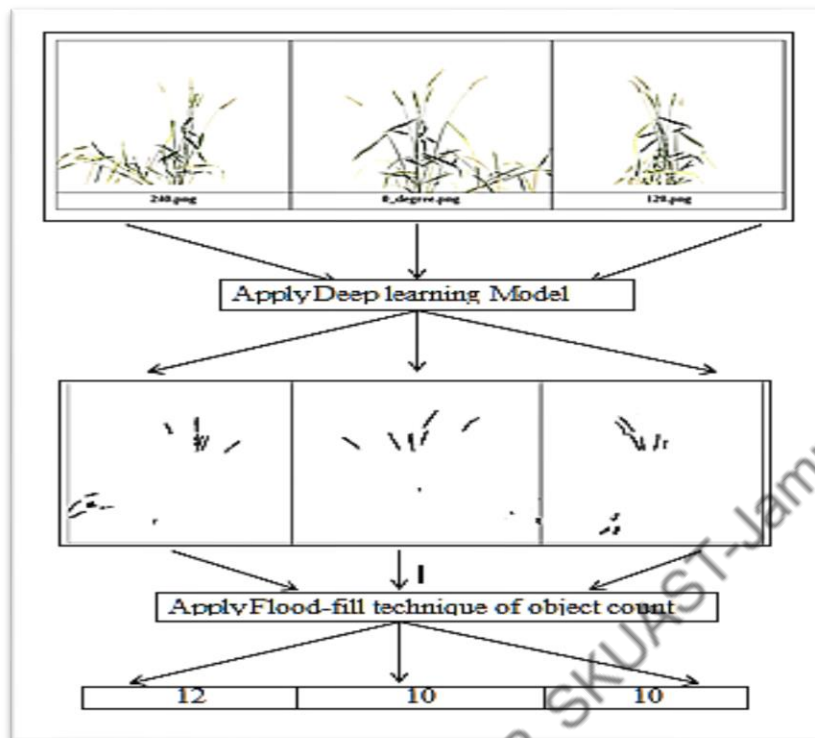


Figure 6: Approach for counting of spikes

For counting the number of spikes per plant, flood-fill algorithm of object counting based on image analysis has been applied on the output image of the encoder-decoder model. The developed model was tested on test image dataset (*i.e.*, image dataset of randomly selected 15% of the total plant) for counting number of spike in a wheat plant. The proposed approach was compared with the ground truth value of spike counting per plant.

Although the proposed encoder-decoder model achieved 94% accuracy in detecting/identifying spikes, but counting accuracy is about 92%. This may be due to undercounting of spikes that overlap each other and object linking (or connecting) problem and invisibility of some spikes which are hidden behind other plant structures.

Online software development – Web-Spike Seg Net: An online platform, “Web-Spike Seg Net”, has been developed based on the proposed deep-learning framework “Spike SegNet”. The software is freely available at <http://spikesegnet.iasri.res.in/> for researchers, and students working in the area of wheat plant phenotyping.

Conclusion:

Recognition and counting of spikes for the large set of germplasms in a non-destructive way is an enormously challenging task. Approach Spike Seg Net has been presented based on combined digital image analysis and deep learning techniques to identify and count spikes in the wheat plant. The developed web-based software “Web-Spike Seg Net” is freely available for researchers, and students are working particularly in the field of wheat plant phenotyping. “m-senescence” app has been developed for estimation of senescence using machine learning techniques. Further, both are useful tools in the automated phenomics facility to automate the phenology-based treatment. These collective

approaches are significant step toward studying the wheat crop phenotyping and can be extended to the other cereal crops.

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Introduction

Information Technology (IT) involves the study and application of computers and any type of telecommunications that store, retrieve, study, transmit, manipulate data and send information. Information Technology involves a combination of hardware and software that is used to perform the essential tasks in a better way and that can **enhance the efficacy of students to understand and implement any task.**

Today's agriculture routinely uses sophisticated technologies such as robots, temperature and moisture sensors, aerial images, and GPS technology. These advanced devices and precision agriculture and robotic systems have taken agriculture to an advanced level.

Thus, it becomes highly essential for students to know the importance of IT tools in the field of Agriculture and related fields. Development of Mobile Apps & Video Clips/Animations are the important **"IT Tools in Improving Learning and Research Efficacy of Students"**

Know the Mobile Apps

A Mobile Application (also called a Mobile App) is a type of application designed to run on a mobile device, which can be a Smartphone or tablet. Even if apps are usually small software units with limited functionalities, they still manage to provide users with quality services and experiences.

Contrary to applications designed for desktop computers, **mobile applications move away from integrated software systems. Instead, each Mobile App provides an isolated and limited functionality.** This is how, mobile apps store, retrieve, study, transmit, manipulate the targeted information and hence gives targeted solutions to its users.

Key Mobile App development Technologies

Native Apps

Native Apps are built for a single mobile operating system. That's why they're called native – they're native to a particular platform or device. The majority of mobile apps today are built for systems like Android or iOS. To put it simply, you can't install and use an Android app on iPhone, and vice versa. The main benefit of native apps is their high performance and excellent user experience. After all, developers who build them use native device UI. Access to a broad range of APIs also helps to accelerate the development work and extend the boundaries of app usage.

The authors are working in Quick n Host

Web Apps

Web apps are software applications that behave similarly to native mobile apps and work on mobile devices. However, there are significant differences between native apps and web apps. Web apps use browsers to run, and they're usually written in CSS, HTML, or JavaScript. Such apps redirect the user to the URL and then offer them the option to install the app. That's why they require minimum device memory.

Since all of the personal databases will be saved on the server, users can only use the application if they have an internet connection. This is the main drawback of web apps – they **always require a good internet connection**. Otherwise, you risk delivering a subpar user experience. Moreover, developers don't have that many APIs works with, except for the most popular features like geolocation. The performance will be linked to browser work and network connection as well.

Hybrid Apps

Hybrid apps combine both web applications created for web browser and native applications that are designed for a particular platform and have to be installed on a device. Hybrid mobile apps are usually developed using HTML, CSS and JavaScript and then wrapped in a native apps with the help of special platforms. You also get a single codebase for all the platforms. This lowers the cost of maintenance and streamlines the updating process. Developers can also take advantage of many APIs for features such as geolocation. On the other hand, hybrid applications may lack speed and performance. Also, you might experience some design issues as the app might not look the same on two or more platforms.

Still! Hybrid App development is so attractive?

It is simple: you can build two-in-one – both iOS and Android apps without having to write separate code for each twice. As a result you will have two apps for the same amount of time.

Creating Video Clips/Animations

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Introduction

Video creation is basically the entire process of creating a video. Whether it's a short film, a full-length movie, business marketing video, television commercial, music video, or other type of film, the process may vary a little with the specifics, but the overall process is basically the same.

The 3 Main Stages of Video creation

- Idea formation.
- Scripting.
- Video creation.

Idea formation

It defines which goals should be achieved, how the final product should look, which target group should be addressed, and what is actually the main topic of your film. It is important to work out ideas and bring them on point.

Scripting.

With your strategy and creative approach developed, it's time to write a script. Your creative approach should heavily influence your script and your research should ground the message behind it.

Video creation

It refers to the process of capturing moving images on electronic media (e.g., videotape, direct to disk recording, or solid-state storage) and even streaming media. ... Nowadays, any video work could be called videographer, whereas commercial motion picture production would be called cinematography.

Why Video is Important?

Engaging

“Our brains are hard-wired to engage in storytelling, as a narrative arc compared to other forms. And video is a great way to tell a story and engage.” There's a reason that often times the best communicators are the best storytellers.

People are drawn to a good story. The better you are at telling a story with your video content, the better your video will be received.

Emotional

“There's an opportunity to connect more emotionally with prospects and buyers through video as a medium...having people on camera and connecting can stimulate different kinds of emotions that the written word can't.”

A video, even if it's just your voice over a screen recording, provides valuable context that cannot be gained from text alone. Videos let you establish authority and a more personal feel to your message. You will be far more likely to connect on an emotional level with your audience if you use video versus another content type.

Educational

“Our brains process visual information faster than text. We store either long-term memory and text the short-term memory and so on. And, so there are lots of reasons why video is a great educational medium and can be more memorable.”

In today's world, organizations must put an emphasis on providing educational videos to employees. In fact, according to Forrester Research, employees are 75% more likely to watch a video than to read documents, emails, or web articles. If you want something communicated effectively throughout your organization a video is a go-to medium.

Types of videos:

1. Demo Video
2. Animated Explainer video.
3. Product Videos.
4. Live video.
5. Tutorial videos.

What is a demo video?

A demo video illustrates how your idea works by showing it in action. Demo videos are a compelling way to communicate your idea's value to prospective customers. Demo videos are one of the four most common types of videos, so knowing how to create this type of instructional video is a great skill to learn. But don't worry! Making a demo video is easier than you might think with the right tools and a bit of planning.

What is an Animated Explainer Video?

It refers to the process of capturing moving images on electronic media (e.g., videotape, direct to disk recording, or solid-state storage) and even streaming media. ... Nowadays, any video work could be called videography, whereas commercial motion picture production would be called cinematography.

What is a Product Demo Video?

Compelling product demo videos are powerful sales tools. They're informative, educational, and memorable. But most of all, they help you make sales and close deals. A great demo video shares the value of your offering shows how it solves a problem and convinces viewers why they cannot live without it.

At Tech Smith, we've made a lot of demo videos and helped a lot of people make their own. We have a bit of experience in the biz.

In this post, I am going to share some criteria to help you decide how to make your demo video and offer a strategy for crafting one that gets your message across.

What is a Live Streaming Video?

Every day when we open social media at work, we are bombarded with live video from Facebook, live streaming webinars, and streaming on YouTube.

How are we supposed to process it all in real-time, especially when it might disappear the second we scroll with no way to find it again?

More importantly, how can you record streaming video so it's not all lost in the internet's void?

Don't let the internet run your schedule.

You can easily capture or record live streaming video and share it with your friends or coworkers, or save it for later viewing. It's easy, it's fast, and it will bring order to a chaotic media landscape.

What is a Tutorial Video?

A goal of using video multimedia is to transform a passive viewing experience into an active learning experience. This is accomplished through "video tutorials". A video tutorial is a student handout is written to accompany a specific video.

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Cyber/Network Security & Ethical Hacking**Bhupal Arya***Corresponding author: bhupalarya@gmail.com*

The current version of Internet Protocol (IPv4) has not been substantially changed in the past 25 years. IPv4 has proven to be robust and easily implemented. In the early stage, the deployment of IPv6 is prepared and begun on the IPv4-based network. In the intermediate stage, IPv4 and IPv6 coexist. In the later stage, IPv6 plays a leading role on the network and the IPv4 network is gradually withdrawing from the market. Meanwhile, researchers put forward many transition mechanisms for different network infrastructures and different evolution stages. In this paper, a detailed study is made on IPv4 along with its different smart saving techniques. Which help in delay of IPv4 to IPv6 shifting delays. Also different addressing schemes are discussed which remains unchanged in future. Along with those limitations of IPv4 is also focused so present IPv4 network infrastructure can be more secured till IPv6 realization.

World Wide Web, www connects all e-resources together where clients and server can use and give such services. Whenever any service or resource is demanded the client should first able to locate the server carrying the resources. After resource has been found out the particular directory or server disk has to be checked to get the location of the file. Once location is identified then there is a need for different protocols which deliver such resources on the internet in electrical forms while keeping it intact. To get the resource we have different addressing schemes while protocols stand

To deliver the content. In this paper Internet Protocol version 4 is studied in order to understand its pros and cons. The different addressing levels such as logical, physical, port and specific addressing is mentioned in their own aspects of need and certainty. Further the relation of such addressing schemes with OSI and TCP/IP models are shown. IPv4 is talked about with its size and different classes, where each class differs by its network and host ID part.

IPv4 addresses are already scarce and IPv6 addressing is under deployment progress. Till all the IPv4 devices are improved to IPv6 devices the only option is to use IPv4. In such scenarios how to use IPv4 addressing scheme with more efficiency is discussed and it covers the different techniques like classful and classless IP addressing. Subnetting is other way by which one can expand the network while keeping the public network id unchanged. Advance to that the private and public IP addresses are mentioned along with their ranges, so one can make use of them in their private and public networks accordingly.

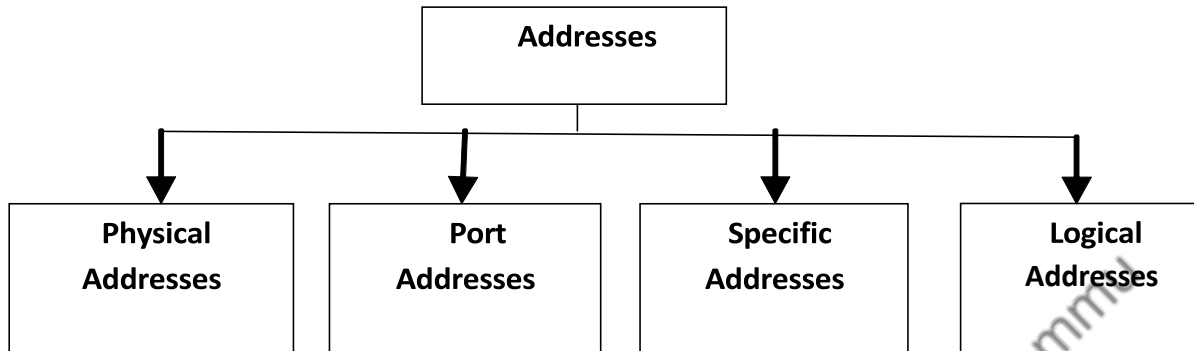
The other possible way to have more users in less range of available IP is DHCP which is focused too, followed by the Network Address Translation technique which makes communication possible for private networks over public domains. At closing different IPv4 loopholes are discussed in order to have present IPv4 network infrastructure more secured and efficient with quality of service

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‘Levels of Addresses

TCP/IP protocol suit addresses four levels of addressing schemes. Each level represents different addressing techniques and sources 1.

Each addressing level is correlated to a definite layer in the TCP/IP design.



Classification in Addresses in TCP/IP1

Physical Addressing

Physical Address is also known as MAC (Media Access Control) Address. It is a unique identifier, typically associated to an essential circuit card which converts communication data to electrical signals, called as Network Interface Card (NIC) which is critical hardware responsible for the communication to a Data Link Layer. NIC can be wired and wireless based on the need

It is 2-digit (6 bytes or 48 bits) hexadecimal numbers. By convention, they are ordinarily written in one of the following three formats 3:

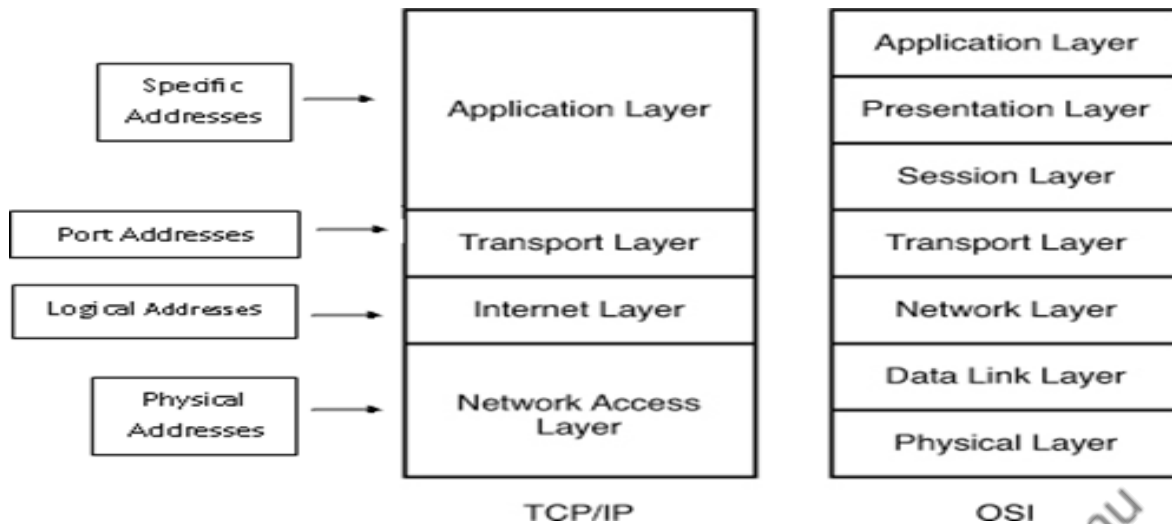
- MM:MM:MM:SS: SS: SS
- MM-MM-MM-SS-SS-SS
- MMM.MMM.SSS.SSS

The leftmost 6 digits that is 24 bits prefix is associated with the adapter manufacturer assigned by IEEE and rightmost 6 digits are identification of each devices.

e.g. 06:01:02:01:2B:4C. In LAN topologies data are in the form of frames are propagated by MAC addresses. Such addresses can be seen at real time by using ipconfig/ifconfig commands on respective windows and linux OS.

Port Addressing

Communication data travels in other forms based on the OSI and TCP/IP layers. They are termed in accordance to a layer. For example at DLL it is called as frame, at NL it is Packet and at PL it is



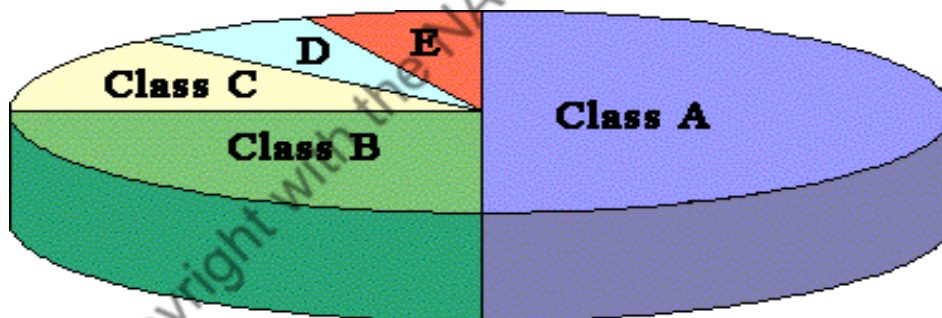
Specific Addressing

The World Wide Web represents the e-resources in the form known as Uniform Resource Locator (URL). Each URL represents communication protocol, domain and the path for the resource. It is known as specific addressing.

Logical Addressing

This addressing scheme represents a particular entity in the world. Through physical addressing the communication is limited to a number of resources in a smaller range but to communicate across a globe logical addressing is the key. It is 32-bit long address which represents network and host part and hence called as logical addressing. This addressing is commonly referred as Internet Protocols and exists in two flavors called as version 4 and 6 that is IPv4 and IPv6

Internet Protocol Version 4



The 32 bit long IPv4 address has first field as network id which represents a particular network in the internet and second field is host ID which identifies a particular host on a particular network. The number of possible addresses using IPv4 is 232 4,294,967,296 (more than 4 billion)

- Class A uses half of them (2,147,483,648 addresses)
- Class B uses one-fourth (1,073,741,824 addresses)
- Class C uses one-eighth (536,870,912)
- Class D and Class E each use 1/16th - they split the rest of the addresses (268,435,456 each)

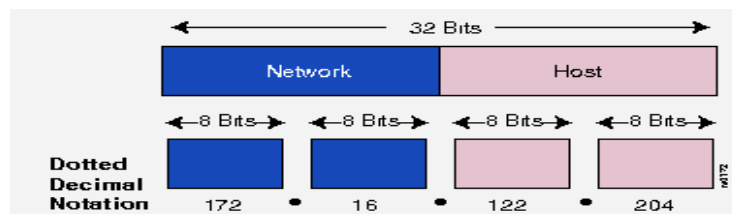
The 32-bit IP address is divided into four octets, where each octet represents a set of bits stand either for network ID or host ID

As each field is an octet in IPv4 so it can have numbers from 0-255. They by each octet overall represents the combination of 0-255. Based on the range and octet size IP addresses are classified into different classes as follows

Class A : has first octet as network field and remaining three as host fields. It has MSB as zero which represents A class address. It can have total 27 networks and 224 hosts. Its network ranges from 0-126.

Class B : has first two octets as network field and remaining two as host fields. It has MSB as one zero which represents B class address. It can have total 214 networks and 216 hosts. Its network ranges from 128-191.

Class C : has first three octets as network field and remaining one as host fields. It has MSB as one one zero which represents C class address. It can have total 221 networks and 28 hosts. Its network ranges from 192-223.



The basic format of typical IP

Class D : has 1110 as MSB and it ranges from 224-239 that is 224.0.0.0 to 239.255.255.255. Class D is reserved for multicasting of data. It does not have any subnet masks.

Class E : has 11110 as MSB and it ranges from 240-255. It is kept for Research and Development purposes.

Classful Network Masks

Network masks are used to separate network and host part at destination so receiver can find the particular host on the network. Defaults masks represent 1 as network field and 0 as host field.

Class A has default mask as 255.0.0.0 Class B has default mask as 255.255.0.0 Class C has default mask as 255.255.255.0

Dynamic Host Configuration Protocol (DHCP)

DHCP is a client/ server protocol responsible for dynamically distributes network configuration parameters, such as interfaces, services and IP addresses. When the devices have static IP allocations and they are inactive the IP address is wasted for that time. The solution is to have DHCP configuration on server side.



Which allocates IPs dynamically to users whenever they need it. And once they are power off the IP is taken back and can be assigned to other users. Whenever any device resumes in a network it will get a new IP from DHCP server.

Network Address Translation (NAT)

An Autonomous System uses a network infrastructure made up of private IP addresses. To have communication over the internet public IP addresses are needed since private IP addresses are rejected.

by ISP routers. In such scenarios to have the communication of private devices to the public world NAT is used. NAT can be a device, gateway or a firewall which has public IP address and represents organization over public network. Whenever the devices with private IPs makes request for public resources the NAT device first receives it and it will convert the packet address to itself and makes request on behalf of device using its own public identity. And on response from server it does the reverse way [15]. In Fig. 7 NAT device has public address as 126.22.99.144 and all private IPs are of range 10.25.1.X.

Limitations of IPv4

The current version of IPv4 has not been changed from last 25 years. However continuous growth of internet enabled devices has put IPv4 addressing at an end.

- **Insufficient IP address space**

With only 32-bit capacity, IPv4 addresses have become comparatively inadequate, forcing some organizations to use NAT. NAT does not support standards-based network layer security and can create problems when connecting two organizations that use the identical private address

- **Address prefix allocation**

The existing IPv4 Internet routing communications is a mixture of both flat and hierarchical routing

- **Complexity of configuration**

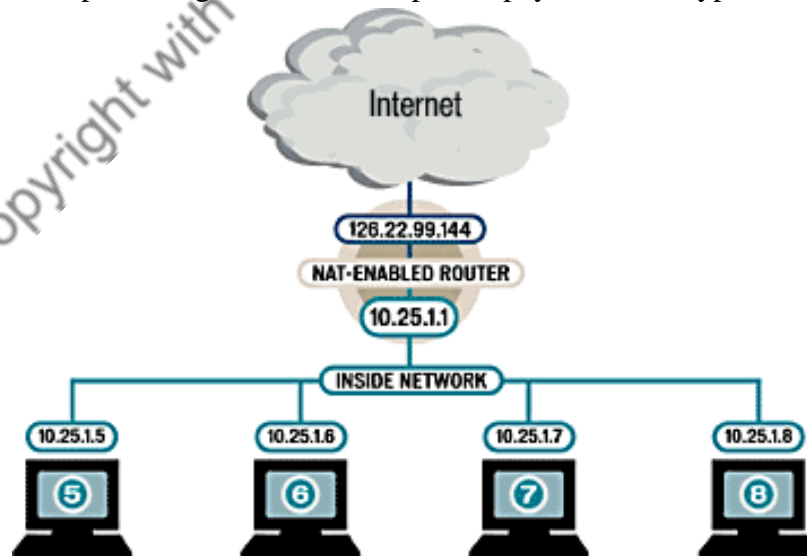
Most IPv4 implementations are either manually configured or DHCP. With more computers and devices using IP, there is a need for a simpler and more automatic configuration of addresses

- **Data security**

IPSec is a Internet Protocol security standard which protects the private communication over public infrastructures. IPSec is an optional field in IPv4 and most of the times other alternatives are used which can be vulnerable

- **Quality of Service (QoS)**

While standards for QoS exist for IPv4, no recognition of packet flow for QoS handling by routers is existing within the IPv4 header. IPv4 QoS field has partial functionality and payload detection using a TCP and UDP port is not promising when the IPv4 packet payload is encrypted



IPV6

The current version of Internet Protocol removing NAT, IPv6 is expected to foster e-government services and to facilitate

IPv4 has not been substantially changes in the past 25 years. IPv4 have proven to be robust and easily implemented. In the early stage, the deployment of IPv6 is prepared and begun on the IPv4-based network. In the intermediate stage, IPv4 and IPv6 coexist. In the later stage, IPv6 plays a leading role on the network and the IPv4 network is gradually withdrawing from the market. Meanwhile, researchers put forward many transition mechanisms for different network infrastructures and different evolution stages. The deployment of IPv6, however, is still far below expectation. The causes include, certain technologies such as NAT alleviate the IPv4 address exhaustion. There is no IPv6-based killer application yet. The costs for network upgrade are huge. In view of the facts, it is generally accepted in the Industry that the IPv6 evolution process has changed from the IPv4/IPv6 transition into the long-term IPv4- IPv6 coexistence. Actually, the delayed deployment of IPv6 makes the IPv4/IPv6 transition more complex. According to the related statistics, the IPv4 allocation pool has been depleted around 2012. By now, no IPv4 address will be available for any new user. The originally most ideal dual-stack mode is facing a new problem, how to maintain IPv4 services in the case of IPv4 address shortage. In addition, having the technology complexity, the original transition technologies need to be optimized and improved. The following parts respectively describe the basic transition technologies and the comprehensive application of these technologies. According to different network infrastructures, users can choose a proper approach to overcome the difficulties in the transition period. It helps users to implement a smooth transition from the IPv4- based network to IPv6.

Need of IPv6

The business and private user situations that benefit from IPv6 have been identified and described:

- **E-government:** A government network comprises interconnections of various government sections and central services networks, offering services for internal clients as well as citizens (e.g. election, tax declaration, car registration, etc.). By removing NAT, IPv6 is expected to foster e-government services and to facilitate Management of the network.
- **Mobile Worker:** Employers of cell phones expect to stay connected without interruption while roaming between different access networks and service providers. Therefore Mobile IP has been consistent. Since IPv6 provides adequate addresses and advanced features, it is expected that a mobility service will be based on Mobile IPv6.
- **Public Safety:** Public safety establishments call for IP-based broadband communication that is exchange of videos, pictures, documents, messages, and all, on-site as well as with the command control centre. The IPv6 benefits in this scenario are auto configuration, enhanced mobility, and easier interworking between different organisations.
- **Direct secure end-to-end communication:** Employers of mobile devices expect to get access to their corporate network or to work with co-workers while being mobile and remote. In this scenario, Mobile IPv6 route optimization could be deployed in order to provide a direct end-to-end link between mobile device and its peer without inefficient triangular routing over a mobility anchor point.
- **Corporate network:** Business networks are evolving from border-protected sets of internal resources to an extended enterprise planning. Forthcoming IPv4 address shortage and possible benefits of IPv6 demand for IPv6 migration.

• **Personal Area Network (PAN):**Users may carry numerous devices like phone, laptop, sensors, input devices and one of the devices could provide admission to the Internet (via WLAN,3G), providing mobility service for the PAN via IPv6-based network mobility(NEMO).

• **Access security:** IEEE 802.1X is deployed to regulate access to a network. Once connected, an infected or malicious node is able to target its neighbours. In IPv6, secure neighbour discovery (SEND) can prevent this type of attack.

• **Home network connectivity and networked**

Address Format 21, 22

IPv6 addresses are represented as a sequence of 16-bit hexadecimal fields separated by colons (:) in the format: x: x:x:x:x:x:x.

Following are two examples of IPv6 addresses: 2001:DB8:7654:3210:FEDC:BA98:76 54:3210
2001:DC8:0:0:8:800:200C:417A

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Introduction Network Security

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A basic understanding of computer networks is requisite in order to understand the principles of network security. In this section, we'll cover some of the foundations of computer networking, then move on to an overview of some popular networks. Following that, we'll take a more in-depth look at TCP/IP, the network protocol suite that is used to run the Internet and many intranets.

Once we've covered this, we'll go back and discuss some of the threats that managers and administrators of computer networks need to confront, and then some tools that can be used to reduce the exposure to the risks of network computing

What is a Network?

A “network” has been defined as “any set of interlinking lines resembling a net, a network of roads an interconnected system, a network of alliances”. This definition suits our purpose well: a computer network is simply a system of interconnected computers. How they're connected is irrelevant, and as we'll soon see, there are a number of ways to do this

The ISO/OSI Reference Model:

The International Standards Organization (ISO) Open Systems Interconnect (OSI) Reference Model defines seven layers of communications types, and the interfaces among them. Each layer depends on the services provided by the layer below it, all the way down to the physical network hardware, such as the computers

Network interface card and the wires that connect the cards together

An easy way to look at this is to compare this model with something we use daily: the telephone. In order for you and I to talk when we're out of earshot, we need a device like a telephone. (In the ISO/OSI model, this is at the application layer.) The telephones, of course, are useless unless they have the ability to translate the sound into electronic pulses that can be transferred over wire and back again. (These functions are provided in layers below the application layer).

Finally, we get down to the physical connection: both must be plugged into an outlet that is connected to a switch that's part of the telephone system's network of switches

If I place a call to you, I pick up the receiver, and dial your number. This number specifies which central office to which to send my request, and then which phone from that central

office to ring. Once you answer the phone, we begin talking, and our session has begun. Conceptually, computer networks function exactly the same way

It isn't important for you to memorize the ISO/OSI Reference Model's layers; but it's useful to know that they exist, and that each layer cannot work without the services provided by the layer below it.

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TCP/IP: The Language of the Internet

TCP/IP (Transport Control

Protocol/Internet Protocol) is the “language” of the Internet. Anything that can learn to “speak TCP/IP” can play on the Internet. This is functionality that occurs at the Network (IP) and Transport (TCP) layers in the ISO/OSI Reference Model. Consequently, a host that has TCP/IP functionality (such as Unix, OS/2, MacOS, or Windows NT) can easily support applications (such as Netscape's Navigator) that uses the network

One of the most important features of TCP/IP isn't a technological one: The protocol is an “open”, protocol, and anyone who wishes to implement it may do so freely. Engineers and scientists from all over the world participate in the IETF (Internet Engineering Task Force) working groups that design the protocols that make the Internet work. Their time is typically donated by their companies, and the result is work that benefits everyone

As noted, IP is a “network layer” protocol. This is the layer that allows the hosts to actually “talk” to each other. Such things as carrying datagrams, mapping the Internet address (such as 10.2.3.4) to a physical network address (such as 08:00:69:0a:ca:8f), and routing, which takes care of making sure that all of the devices that have Internet connectivity can find the way to each other

Understanding IP:

IP has a number of very important features which make it an extremely robust and flexible protocol. For our purposes, though, we're going to focus on the security of IP, or more specifically, the lack there of.

Attacks against IP:

A number of attacks against IP are possible. Typically, these exploit the fact that IP does not perform a robust mechanism for authentication, which is proving that a packet came from where it claims it did. A packet simply claims to originate from a given address, and there isn't a way to be sure that the host that sent the packet is telling the truth. This isn't necessarily a weakness, per se , but it is an important point, because it means that the facility of host authentication has to be provided at a higher layer on the ISO/OSI Reference Model. Today, applications that require strong host authentication (such as cryptographic applications) do this at the application layer

IP Spoofing:

This is where one host claims to have the IP address of another. Since many systems (such as router access control lists) define which packets may and which packets may not pass based on the sender's IP address, this is a useful technique to an attacker: he can send packets to a host, perhaps causing it to take some sort of action

IP Session Hijacking:

This is a relatively sophisticated attack, first described by Steve Bellovin. This is very dangerous, however, because there are now toolkits available in the underground community that allow otherwise unskilled bad-guy-wannabes to perpetrate this attack. IP Session Hijacking is an attack whereby a user's session is taken over, being in the control of the attacker. If the user was in the middle of email, the attacker is looking at the email and then can execute any commands he wishes as the attacked user.

The attacked user simply sees his session dropped, and may simply login again, perhaps not even noticing that the attacker is still logged in and doing things

For the description of the attack, let's return to our large network of networks in Figure 4. In this attack, a user on host A is carrying on a session with host G. Perhaps this is a telnet session, where the user is reading his email, or using a UNIX shell account from home. Somewhere in the network between A and G sits host H which is run by a naughty person. The naughty person on host H watches the traffic between A and G, and runs a tool which starts to impersonate A to G, and at the same time tells A to shut up, perhaps trying to convince it that G is no longer on the net (which might happen in the event of a crash, or major network outage). After a few seconds of this, if the attack is successful, naughty person has ``hijacked" the session of our user. Anything that the user can do legitimately can now be done by the attacker, illegitimately. As far as G knows, nothing has happened

This can be solved by replacing standard telnet-type applications with encrypted versions of the same thing. In this case, the attacker can still take over the session, but he'll see only "gibberish" because the session is encrypted. The attacker will not have the needed cryptographic key(s) to decrypt the data stream from G, and will, therefore, be unable to do anything with the session

TCP:

TCP is a transport-layer protocol. It needs to sit on top of a network-layer protocol, and was designed to ride atop IP. (Just as IP was designed to carry, among other things, TCP packets.) Because TCP and IP were designed together and wherever you have one, you typically have the other, the entire suite of Internet protocols are known collectively as "TCP/IP". TCP itself has a number of important features that we'll cover briefly

Guaranteed Packet Delivery:

Probably the most important is guaranteed packet delivery. Host A sending packets to host B expects to get acknowledgments back for each packet. If B does not send an acknowledgment within a specified amount of time, A will resend the packet

Applications on host B will expect a data stream from a TCP session to be complete, and in order. As noted, if a packet is missing, it will be resent by A, and if packets arrive out of order, B will arrange them in proper order before passing the data to the requesting application[3][5]. This is suited well toward a number of applications, such as a telnet session. A user wants to be sure every keystroke is received by the remote host, and that it gets every packet sent back, even if this means occasional slight delays in

Responsiveness while a lost packet is resent, or while out- of-order packets are rearranged

It is not suited well toward other applications, such as streaming audio or video, however. In these, it doesn't really matter if a packet is lost (a lost packet in a stream of 100 won't be distinguishable) but it does matter if they arrive late (i.e., because of a host resending a packet presumed lost), since the data stream will be paused while the lost packet is being resent. Once the lost packet is received, it will be put in the proper slot in the data stream, and then passed up to the application

UDP:

UDP (User Datagram Protocol) is a simple transport-layer protocol. It does not provide the same features as TCP, and is thus considered "unreliable". Again, although this is unsuitable for some

applications, it does have much more applicability in other applications than the more reliable and robust TCP

Denial-of-Service:

DoS (Denial-of-Service) attacks are probably the nastiest, and most difficult to address. These are the nastiest, because they're very easy to launch, difficult (sometimes impossible) to track, and it isn't easy to

refuse the requests of the attacker, without also refusing legitimate requests for service.

The premise of a DoS attack is simple: send more requests to the machine than it can handle. There are toolkits available in the underground community that make this a simple matter of running a program and telling it which host to blast with requests. The attacker's program simply makes a connection on some service port, perhaps forging the packet's header information that says where the packet came from, and then dropping the connection. If the host is able to answer 20 requests per second, and the attacker is sending 50 per second, obviously the host will be unable to service all of the attacker's requests, much less any legitimate requests (hits on the web site running there, for example).

Such attacks were fairly common in late 1996 and early 1997, but are now becoming less popular.

Some things that can be done to reduce the risk of being stung by a denial of service attack include

- Not running your visible-to-the-world servers at a level too close to capacity
- Using packet filtering to prevent obviously forged packets from entering into your network address space.

Obviously forged packets would include those that claim to come from your own hosts, addresses reserved for private networks as defined in RFC 1918 [4] and the loopback network

- Keeping up-to-date on security-related patches for your hosts' operating systems.

Unauthorized Access:

“Unauthorized access” is a very high-level term that can refer to a number of different sorts of attacks. The goal of these attacks is to access some resource that your machine should not provide the attacker. For example, a host might be a web server, and should provide anyone with requested web pages. However, that host should not provide command shell access without being sure that the person making such a request is someone who should get it, such as a local administrator

Executing Commands Illicitly:

It's obviously undesirable for an unknown and untrusted person to be able to execute commands on your server machines. There are two main classifications of the severity of this problem: normal user access, and administrator access. A normal user can do a number of things on a system (such as read files, mail them to other people, etc.) that an attacker should not be able to do. This might, then, be all the access that an attacker needs. On the other hand, an attacker might wish to make configuration changes to a host (perhaps changing its IP address, putting a start-up script in place to cause the machine to shut down every time it's started or something similar). In this case, the attacker will need to gain administrator privileges on the host

Confidentiality Breaches:

We need to examine the threat model: what is it that you're trying to protect yourself against? There is certain information that could be quite damaging if it fell into the hands of a competitor, an enemy, or

the public. In these cases, it's possible that compromise of a normal user's account on the machine can be enough to cause damage (perhaps in the form of PR, or obtaining information that can be used against the company, etc.)

While many of the perpetrators of these sorts of break-ins are merely thrill-seekers interested in nothing more than to see a shell prompt for your computer on their screen, there are those who are more malicious, as we'll consider next. (Additionally, keep in mind that it's possible that someone who is normally interested in nothing more than the thrill could be persuaded to do more: perhaps an unscrupulous competitor is willing to hire such a person to hurt you)

Among the destructive sorts of break-ins and attacks, there are two major categories

Data Diddling:

The data diddler is likely the worst sort, since the fact of a break-in might not be immediately obvious. Perhaps he's toying with the numbers in your spreadsheets, or changing the dates in your projections and plans. Maybe he's changing the account numbers for the auto-deposit of certain pay checks. In any case, rare is the case when you'll come in to work one day, and simply know that something is wrong. An accounting procedure might turn up a discrepancy in the books three or four months after the fact. Trying to track the problem down will certainly be difficult, and once that problem is discovered, how can any of your numbers from that time period be trusted? How far back do you have to go before you think that your data is safe?

Data Destruction:

Some of those perpetrators are simply twisted jerks who like to delete things. In these cases, the impact on your computing capability -- and consequently your business -- can be nothing less than if a fire or other disaster caused your computing equipment to be completely destroyed

Lessons Learned

From looking at the sorts of attacks that are common, we can divine a relatively short list of high-level practices that can help prevent security disasters, and to help control the damage in the event that preventative measures were unsuccessful in warding off an attack

Hope you have backups:

This isn't just a good idea from a security point of view. Operational requirements should dictate the backup policy, and this should be closely coordinated with a disaster recovery plan, such that if an airplane crashes into your building one night, you'll be able to carry on your business from another location. Similarly, these can be useful in recovering your data in the event of an electronic disaster: a hardware failure or a break in that changes or otherwise damages your data

Don't put data where it doesn't need to be: Although this should go without saying, this doesn't occur to lots of folks. As a result, information that doesn't need to be accessible from the outside world sometimes is, and this can needlessly increase the severity of a break-in dramatically

Avoid systems with single points of failure:

Any security system that can be broken by breaking through any one component isn't really very strong. In security, a degree of redundancy is good, and can help you protect your organization from a minor security breach becoming a catastrophe

Stay current with relevant operating system patches:

Be sure that someone who knows what you've got is watching the vendor's security advisories. Exploiting old bugs is still one of the most common (and most effective!) means of breaking into systems

Watch for relevant security advisories:

In addition to watching what the vendors are saying, keep a close watch on groups like CERT and CIAC. Make sure that at least one person (preferably more) is subscribed to these mailing lists

Have someone on staff be familiar with security practices:

Having at least one person who is charged with keeping abreast of security developments is a good idea. This need not be a technical wizard, but could be someone who is simply able to read advisories issued by various incident response teams, and keep track of various problems that arise. Such a person would then be a wise one to consult with on security related issues, as he'll be the one who knows if web server software version such-and-such has any known problems, etc

This person should also know the "do's" and "don'ts" of security, from reading such things as the "Site Security Handbook

Firewalls

As we've seen in our discussion of the Internet and similar networks, connecting an organization to the Internet provides a two-way flow of traffic. This is clearly undesirable in many organizations, as proprietary information is often displayed freely within a corporate intranet (that is, a TCP/IP network, modeled after the Internet that only works within the organization).

In order to provide some level of separation between an organization's intranet and the Internet, firewalls have been employed. A firewall is simply a group of components that collectively form a barrier between two networks.

A number of terms specific to firewalls and networking are going to be used throughout this section, so let's introduce them all together

Access Control List (ACL):

Many routers now have the ability to selectively perform their duties, based on a number of facts about a packet that comes to it. This includes things like origination address, destination address, destination service port, and so on. These can be employed to limit the sorts of packets that are allowed to come in and go out of a given network

Demilitarized Zone (DMZ):

The DMZ is a critical part of a firewall: it is a network that is neither part of the untrusted network, nor part of the trusted network. But, this is a network that connects the untrusted to the trusted. The importance of a DMZ is tremendous: someone who breaks into your network from the Internet should have to get through several layers in order to successfully do so. Those layers are provided by various components within the DMZ

Proxy:

This is the process of having one host act in behalf of another. A host that has the ability to fetch documents from the Internet might be configured as a proxy server, and host on the intranet might be

configured to be proxy clients. In this situation, when a host on the intranet wishes to fetch the <http://www.interhack.net/> web page, for example, the browser will make a connection to the Proxy server, and request the given URL. The proxy server will fetch the document, and return the result to the client. In this way, all hosts on the intranet are able to access resources on the Internet without having the ability to direct talk to the Internet

Types of Firewalls:

There are three basic types of firewalls, and we'll consider each of them

Application Gateways:

The first firewalls were application gateways, and are sometimes known as proxy gateways. These are made up of bastion hosts that run special software to act as a proxy server. This software runs at the Application Layer of our old friend the ISO/OSI Reference Model, hence the name. Clients behind the firewall must be proxitized (that is, must know how to use the proxy, and be configured to do so) in order to use Internet services. Traditionally, these have been the most secure, because they don't allow anything to pass by default, but need to have the programs written and turned on in order to begin passing traffic

Packet Filtering:

Packet filtering is a technique whereby routers have ACLs (Access Control Lists) turned on. By default, a router will pass all traffic sent it, and will do so without any sort of restrictions. Employing ACLs is a method for enforcing your security policy with regard to what sorts of Access you allow the outside world to have to your internal network, and vice versa.

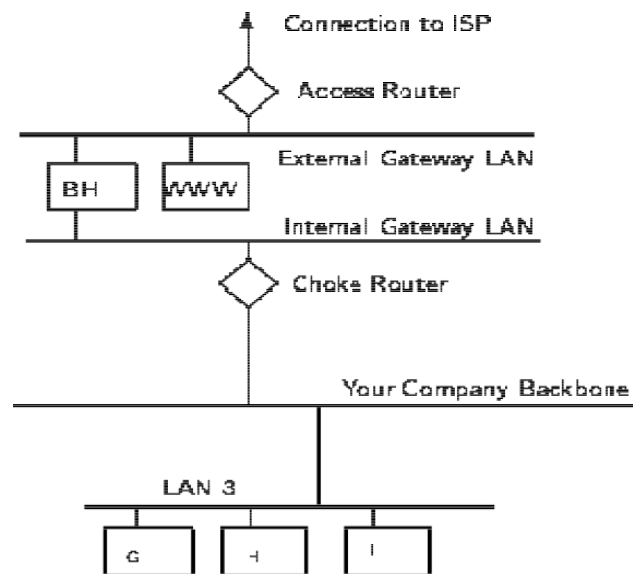
There is less overhead in packet filtering than with an application gateway, because the feature of access control is performed at a lower ISO/OSI layer (typically, the transport or session layer). Due to the lower overhead and the fact that packet filtering is done with routers, which are specialized computers optimized for tasks related to networking, a packet filtering gateway is often much faster than its application layer cousins. Figure 6 shows a packet filtering gateway

Because we're working at a lower level, supporting new applications either comes automatically, or is a simple matter of allowing a specific packet type to pass through the gateway. (Not that the possibility of something automatically makes it a good idea; opening things up this way might very well compromise your level of security below what your policy allows.

There are problems with this method, though. Remember, TCP/IP has absolutely no means of guaranteeing that the source address is really what it claims to be. As a result, we have to use layers of packet filters in order to localize the traffic. We can't get all the way down to the actual host, but with two layers of packet filters, we can differentiate between a packet that came from the Internet and one that came from our internal network. We can identify which network the packet came from with certainty, but we can't get more specific than that

Hybrid Systems:

In an attempt to marry the security of the application layer gateways with the flexibility and speed of packet filtering, some vendors have created systems that use the principles of both.



In some of these systems, new connections must be authenticated and approved at the application layer. Once this has been done, the remainder of the connection is passed down to the session layer, where packet filters watch the connection to ensure that only packets that are part of an ongoing (already authenticated and approved) conversation are being passed.

Other possibilities include using both packet filtering and application layer proxies. The benefits here include providing a measure of protection against your machines that provide services to the Internet (such as a public web server), as well as provide the security of an application layer gateway to the internal network. Additionally, using this method, an attacker, in order to get to services on the internal network, will have to break through the access router, the bastion ho.

Development of Android-based Mobile Application

Soumen Pal

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Introduction

Recent advances in Information Technology (IT) are making it more feasible to provide farmers with required agricultural information. However, farmers are still lagging behind in getting such timely information as accessibility to IT technology is not available to most of them for several reasons. The major cause for this is abundance of small and marginal farmers without formal education and lack of training in the field of IT. To overcome such scenario, internet and mobile networks have potentiality to provide agro-information services which are (i) affordable, (ii) relevant (timely and customized), (iii) searchable and (iv) up-to-date. The mobile based technology can provide the information electronically to farmers anytime/anywhere at low cost. Mobile application or app provides users with similar services to those accessed through desktop/laptop. A number of mobile based app have already been developed by various organizations/ICAR institutes for dissemination of agricultural information. Thus, the mobile technology has transformed the information sharing in many ways in agricultural sector. Government is also taking steps and encouraging development of mobile application that will enable farmers across the country to get information on time. As on today, several mobile apps have already been developed by various organizations/ICAR Institutes on different aspects such as crops, livestock, horticulture, fishery, Krishi Vigyan Kendra (KVK) etc.

Android-based Mobile Application

Android is a mobile operating system based on a modified version of the Linux kernel and other open source software, designed primarily for touch screen mobile devices such as smart phones and tablets.

Building Blocks of an Android Application include the following:

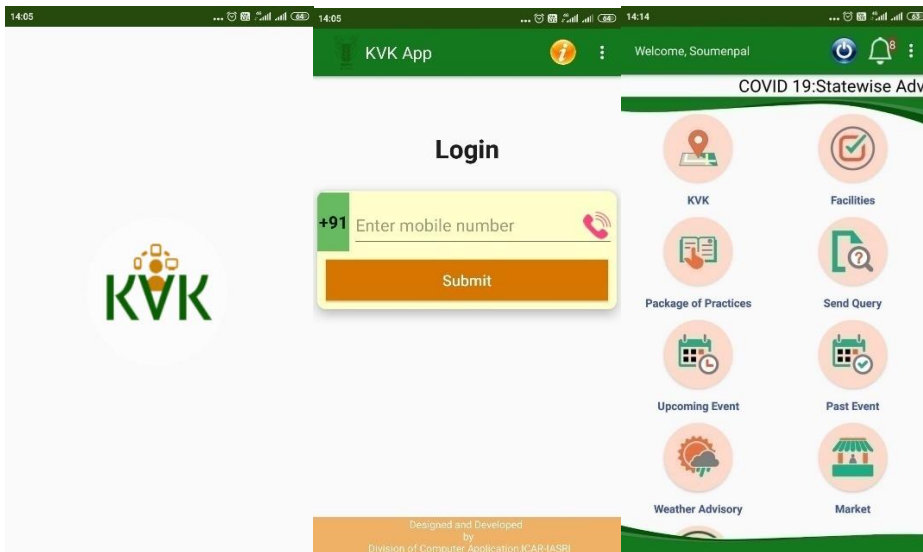
1. Activity
2. Intent
3. Services
4. Content provider
5. Broadcast receiver

Activity:

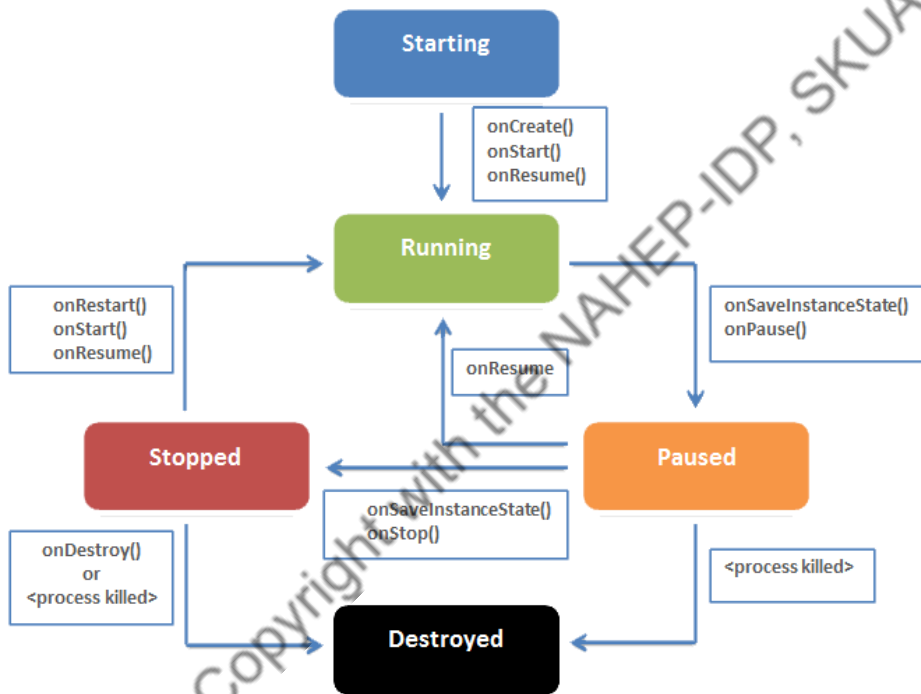
Activity is typically a screen. For example, when you open any app, first of all, you will see logo

in the screen, the next screen that you can see is the login page and after login, you can access the Home page. These are all 3 different activities. So, we can say that Android is having a group of activities. You can compare this with web application, where website is a group of web pages.

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Activity Lifecycle:



There are 5 different states in Activity Lifecycle:

1. Starting: It is the state when the app does not exist in RAM. We are just going to click on the application to start. After clicking, 3 methods are called:

- (i) on Create()
- (ii) on Start()
- (iii) on Resume()

These are predefined methods in java for android.

2. Resumed/Running: An activity that is in the foreground is in the running state. Any activity that is currently on the screen and interacting with the user is the running activity at that particular point in time. It exists at the top of the Activity stack.

3. Stopped: The app will be in stopped state when you exit from the application (by pressing the back button or exit button). An activity that is not visible on the screen, but exists in the memory, is in the stopped state.

4. Paused: When you minimize the app (or press the pause button), the app go into the paused state. In the paused state, 2 methods are called:

(i) on Save Instance State(): saves the status of the app.

(ii) on Pause(): takes app to the paused state.

5. Destroyed: When an app is paused or stopped, it's still running in the background. When you click on the cross application button, the app is destroyed. When you leave the stopped application unused for long time, it is destroyed i.e. it is removed from the RAM. Such removals generally occur, when the activity manager decides that there is no use for such activities anymore.

Activity Methods:

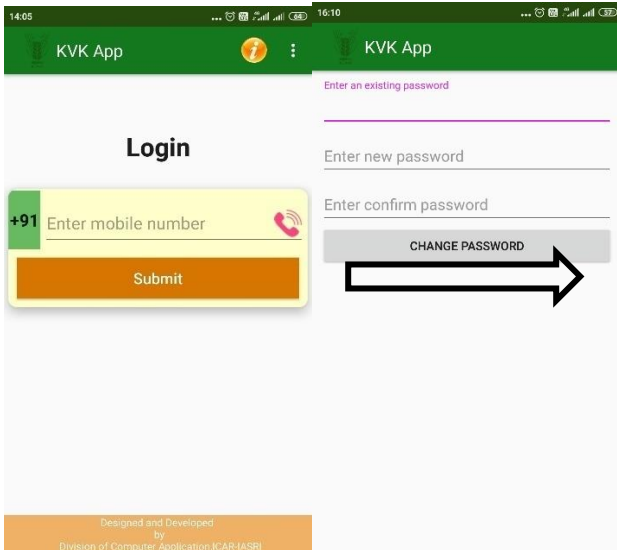
All activities in your Android apps are represented by an activity class. The Activity class contains a set of methods that corresponds to the life cycle states an activity can be in. These methods are:

- on Create ()
- on Start ()
- on Restart ()
- on Resume ()
- on Pause ()
- on Stop ()
- on Destroy ()

When activity is to transition into one of the life cycle states, the corresponding life cycle method is called on the Activity subclass instance. When the life cycle method finishes the activity is assumed to be in the new life cycle state. For instance, once the on Create() life cycle method returns, the activity is assumed to be in the created state.

Intent/Switching between activities:

If we want to move from one activity to another activity, we have to use intent. Intent makes possible in switching between activities.

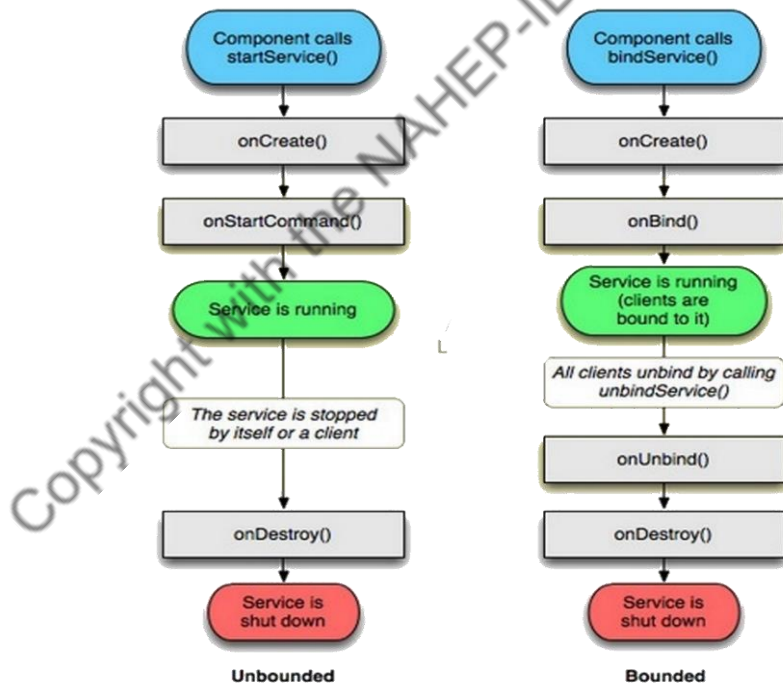


Login Activity

Change Password Activity

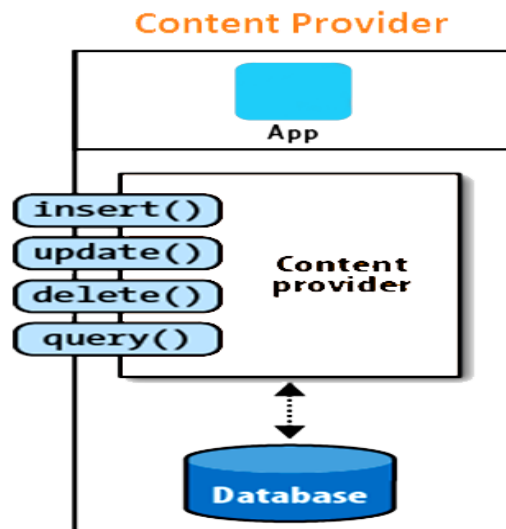
Services:

Services are the background jobs that the user can't see. Example, notification from WhatsApp, music playing in the background, download continuing in the background etc. Faceless components run in the background.



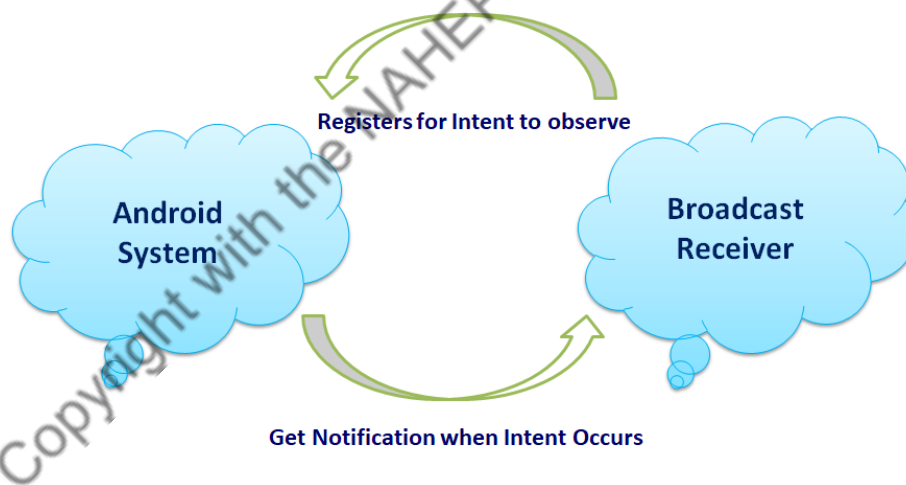
Content Provider:

It enables sharing of data across applications. For example, address book, Photo Gallery etc. It provides uniform APIs for query, delete, update and insert. It acts as an interface between the app and the database.



Broadcast Receiver:

It is also called as dormant observer. For example, when your mobile battery percentage is below, say, 10 percent, you used to get notification for that. Or when any open access wi-fi is available, you get notification that open access wi-fi is available. Similarly, when the mobile is having very low memory, you get notification for that. When you download something, and the internet connection is lost, you get notification for that. That means we have registered for some intent, and when the intent occurs, we get the notification. These are done by broadcast receiver.



Android IDEs

There are so many sophisticated Technologies are available to develop android applications, the familiar technologies, which are predominantly using tools as follows

- Android Studio
- Eclipse IDE (Deprecated)

Setup Android Studio:

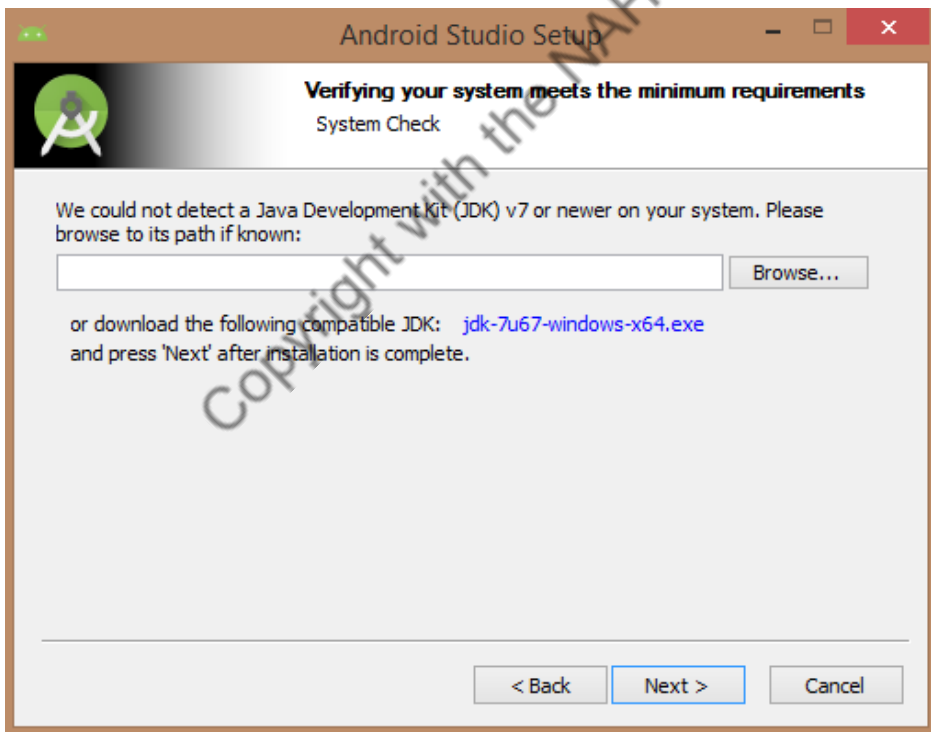
Android Studio is the official IDE for android application development. You can download the latest version of android studio from <https://developer.android.com/studio>.

Installation:

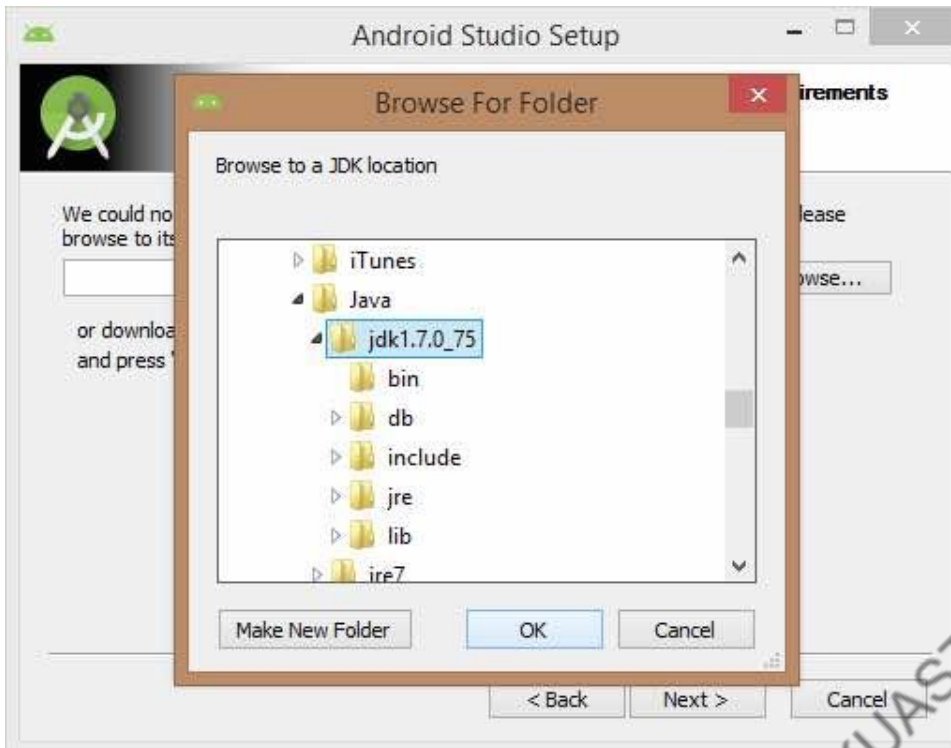
To launch Android Studio.exe, make sure that your machine is having the required installed Java JDK. To install Java JDK, take a reference of Android environment setup.



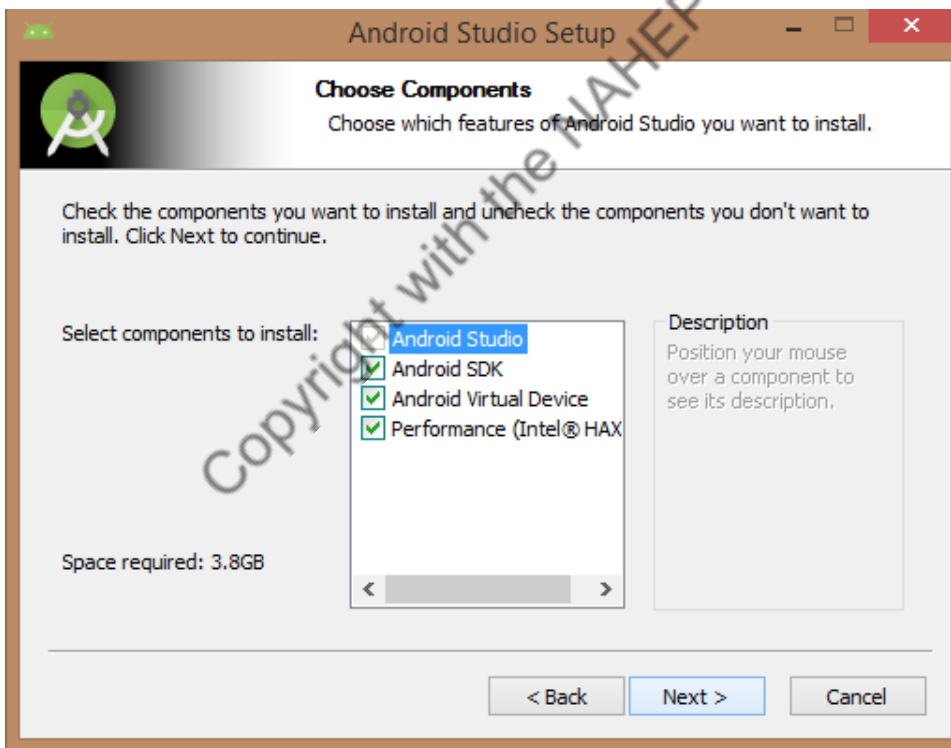
Once you launched Android Studio, mention JDK7 path or later version in android studio installer.



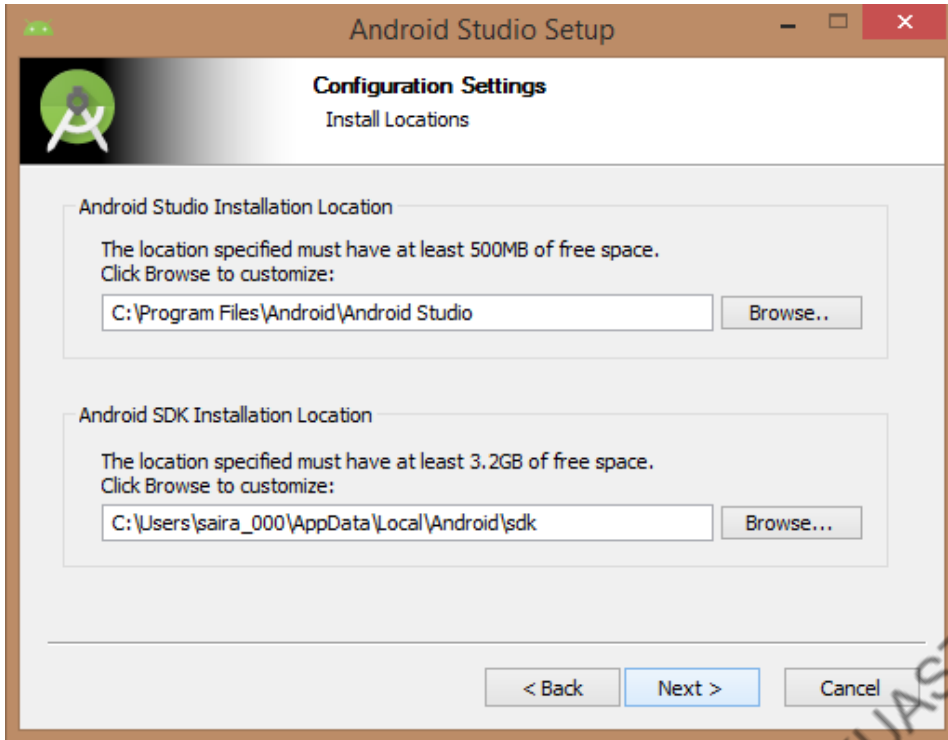
Below the image initiating JDK to android SDK:



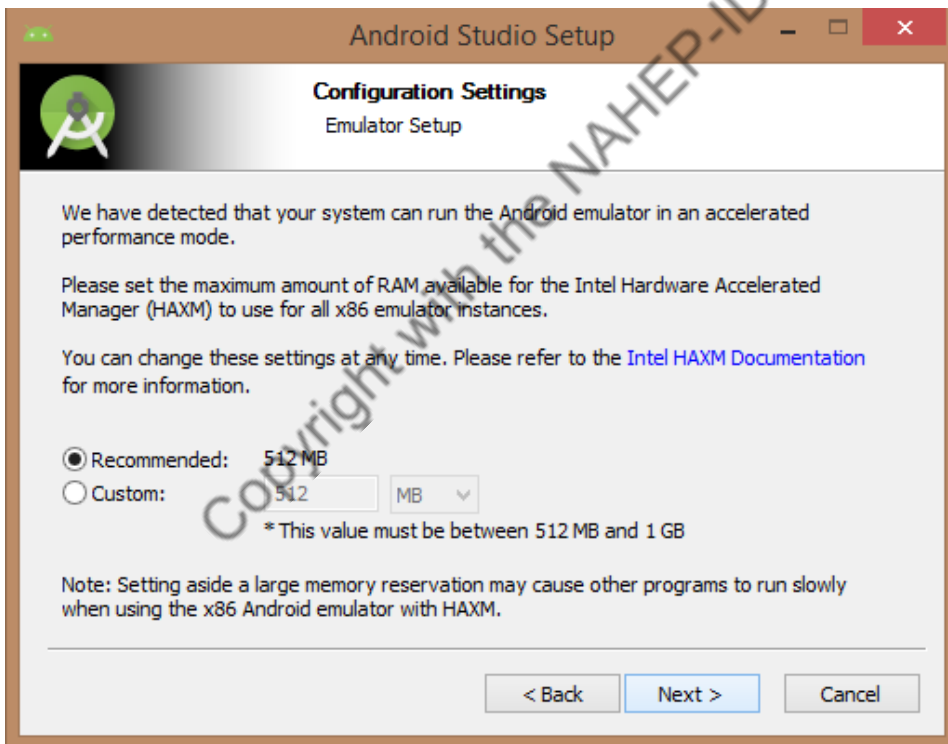
It is needed to check the components, which are required to create applications, the image depicted below has selected **Android Studio**, **Android SDK**, **Android Virtual Machine** and **performance (Intel chip)**.



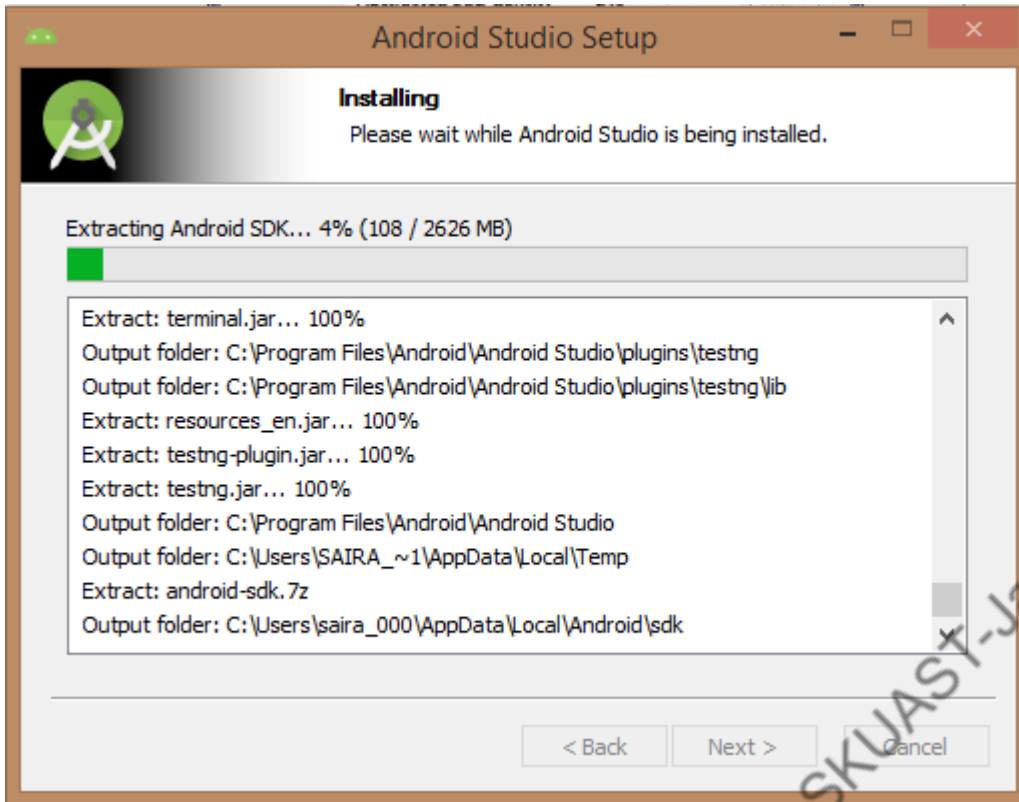
It is required to specify the location of local machine path for Android studio and Android SDK, below the image has taken default location of windows 8.1 x64 bit architecture.



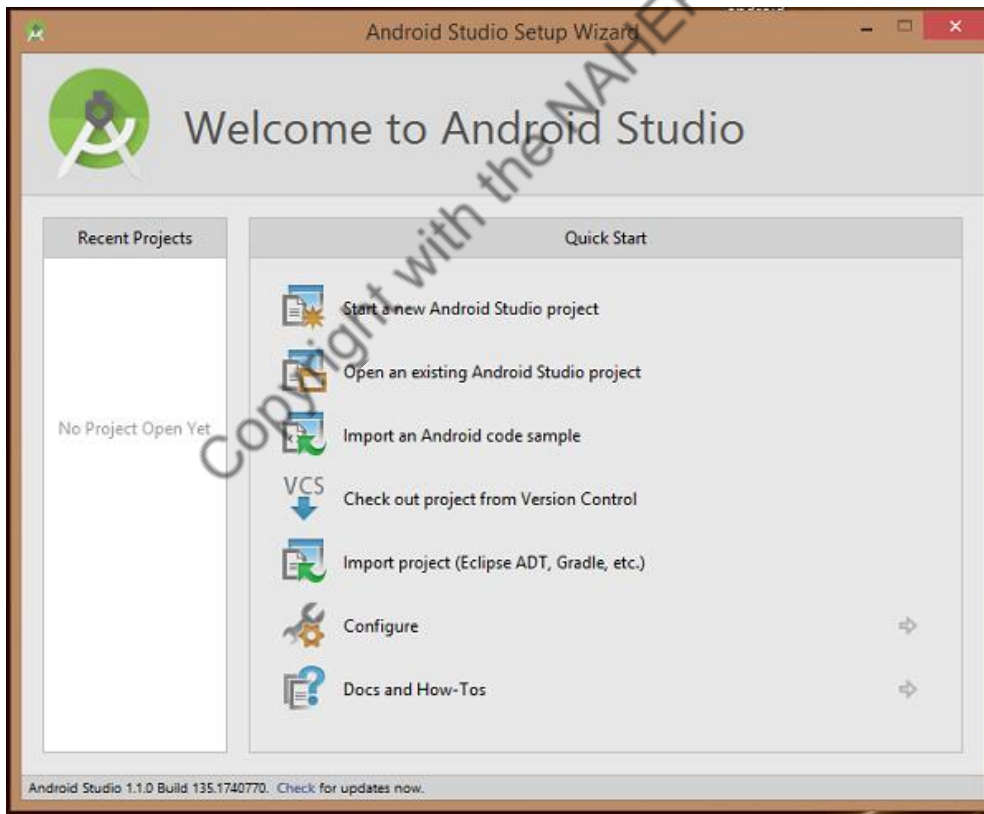
It is needed to specify the RAM space for Android emulator, by default it would take 512MB of local machine RAM.



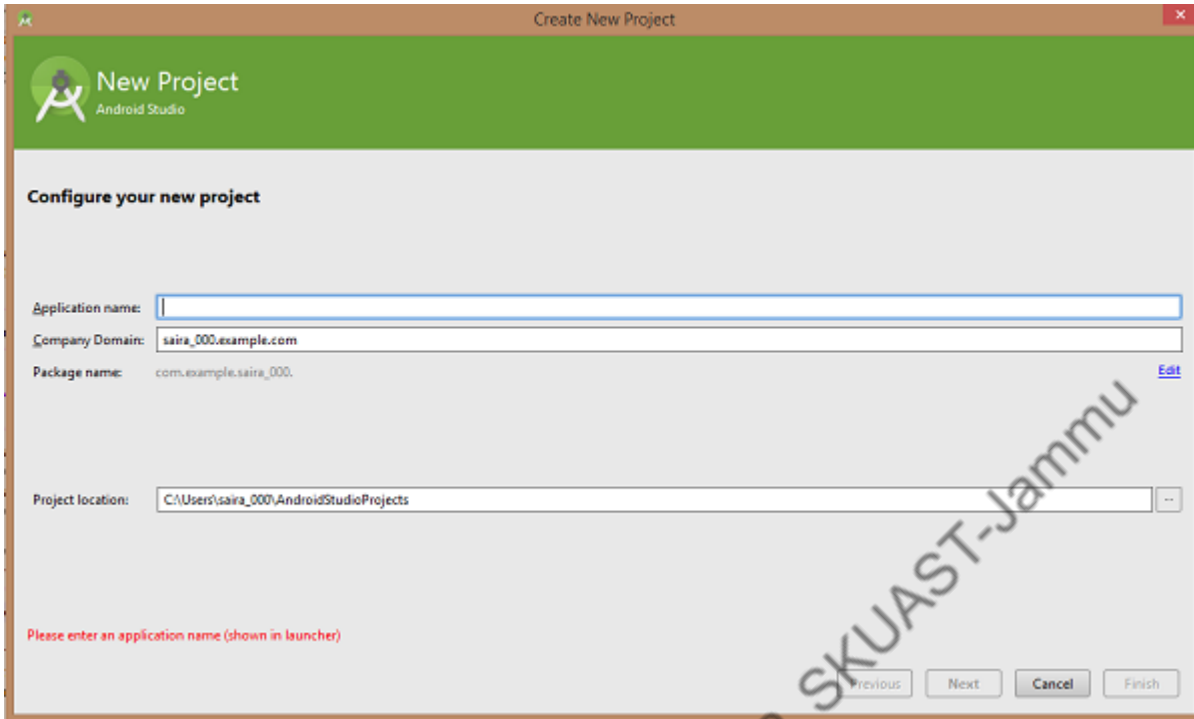
At final stage, it would extract SDK packages into your local machine, it would take a while time to finish the task and would take 2626MB of Hard disk space.



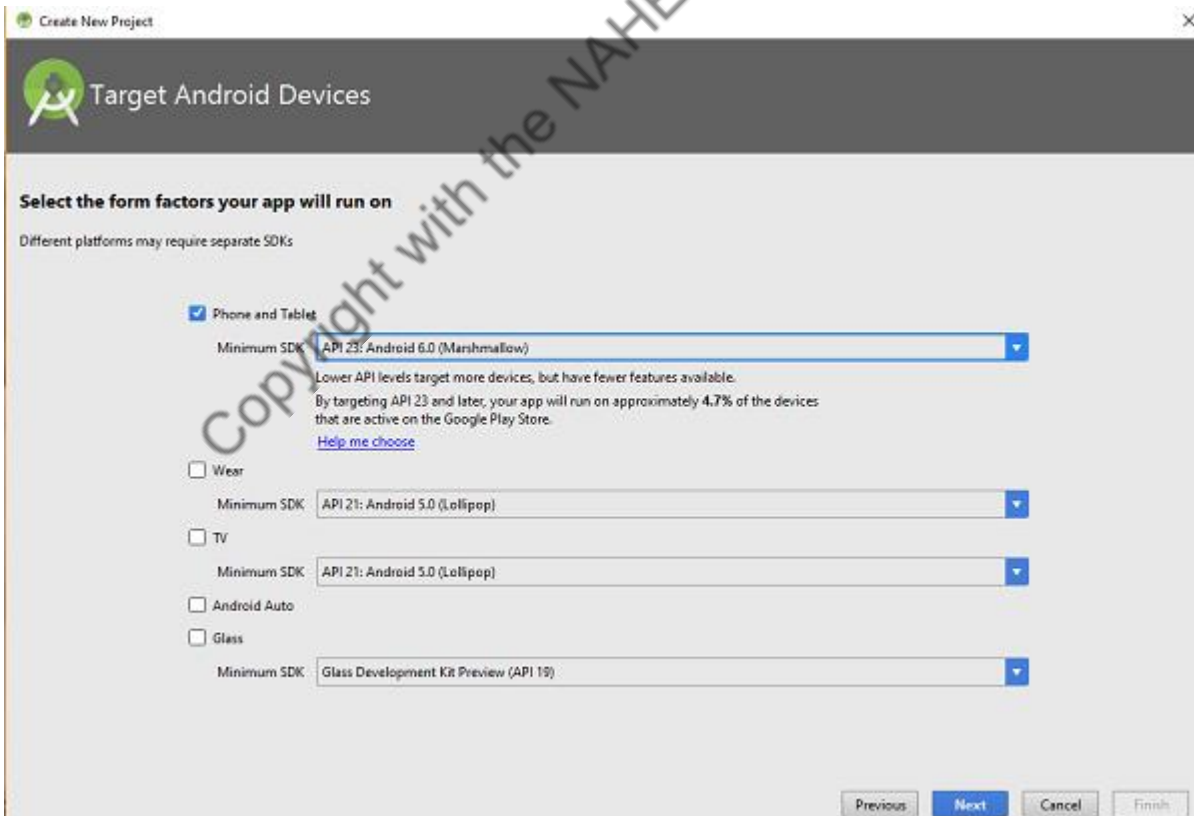
After doing all the steps mentioned above, you will get finish button and an android studio project will be opened with 'Welcome to android Studio' message as shown below:



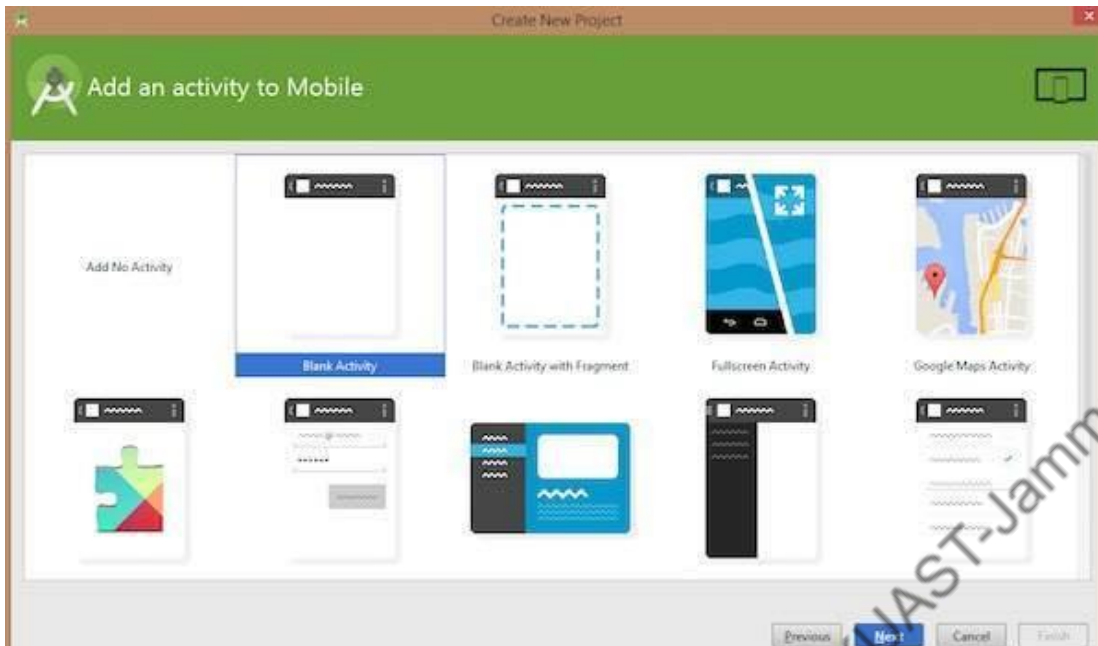
You can start your application development by calling *Start a new Android Studio project* in a new installation frame which asks Application name, package information and location of the project.



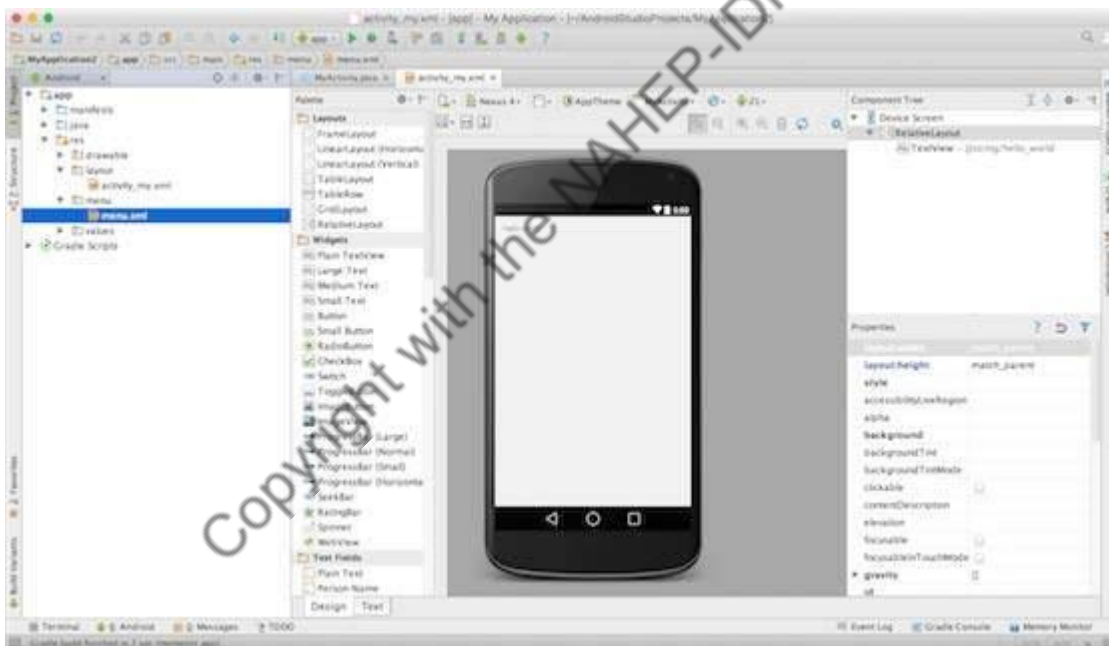
After entering application name, select the form factors your application runs on. Here you need to specify Minimum SDK.



The next level of installation contains selecting the activity to mobile. It specifies the default layout for Applications.

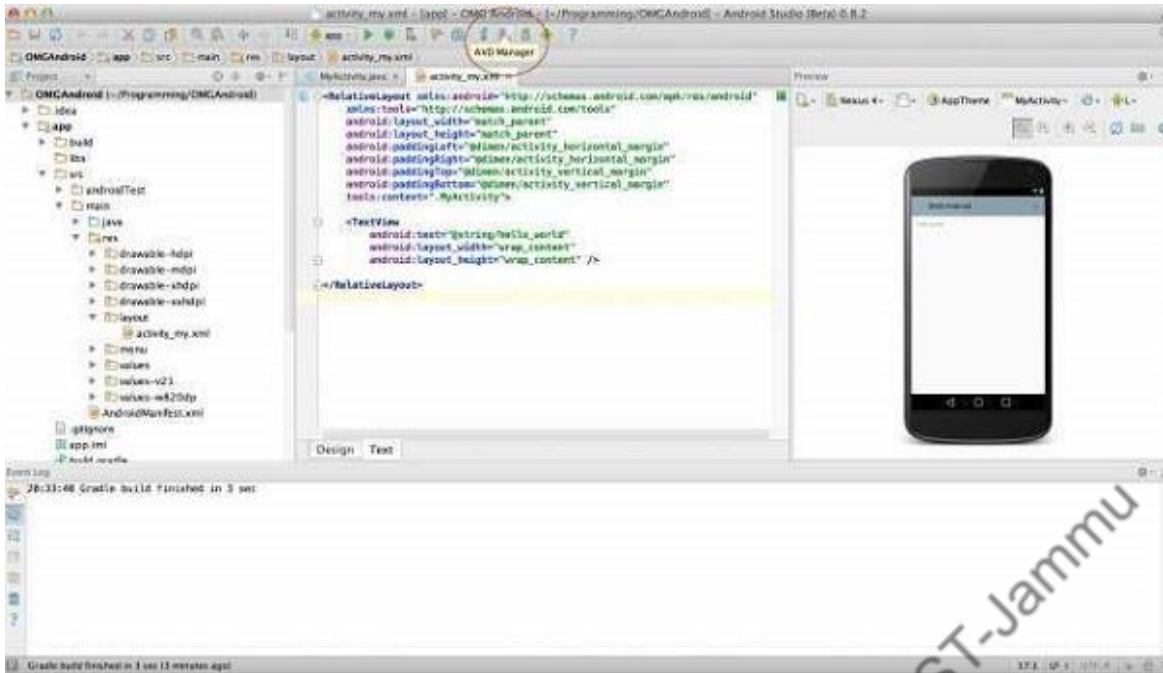


At the final stage, open development tool to write the application code.

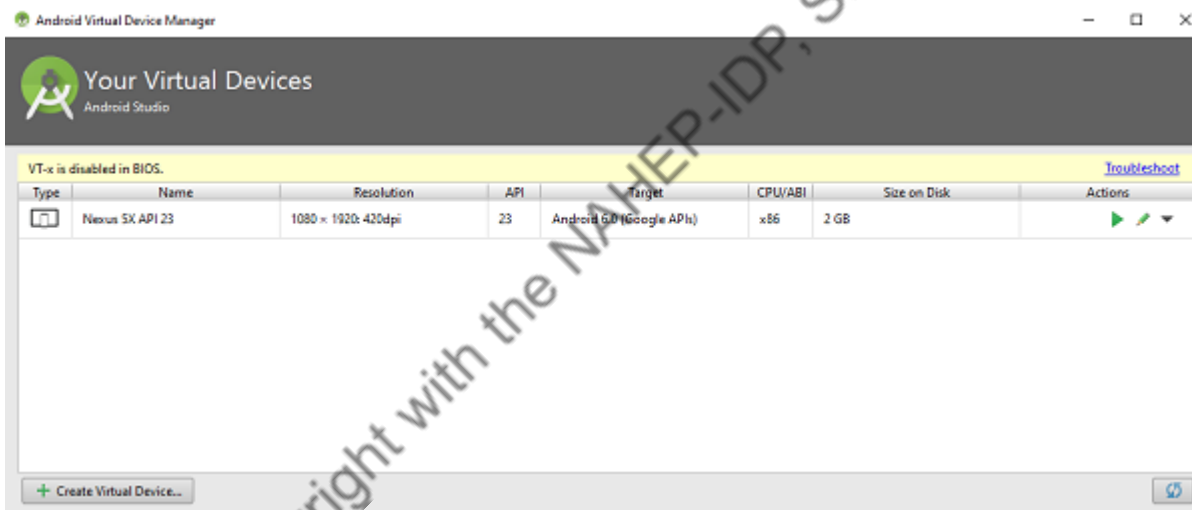


Create Android Virtual Device:

To test your Android application, you will need a virtual Android device. So before you start writing our code, create an Android virtual device. Launch Android AVD Manager by clicking AVD_Manager icon as shown below:



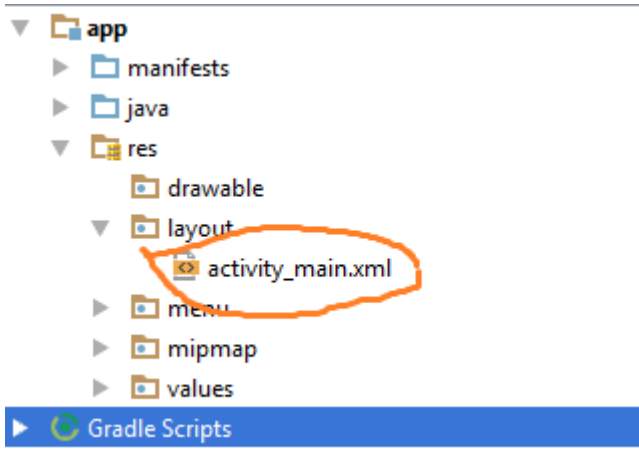
After clicking on a virtual device icon, it shows default virtual devices which are present on your SDK, or else need to create a virtual device by clicking **Create New Virtual device** button.



If your AVD is created successfully it means your environment is ready for Android application development. If you like, you can close this window using top-right cross button. It is better that you re-start your machine and once you are done with this last step, you are ready to proceed for your first Android example.

Hello World Example:

Before Writing a Hello word code, you must know about XML tags. To write hello word code, you should redirect to **App>res>layout>Activity_main.xml**.



To show 'Hello world', you need to call text view with layout.

```
<RelativeLayoutxmlns:android="http://schemas.android.com/apk/res/android"
"
xmlns:tools="http://schemas.android.com/tools"android:layout_width="matc
h_parent"
android:layout_height="match_parent"android:paddingLeft="@dimen/activity
_horizontal_margin"
android:paddingRight="@dimen/activity_horizontal_margin"
android:paddingTop="@dimen/activity_vertical_margin"
android:paddingBottom="@dimen/activity_vertical_margin"tools:context=".M
ainActivity">

<TextViewandroid:text="@string/hello_world"
android:layout_width="550dp"
android:layout_height="wrap_content"/>
</RelativeLayout>
```

You need to run the program by clicking **Run>Run App** or else need to call **shift+f10**key. Finally, result should be placed at Virtual device as shown below:



References:

- https://en.wikipedia.org/wiki/Mobile_app
- <https://www.androidauthority.com/android-sdk-tutorial-beginners-634376/>
- <http://tutorials.jenkov.com/android/activity.html>
- https://www.tutorialspoint.com/android/android_overview.htm
- https://www.tutorialspoint.com/android/android_hello_world_example.htm

Hands on Training on Image Analysis using AI

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Introduction: Image analysis deals with enhancing or manipulating an image to extract information from it. Python programming language is used for image analysis due to the availability of image analysis libraries. Well known libraries available in Python for image analysis are Tensor Flow and Keras. These libraries provide the basic building blocks to train ANN and Deep learning based models. In addition, model datasets are also available in these libraries to train models. In this training, Keras is used with Tensor Flow to build an Image Classification model on CIFAR-10 dataset. This dataset is available with Keras framework.

Tensor Flow

Tensor Flow is an end-to-end open-source platform for machine learning. It's a comprehensive and flexible ecosystem of tools, libraries and other resources that provide workflows with high-level APIs. The framework offers various levels of concepts to choose the one you need to build and deploy machine learning models.

Keras

Keras is a high-level neural networks library that runs on the top of Tensor Flow, Microsoft Cognitive Toolkit (CNTK) and Theano, which are different libraries for running deep networks. Using Keras in deep learning allows for easy and fast prototyping as well as running seamlessly on CPU and GPU. This framework is written in Python code which is easy to debug and allows ease for extensibility. The main advantages of Keras are described below:

- **User-Friendly:** Keras has a simple, consistent interface optimized for common use cases which provides clear and actionable feedback for user errors.
- **Modular and Composable:** Keras models are made by connecting configurable building blocks together, with few restrictions.
- **Easy To Extend:** With the help of Keras, one can easily write custom building blocks for new ideas and researches.
- **Easy To Use:** Keras offers consistent & simple APIs which helps in minimizing the number of user actions required for common use cases, also it provides clear and actionable feedback upon user error.

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Image Recognition

Image Recognition is the task of associating one (*single-label classification*) or more (*multi-label classification*) labels to a given image. The convolutional neural network (CNN) is a class of **deep learning neural networks**. CNNs represent a huge breakthrough in image recognition. They're most commonly used to analyse visual imagery and are frequently working behind the scenes in image classification. They can be found at the core of everything from Facebook's photo tagging to self-driving cars.

Image classification is the process of taking an **input** (like a picture) and outputting a **class** (like "cat") or a **probability** that the input is a particular class ("there's a 90% probability that this input is a cat"). You can look at a picture and know that you're looking at a terrible shot of your own face, but how can a computer learn to do that?

With a convolutional neural network.

A CNN has

- Convolutional layers
- ReLU layers
- Pooling layers
- a Fully connected layer

A classic CNN architecture would look something like this:

Input → Convolution → ReLU → Convolution → ReLU → Pooling → ReLU → Convolution → ReLU → Pooling → Fully Connected

CIFAR-10 dataset

This Dataset is available with Keras Framework and it is used for image classification as a model dataset. The CIFAR-10 dataset consists of 60000, 32x32 color images in 10 classes, with 6000 images per class. There are 50000 training images and 10000 test images. The dataset is divided into five training batches and one test batch, each with 10000 images. The test batch contains exactly 1000 randomly-selected images from each class. The training batches contain the remaining images in random order, but some training batches may contain more images from one class than another. Between them, the training batches contain exactly 5000 images from each class.

Table 3: Classes Names in CIFAR-10 Dataset

Airplane	Automobile	Bird	Cat	Deer	Dog	Frog	Horse	Ship	Truck
----------	------------	------	-----	------	-----	------	-------	------	-------

Editors to run python code

There are many editors that provide the facility to run the Python code. Most of them are offline usable, for example Pycharm, Sublime Text, Spyder, Jupyter notebook etc. With these editors there is need to install python on system. Google developed the Google Colab, a code editor and environment to run the python code without installing python and editors. Following are the important features and aspects regarding Google Colab.

Google Colab

Google Colaboratory, or Colab, is a cloud-based environment for writing documents with live code, visualizations and narrative text. It combines code, output and descriptive text into one document. The environment that Google Colab provides is similar to that of Jupyter notebook that runs on cloud.

Important features

<ul style="list-style-type: none">• Google Colab is a free cloud service that also supports GPU
<ul style="list-style-type: none">• Can be good platform to practice Python programming skills
<ul style="list-style-type: none">• Allows user to develop, deep learning applications using libraries such as Keras, Tensor Flow, PyTorch and Open CV
<ul style="list-style-type: none">• Sharing of code and results with Google Drive
<ul style="list-style-type: none">• The most important feature of Google Colab is it supports Free GPU

Types of runtimes in Google Colab:

Google Colab, provides three types of runtimes:

CPUs

- Model name: Intel(R) Xeon(R) CPU @ 2.30GHz
- Address sizes: 46 bits physical, 48 bits virtual
- Cache size: 46080 KB

GPUs

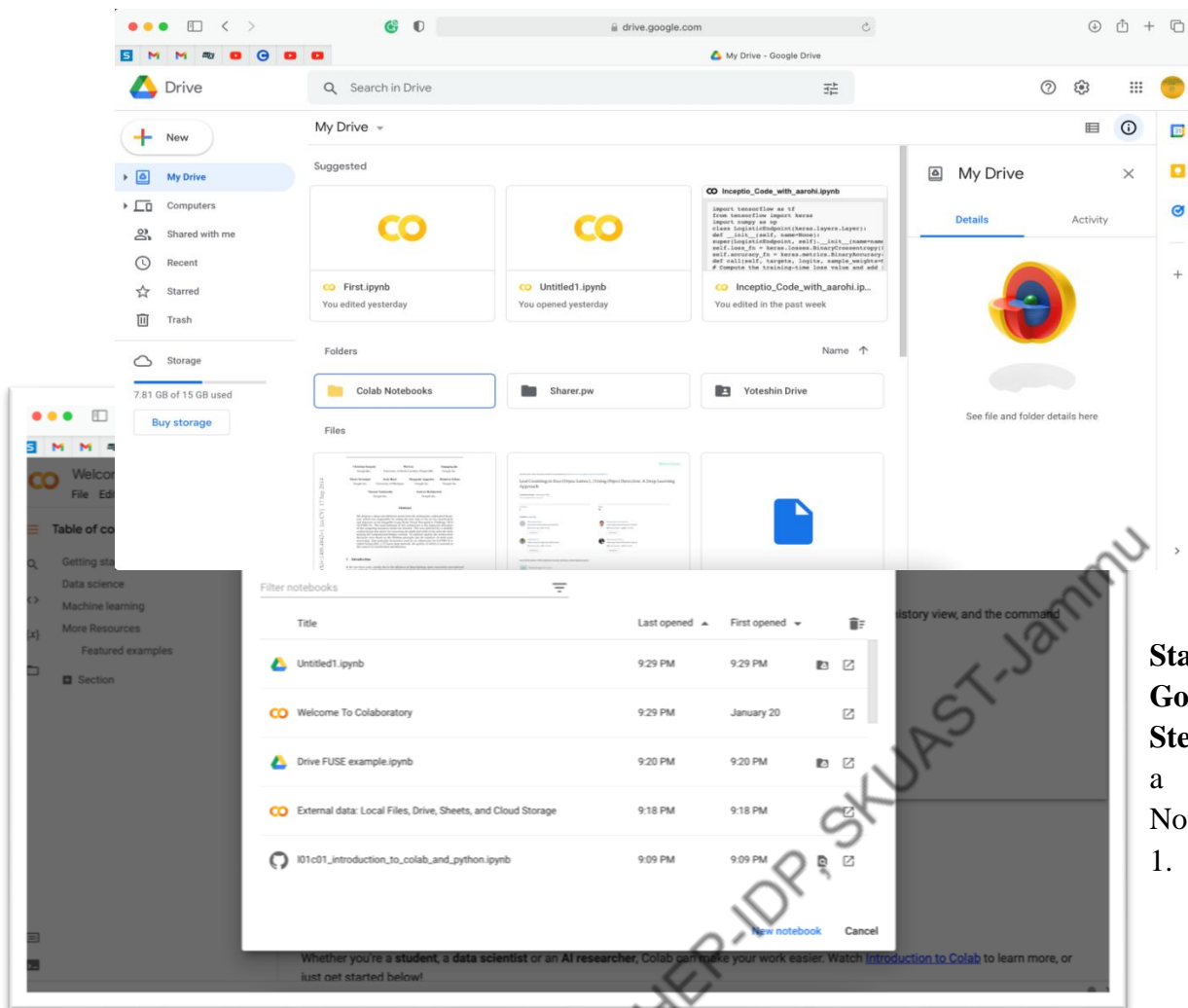
- single 12GB NVIDIA Tesla K80 GPU
- It can be used up to 12 hours continuously
- 13 GB RAM

TPUs

- Cloud TPU with 180 teraflops of computation, Intel Xeon processor with two core @ 2.30 GHz
- 13 GB RAM

Google Drive

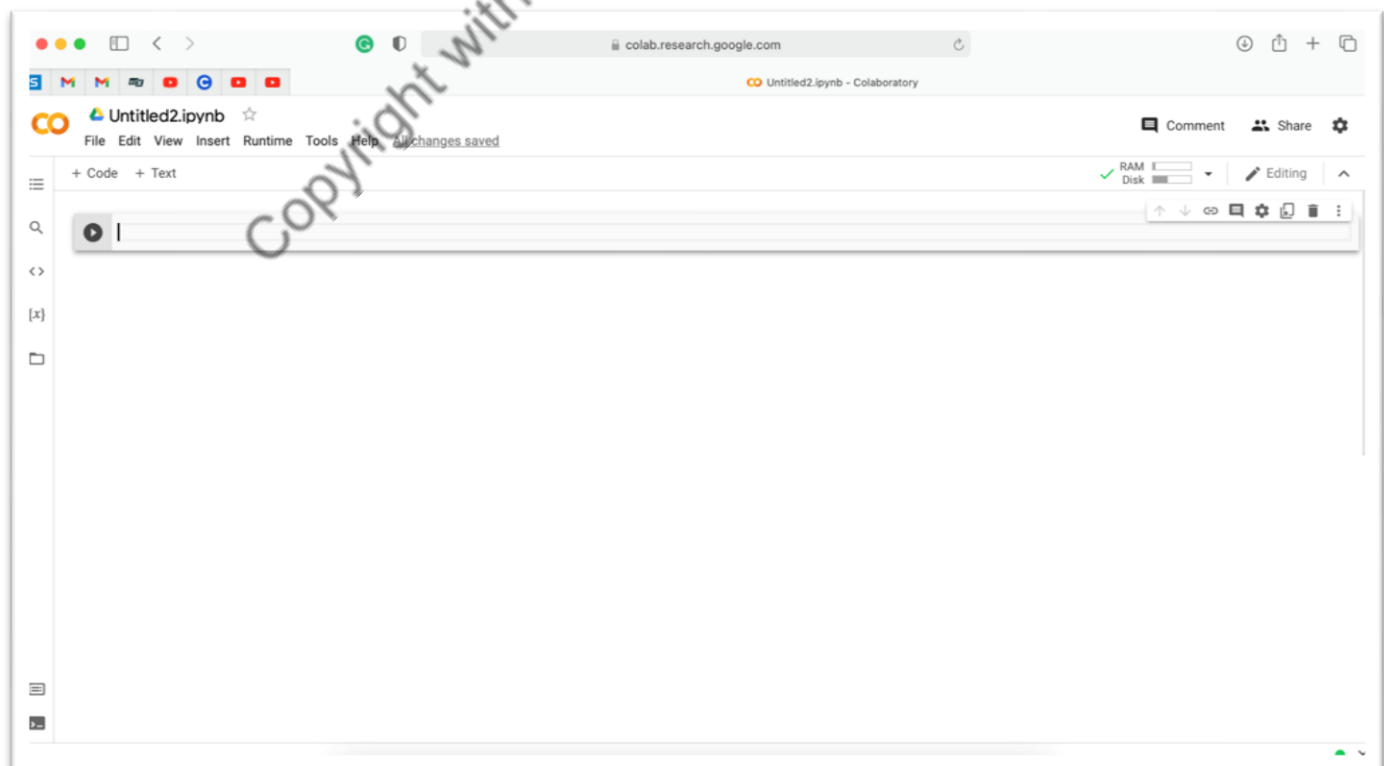
Google Drive is a “cloud-based” storage system. It gives us the facility to share files online. User can simply drag and drop the files into the Drive and it will enable user to share, collaborate the documents with others. It provides every user with 15GB of free space and the capacity can be further increased by purchasing different plans. If the Drive is mounted with Colab, all the Notebooks will be stored/visible in Drive.

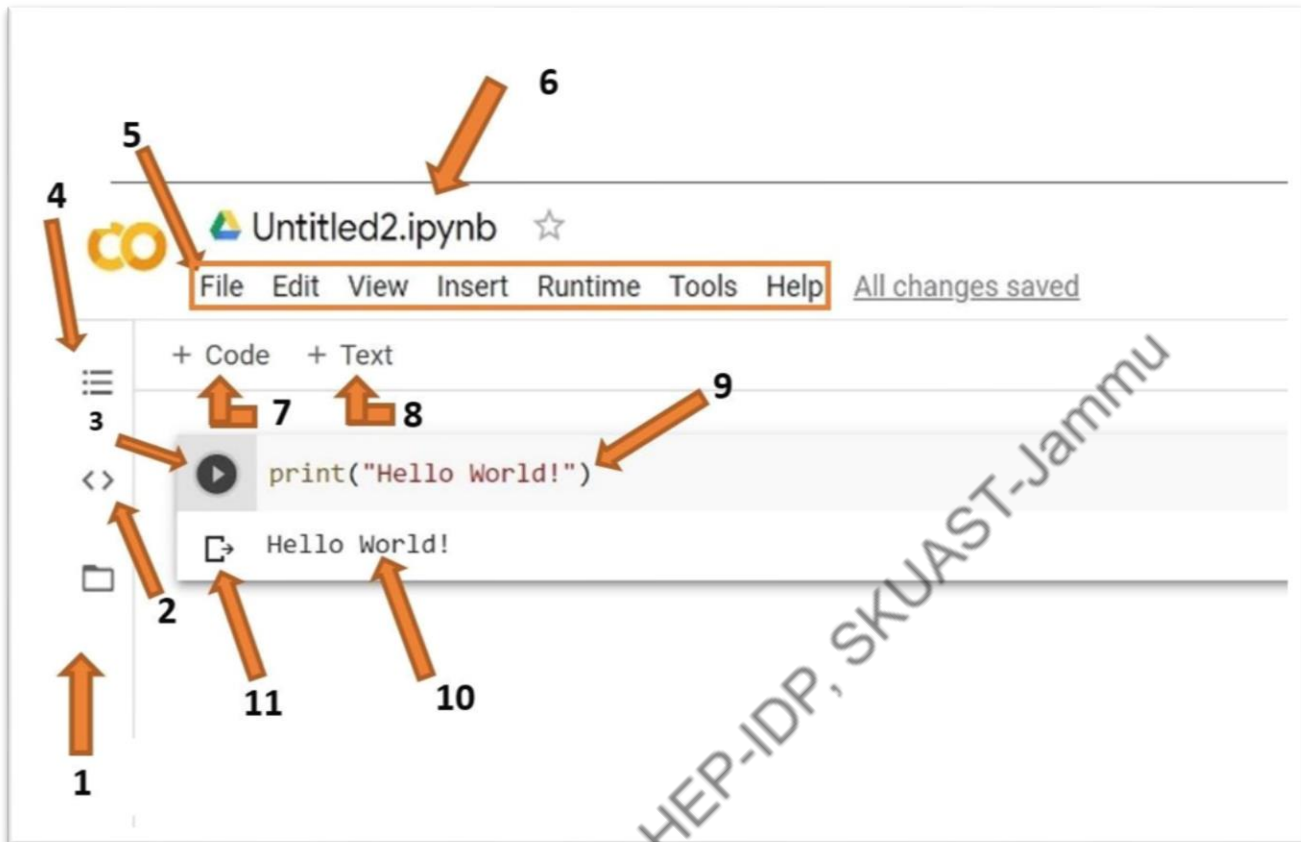


Starting with Google Colab Steps to open a new Colab Notebook:
 1. Go to

<https://colab.research.google.com>

2. Click "New Notebook"





1	File menu: Give options like <ul style="list-style-type: none"> • Create, Open and upload Notebook • Connect with Google Drive and Github
2	Code Snippets are prewritten snippets
3	This is the run button
4	Table of Contents shows different sections of the notebook.
5	The Menu Bar
6	Name of File (Notebook). The Notebook can be renamed by just clicking on its name
7	Insert Code: Click the button to insert new code
8	Insert Text: Click the button to insert new text (can be used to describe the code)
9	This is where user write code or text depending upon the section
10	This is the place where the output will be displayed
11	Click this button to remove output

Running first program

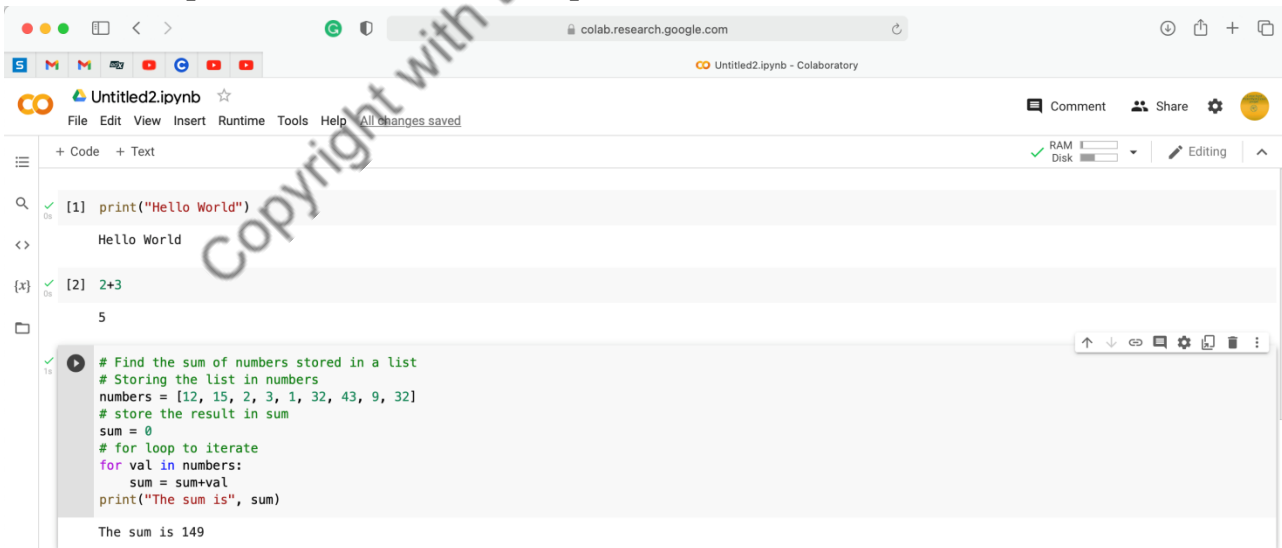
Steps:

1. Write code in Code Section
2. Click “Run” button or hit (Shift+Enter)

Try Running:

S. No.	Code
1	<code>print("Hello World")</code>
2	<code>2+3</code>
3	<pre># Find the sum of numbers stored in a list # Storing the list in numbers numbers = [12, 15, 2, 3, 1, 32, 43, 9, 32] # store the result in sum sum = 0 # for loop to iterate for val in numbers: sum = sum+val print("The sum is", sum)</pre>

Download implemented code to local computer



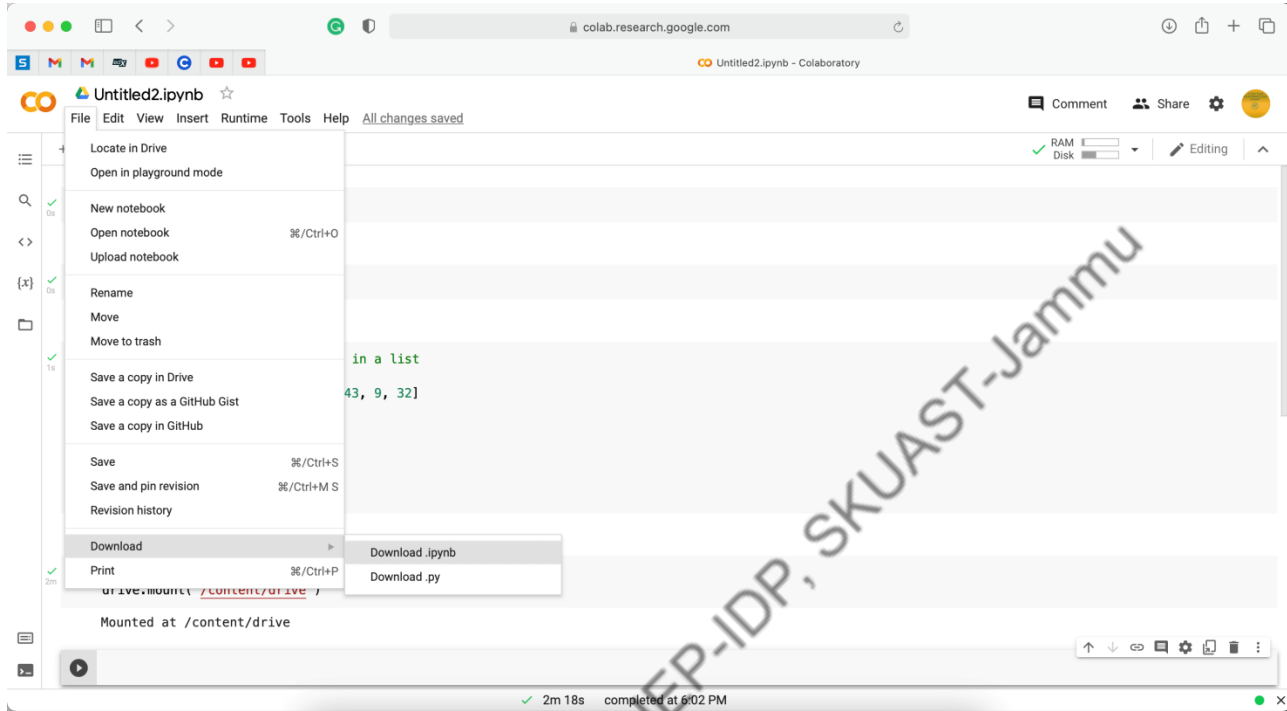
Steps:

1. Go to File
2. Click Download

3. Select extension in which you want your python file

- ipynb (for jupyter notebook)
- .py (for regular python file)

Mounting Google Drive on Google Colab



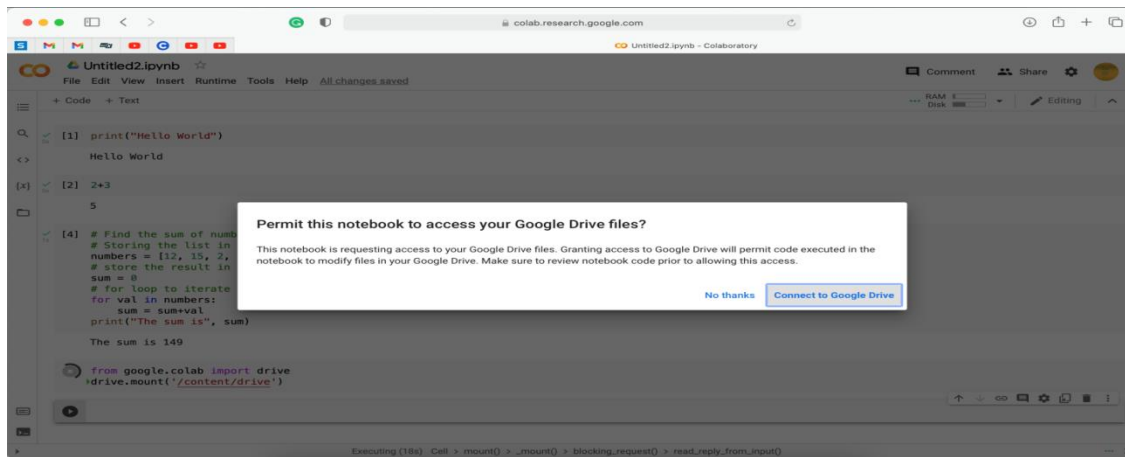
Steps:

1. Go to https://colab.research.google.com/?utm_source=scs-index
2. Go to file
3. Click on 'Mount Drive' button
4. Click “Connect to Google Drive”
5. Select the Google Account
6. “Allow” all permissions

OR

Run the following code snippet

```
from google.colab import drive
drive.mount('/content/drive')
```



References:

- https://colab.research.google.com/notebooks/basic_features_overview.ipynb
- https://colab.research.google.com/?utm_source=scs-index
- <https://research.google.com/colaboratory/faq.html>
- <https://drive.google.com/drive/u/1/my-drive>
- <https://support.google.com/drive/?hl=en#topic=14940>
- <https://www.mygreatlearning.com/blog/google-colab-tutorial/>
- <https://www.analyticsvidhya.com/blog/2020/10/create-image-classification-model-python-keras/>
- <https://keras.io/>

Hands-on Session Activity List for SKUAST Jammu
Pawanesh Abrol, Parul Sharma, Palak Mahajan and Namrata Phonsa
Corresponding Author: pawanesh.abrol@gmail.com

**AI in agriculture:**

Artificial intelligence (AI) is the branch of computer science that deals with the simulation of human intelligence. Every vendor across the world wants to incorporate their product with AI for its more usability and acceptability.

Artificial Intelligence in agriculture not only helps farmers to automate their farming but also shifts to precise cultivation for higher crop yield and better quality while using fewer resources. In recent times, Agriculture and farming are seeing the rapid implementation of Artificial Intelligence (AI) and Machine Learning (ML) both in terms of agricultural products and in-field farming techniques.

AI implementation tools and softwares:

Artificial intelligence (AI) and Machine learning (ML) are everywhere and in every industry. It allows processing huge amounts of data letting experts put the analysis to better use. With the growth in AI and ML, several frameworks and Artificial Intelligence tools have been made available to developers and scientists.

Listed below are the popular artificial intelligence tools and frameworks that are available in the market:

1. Scikit Learn
2. Tensor flow
3. Theano
4. Caffe
5. MxNet
6. Keras
7. PyTorch

There are four different types of AI softwares :

1. Artificial Intelligence Platforms: This will provide the platform for developing an application from scratch. Many built-in algorithms are provided in this. The drag and drop facility make it easy to use.
2. Chatbots: This software will give the effect that a human or person is doing in a conversation.
3. Deep Learning Software: It includes speech recognition, image recognition etc.
4. Machine Learning Software: Machine learning is the technique that will make the computer learn through data.

The corresponding author is working as Professor and Head in Department of Computer Science and IT, University of Jammu, J&K, UT

Language: Python

Python is an interpreted, object-oriented, high-level programming language with dynamic semantics. Its high-level built-in data structures, combined with dynamic typing and dynamic binding, make it very attractive for Rapid Application Development, as well as for use as a scripting or glue language to connect existing components. Python's simple, easy to learn syntax emphasizes readability and therefore reduces the cost of program maintenance. Python supports modules and packages, which encourages program modularity and code reuse. Multiple softwares are available online and offline for deploying python language: Python shell Anaconda, Spyder, Jupiter Notebook, Google Colab etc.

Interface: Google Colab

Google Colab is a **great online platform for deep learning enthusiasts**, and it can also be used to test basic machine learning models, gain experience, and develop an intuition about deep learning aspects such as hyperparameter tuning, preprocessing data, model complexity, overfitting and more. Google Colab is an excellent tool for implementing AI as it offers platform independent online services.

Pre-requisites: Internet Connectivity,
Google Account

Language: Python

Libraries: Numpy, Pandas, Matplotlib, Seaborn, Folium, Stats, Date Time, Pytorch

List of Programs:

1. **Fundamentals of python programming:**

- a) Variables
- b) Conditional Statement
- c) Loops

Creating variables

```
# Creating variable as String
a="Hello SKUAST"
```

```
# Printing variable
print(a)
```

```
# Creating integer variables
i=10
j=2
# Addition of two integers
sum= i+j
print(sum)
```

Conditional Statement

```
# Greatest of 2 numbers
a = 33
b = 200
if b > a:
    print("b is greater than a")
```

```
# Greatest of 2 numbers
# using if-elif-else condition
a = 200
b = 33
if b > a:
    print("b is greater than a")
elif a == b:
    print("a and b are equal")
else:
    print("a is greater than b")
```

```
# Greatest of 3 numbers
a = 200
b = 33
c = 500
if a > b and a > c:
    print("Both conditions are True: a os greatest")
else:
    print("a is not greatest")
```

```
# Printing "Hello World" in a loop
i = 1
while i < 10:
    print("Hello world")
    i += 1
```

2. Working with Arrays:

- a) 1D array
- b) 2D array

1D array

```
# Create an array containing '1' as its items using the 'ones()' function from the 'numpy' module.
import numpy as np
# Step 1: Always import the 'numpy' module at the beginning of the code and give it an alias (or nickna
me) called np.
# We will always refer to the 'numpy' module as 'np' throughout the code.
a = np.ones((3))
# Step 2: Call 'ones()' function from the np module using the dot operator.
# The 'ones()' function, requires two inputs: the dimension of the array and data-
type of the items which in this case is 'int'.
print(a)
```


2D array

```
# Create 2Dimensional NumPy array with 15 random integers between 50 and 100.  
p = np.random.randint(50,100, size = (5,3))  
print(p)
```

3. **Working on Statistical operations:** Mean, Median, Mode, etc.

4. **Working with Date Time Module**

5. **Working with Datasets:** Real-Time Standard Datasets (Secondary Dataset)

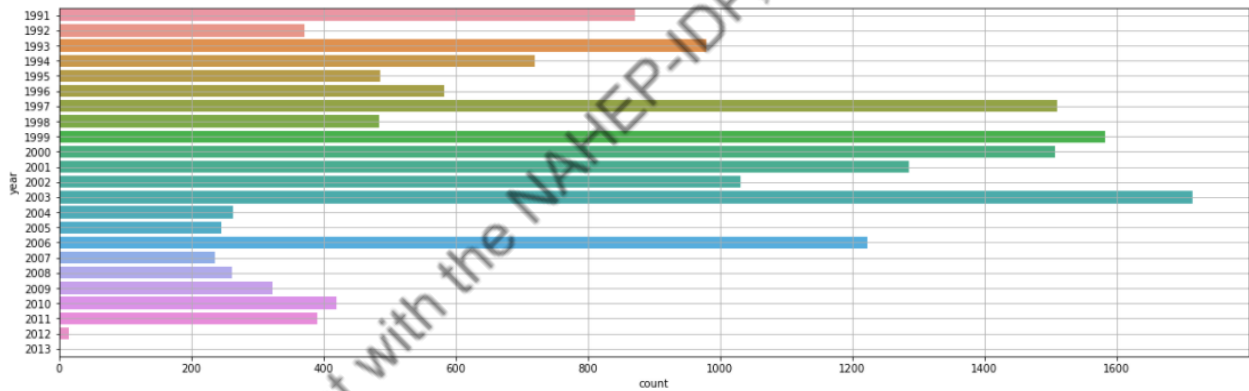
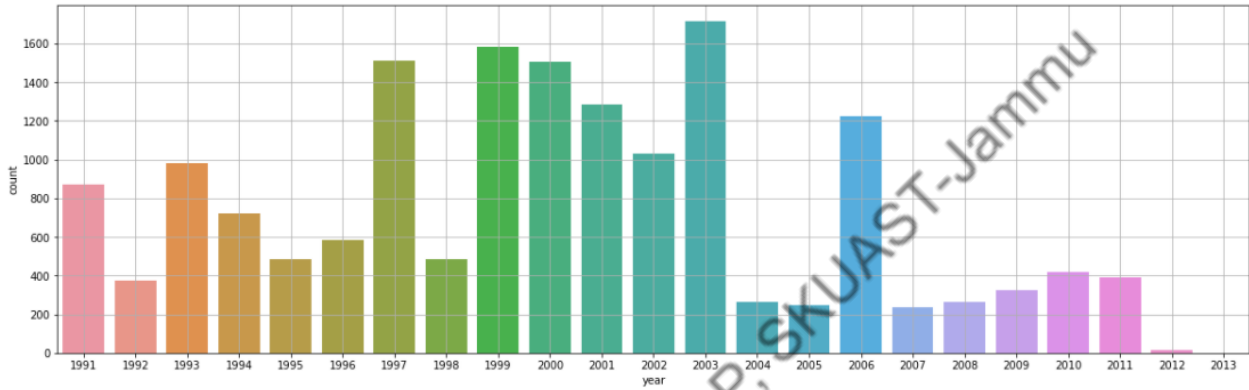
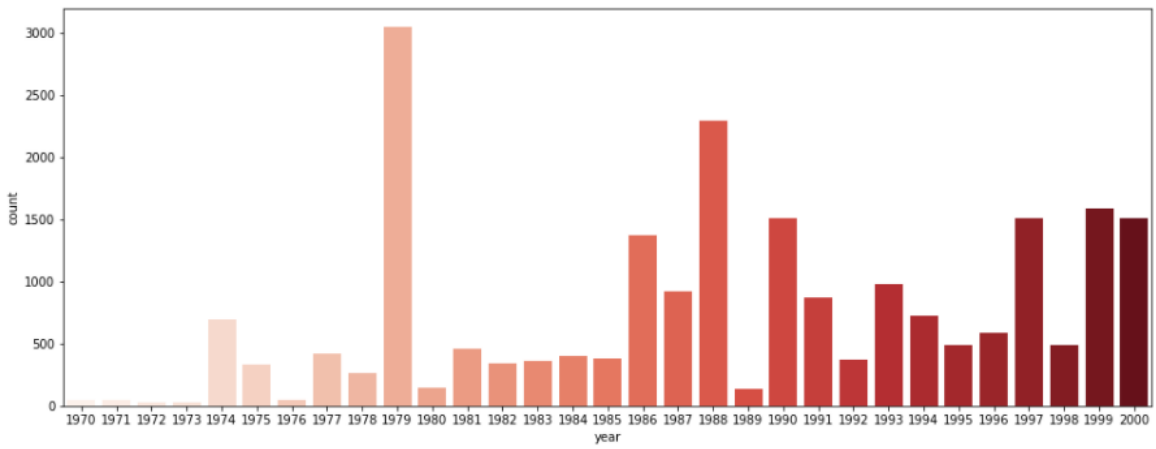
```
# Import the necessary libraries for this class and create a DataFrame.  
import numpy as np  
import pandas as pd  
import matplotlib.pyplot as plt  
  
met_df = pd.read_csv('https://student-datasets-bucket.s3.ap-south-1.amazonaws.com/whitehat-ds-datasets/meteorite-landings/meteorite-landings.csv')  
met_df.head()
```

	name	id	nametype	recclass	mass	fall	year	reclat	reclong	GeoLocation
0	Aachen	1	Valid	L5	21.0	Fell	1880.0	50.77500	6.08333	(50.775000, 6.083330)
1	Aarhus	2	Valid	H6	720.0	Fell	1951.0	56.18333	10.23333	(56.183330, 10.233330)
2	Abee	6	Valid	EH4	107000.0	Fell	1952.0	54.21667	-113.00000	(54.216670, -113.000000)
3	Acapulco	10	Valid	Acapulcoite	1914.0	Fell	1976.0	16.88333	-99.90000	(16.883330, -99.900000)
4	Achiras	370	Valid	L6	780.0	Fell	1902.0	-33.16667	-64.95000	(-33.166670, -64.950000)

Output:

6. **Creating Graphs:** Bar Graphs on Real-Time Dataset

```
#Create a count plot for the count of the meteorites between the years 1970 & 2000.  
df_2000=correct_lat_long_df[(correct_lat_long_df["year"]>=1970) & (correct_lat_long_df["year"]<=2000)]  
# Create a DataFrame for the meteorites fallen between 1970 and 2000 including both.  
import matplotlib.pyplot as plt  
import seaborn as sns  
# Create a count plot for the meteorites fallen between 1970 and 2000 including both.  
plt.figure(figsize=(16,6))  
sns.countplot(x= "year", data=df_2000 ,palette="Reds", )  
plt.show()
```

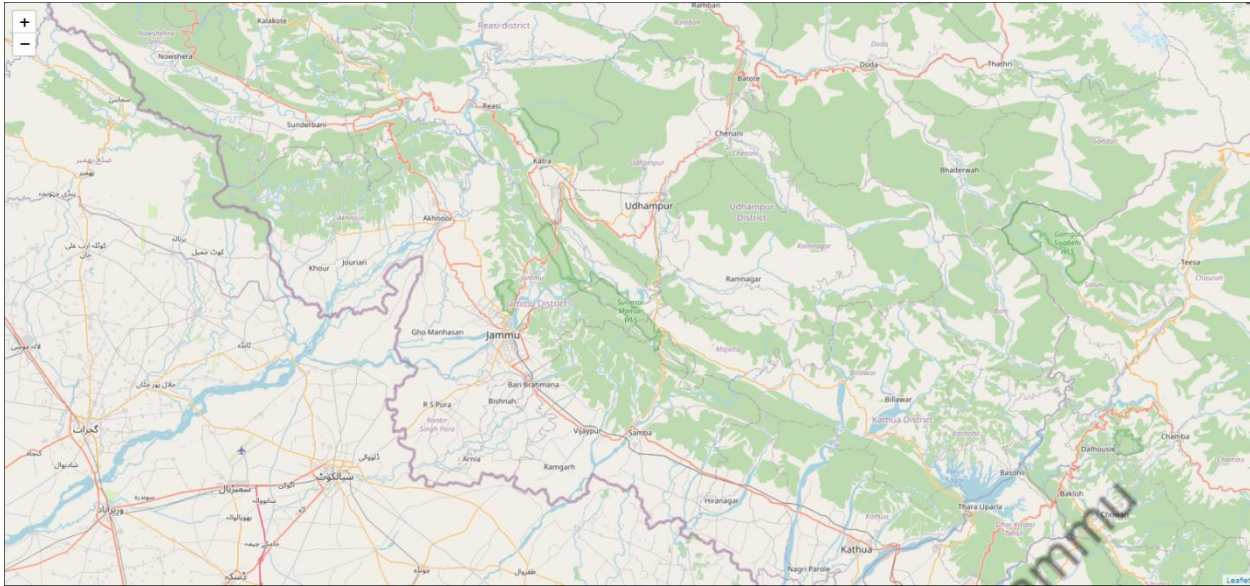


7. Working with Maps: Locating Jammu city, Marking SKUAST Jammu

Create a map for the Jammu location.

```
import folium
```

```
folium.Map(location=[32.652915,74.807113])
```



8. Demo machine learning program: Agriculture domain

To do activity: Python coding exercises

Copyright with the NAHEP-IDP, SKUAST-Jammu

Reference Managers

Vikas Sharma

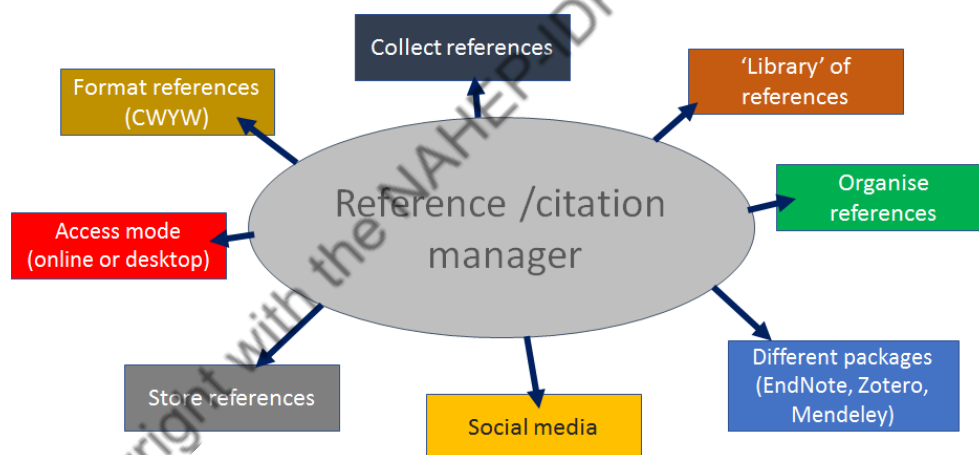
Corresponding Author: svikas2000@gmail.com



A higher degree by research thesis commonly has hundreds of references, so some time spent at the beginning can save you many hours towards the end of your degree. It is important that the literature is collected in an organized manner. We have often seen numerous mistakes in thesis citations and bibliography including non-uniformity of style and omissions/commissions.

Reference management programs (also known as citation managers or bibliographic management software) provide many useful features that can help you with your research such as:

- Collecting, storing and organising your references
- generating citations and bibliographies in the style you prefer; and,
- insert in-text citations into a document as you type. This will also generate a reference list or bibliography at the end of your document, based on those citations.
- easily converting/formatting referencing styles to suit publication requirements as in to create a bibliography.



(<https://library-guides.ucl.ac.uk/reference-management-software>)

As there are a number of different programs available it is important to choose the one that suits your needs. (<https://latrobe.libguides.com/reference-management>).

General Features of Reference Managers

- Store references in a searchable database
- Attach PDFs and other files
- Auto-generate citations and bibliographies/ reference lists in your document in your chosen style

The authors is working as Professor & Head in Sher-e-Kashmir University of Agricultural Sciences & Technology, Jammu

- Share collections of references with others
- Sync your references across multiple devices

Important Citation/Reference Managers (Free)

Zotero

Zotero is both free and open source, which means that you don't have to pay for it and that its design is publicly accessible. Zotero is a great choice for a reference manager, especially for students, because it runs as both a web service and an offline service on your personal device (laptop, iPad, cell phone, etc.). Zotero not only stores and formats your bibliographic information but also allows you to organize, tag, and search this information. It automatically and seamlessly extracts information from books, journal articles, and other online sources, making the entire process of creating a reference list effortless.

Mendeley

If you're in a technical or scientific field, Mendeley is an excellent option for you. This reference management software allows users to generate citations and bibliographies in Microsoft Word, Libre Office, and LaTeX. As with End Note, it's great for collaborative work because it allows you to connect with colleagues and share your papers, notes, and annotations. It can be used on your computer via the web or through your iPhone or iPad, which makes it easy to do your work wherever you go.

Important Citation/Reference Managers (Paid)

End Note

EndNote is great if you're collaborating on a research paper. It lets you share with up to 14 colleagues anywhere in the world, so it's definitely the top choice for collaborations. One of the highlights of this reference manager is that it includes reference types such as interviews, podcasts, conference papers, and press releases. It also lets you add citations to Microsoft PowerPoint slides, which is especially helpful if you're creating a presentation with a group.

EndNote has a huge catalogue of format options with over 6,000 reference styles, so regardless of your discipline, you're bound to find one that fits your needs. Endnote is a paid software.

Ref Works

Ref Works is an exceptional reference management software program but is paid. RefWorks is great because it allows users to generate and format bibliographies and manuscripts in hundreds of output styles, including some of the most common (e.g., APA, MLA, or Chicago). It also allows users to manage more than just bibliographic data, which is why it's great for academics and researchers alike.

Comparison of important software

Software	Cost (USD)	Free software	License	Notes
CiteULike	Free	No	proprietary ^[9]	centrally hosted website
EndNote	US\$299.95 ^[11]	No	Proprietary	The web version EndNote basic (formerly, EndNote Web) is free of charge

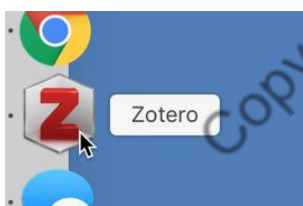
JabRef	Free	Yes	MIT license	Java BibTeX and BibLaTeX manager
Mendeley	Free / Online storage free up to 2 GB / Additional storage space available	No	proprietary (OS API clients exist)	Account required, Desktop & Web components, Windows, Linux, macOS (not macOS 11 Big Sur)
Paperpile	US\$2.99/month for academics, 9.99/month otherwise	No	Proprietary	web-application, integrates with Google Docs, collaboration & sharing features, currently only on Google Chrome
Reference Manager	Not for sale anymore, sales ceased December 31, 2015	No	Proprietary	network version; built-in web publishing tool; discontinued
Zotero	Free / Online storage free up to 300 MB / Additional storage space available	Yes	AGPL	Multi-platform desktop version with connectors for Firefox, Chrome and Safari. Web-based access to reference library also available through Zotero.org or through a personal cloud-based database folder on a user's computer (Google Drive, Dropbox, etc.).

https://en.wikipedia.org/wiki/Comparison_of_reference_management_software

Zotero

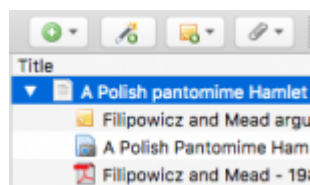
Zotero is my favourite software, when it comes to managing my references. One important thing is its free and open source. You can sync your references across devices. Below I have given a few basic steps for getting acquainted and using Zotero (https://www.zotero.org/support/quick_start_guide).

How do I open Zotero?



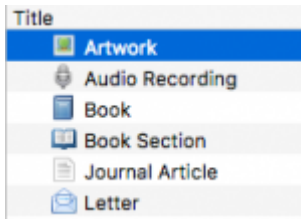
Zotero can be opened from your operating system's dock or file manager like any other program.

What does Zotero do?



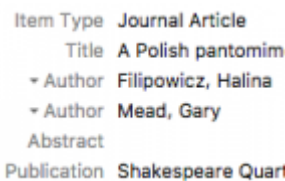
Zotero is, at the most basic level, a reference manager. It is designed to store, manage, and cite bibliographic references, such as books and articles. In Zotero, each of these references constitutes an item. More broadly, Zotero is a powerful tool for collecting and organizing research information and sources.

What kind of items are there?



Every item contains different metadata, depending on what type it is. Items can be everything from books, articles, and reports to web pages, artwork, films, letters, manuscripts, sound recordings, bills, cases, or statutes, among many others.

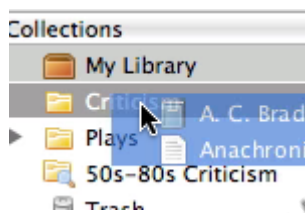
What can I do with items?




Items appear in Zotero's center pane. The metadata for that item is shown in the right pane. This includes titles, creators, publishers, dates, page numbers, and any other data needed to cite the item.

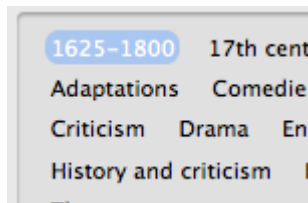
Organize

Collections



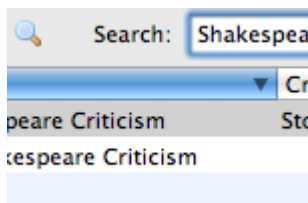
The left pane includes My Library, which contains all the items in your library. Right-click on My Library or click on the New Collection button ( above the left pane to create a new collection, a folder into which items relating to a specific project or topic can be placed. Think of collections like playlists in a music player: items in collections are aliases (or “links”) to a single copy of the item in your library. The same item can belong to many collections at one time.

Tags



Items can be assigned tags. Tags are named by the user. An item can be assigned as many tags as is needed. Tags are added or removed with the tag selector at the bottom of the left pane or through the Tags tab of any item in the right-hand pane. Up to 6 tags can be assigned **colors**. Colored tags are readily visible in the item list and can be quickly added or removed using the number keys on your keyboard.

Searches



Quick searches show items whose metadata, tags, or fulltext content match the search terms and are performed from the Zotero toolbar. Clicking the spyglass icon to the left of the search box opens the Advanced Search window, allowing for more complex or narrow searches.

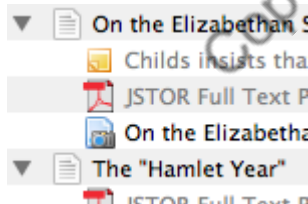
Saved Searches



Advanced searches can be saved in the left pane. They are similar to collections, but will update with new matching items automatically.

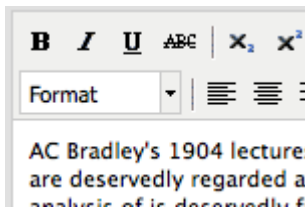
Collect

Attachments



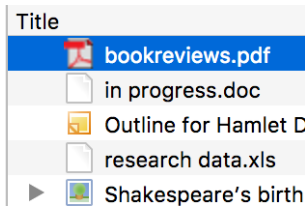
Items can have notes, files, and links attached to them. These attachments appear in the middle pane underneath their parent item. Attachments can be shown or hidden by clicking the arrow next to their parent item.

Notes



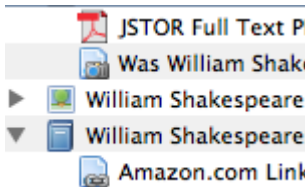
Rich-text notes can be attached to any item through the Notes tab in the right-hand pane. They can be edited in the right-hand pane or in their own window. Click the New Note button (📝) in the toolbar to create a note without attaching it to an item.

Files



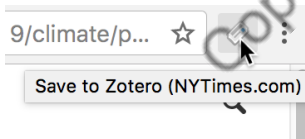
Any type of file can be attached to an item. Attach files with the Add Attachment (paperclip) button in the Zotero toolbar, by right-clicking on an existing item, or by drag-and-dropping. Files do not need to be attached to existing items. They can simply be added to your library. Files can also be downloaded automatically when you import items using the Zotero Connector in your browser.

Links & Snapshots



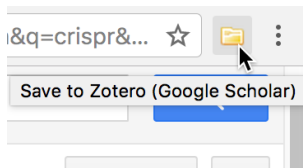
Web pages can be attached to any item as a link or a snapshot. A link simply opens the website online. Zotero can also save a snapshot of a web page. A snapshot is a locally stored copy of a web page in the same state as it was when it was saved. Snapshots are available without an internet connection.

Capturing Items



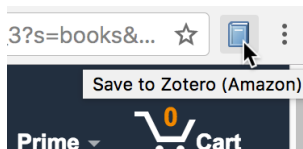
With the Zotero Connector for Chrome, Firefox, or Safari, it's simple to create new items from information available on the internet. With the click of a button, Zotero can automatically create an item of the appropriate type and populate the metadata fields, download a full-text PDF if available, and attach useful links (e.g., to the PubMed entry) or Supplemental Data files.

Single or Multiple Captures



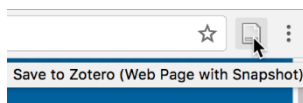
If the save icon is a book, article, image, or other single item, clicking on it will add the item to the current collection in Zotero. If the save icon is a folder, the webpage contains multiple items. Clicking it will open a dialog box from which items can be selected and saved to Zotero.

Translators



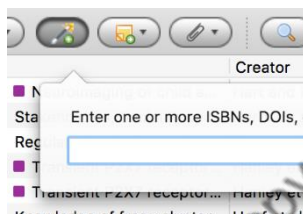
Zotero uses bits of code called translators to recognize information on webpages. There are generic translators which work with many sites and translators written for individual sites. If a site you're using does not have a translator, feel free to request one on the Zotero Forums.

Saving a Web Page



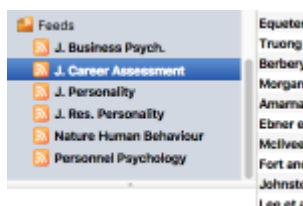
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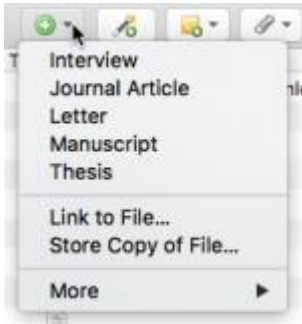
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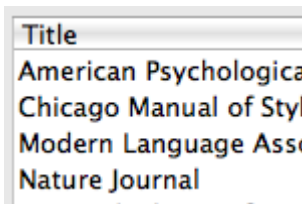
Manually Adding Items



Items can be added manually by clicking the green New Item (+) button in the Zotero toolbar and selecting the appropriate item type. Metadata can then be added by hand in the right-hand pane. While you should generally not add items manually, it can be useful for adding primary documents that aren't available online.

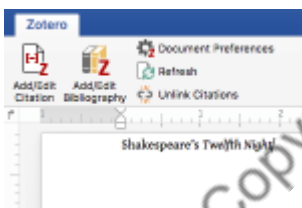
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Citing Items



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Automatic Bibliographies

Shakespeare (Desmet & Sawyer 5

Bibliography

Brandon, James R. "Kabuki and 5

Desmet, Christy, and Robert Saw

Godsalve, William H. L. *Britten's*

Using the word processor plugins makes it possible to automatically generate a bibliography from the items cited and to switch citation styles for the entire document with the click of a button.

Manual Bibliographies

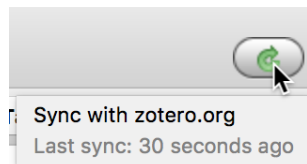
1. Katharine Cooke, A.
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Zotero can also insert citations and bibliographies into any text field or program. Simply drag-and-drop items, use Quick Copy to send citations to the clipboard, or export them directly to a file.

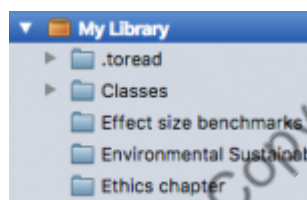
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Limitations of referencing tools

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- may not create a perfect bibliography or reference list according to your preferred style (or your supervisor's or tutor's).
 - You still need to be familiar with the referencing style to be used.
 - Refer to Style Manuals.
 - In some programs it is possible to adjust or edit output styles.
- will not correct typos or errors or omissions from references manually entered or downloaded from databases.
 - You will always need to proof-read references for accuracy: punctuation, capitalisation, spelling.
- may not always know what reference type you are downloading.
 - For example they cannot always distinguish a conference proceeding from a book.
 - Also some information may be inserted in the wrong format requiring editing.

(Disclaimer: The information is collected from various websites and used as is for the benefit of trainees. The software is ever evolving and its features and operational system may change from time to time)

Use of Information and Communication Technology in Agriculture

Rakesh Sharma

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A solid extension programme is critical transfer of new technologies. Extension organizations have been concerned with what should be the appropriate means and approaches to use to get the right agricultural information to the farmers. Agricultural extension or information delivery is a process of communication of improved skills, practices, innovations, technologies and knowledge and must engage all components of ICT in order to reach all these out to the rural farmers.

Introduction

To achieve agriculture development and to reach large number of farmers, revolutionary efficient, reliable and potential tools must be employed. Such tools are the Information and Communication Technologies (ICTs): mobile telephony, radio and television programmes, mobile phones in combination with radio, video shows, information kiosks, web portals, rural tele-centers, farmer call centers, video-conference, offline multimedia CDs, open distance learning, etc. ICT in agriculture is an emerging field focusing on the enhancement of agricultural and rural development in India. It involves application of innovative ways to use Information & Communication Technologies (ICT) in the rural domain. The advancements in ICT can be utilised for providing accurate, timely, relevant information and services to the farmers, thereby facilitating an environment for more remunerative agriculture. Given the development scenario in Indian Agriculture, ICT movement is still evolving. However, all the ICT initiatives are not uniform with disparities between regions in the level and quality of telecommunications, information and the effort of individuals, public and private organizations, and differentiated nature of demand of the farmers in different areas.

ICT enables vital information flows by linking rural agricultural communities to the Internet, both in terms of accessing information and providing local content.

New information and communication technologies are generating possibilities to solve problems of rural poverty, inequality and giving an opportunity to bridge the gap between information rich and information poor and support sustainable development in rural and agricultural communities. As farming is becoming highly knowledge intensive, commercialized, competitive and globalized against traditional resource-based approach, the need to adopt right means to bring in all players of agribusiness, cannot be over emphasized.

Innovations in ICT are of great help in offering a communication platform circumventing all traditional physical barriers and backwardness with its wider reach out and neutrality to social and gender bias and it's inclusive nature of public and private sectors and its innate strength of offering a reliable, good and cost effective communication platform to various management agencies involved in the extension to and from to the farmers. With these features, ICT will definitely strengthen the current ongoing extension reforms in bridging gaps in access and in bridging rural economy with globalised markets.

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ICT- Meaning

Integration of technologies in order to disseminate desired information to the target audience in order to make them more participatory. Information and Communication Technology (ICT) concept involves transfer and use of all kinds of information. The importance of ICTs is not the technology as such, but it's enabling function in access to knowledge, information and communications, increasingly important elements in today's economic and social interactions. ICT is an umbrella term that includes any communication device or application, encompassing radio, television, cellular phones, computer and network hardware and software, satellite systems and so on, as well as the various services and applications associated with them, such as videoconferencing and distance learning. ICTs are often spoken of in a particular context, such as ICTs in education, health care, or libraries. Thus, term ICTs can be broadly interpreted as technologies that facilitate communication and the processing and transmission of information by electronic means. This definition encompasses the full range of ICTs from radio, television to telephones, computers and internet.

ICT and Agriculture

ICT can act as an accelerating force behind the productivity of Indian agricultural markets. Knowledge is a useful resource and backed by adequate technological infrastructure and appropriate strategies, it can become a transformational factor for overall development of agricultural markets. According to Jones (1997), agricultural extension is an essential mechanism for delivery of knowledge and advice as an input for modern farming. The need is of a shift of focus from delivery of technology to delivery of knowledge and information. This is possible with the use of Information and communication technologies which can make agricultural extension a more diversified, knowledge driven system for meeting on demand farmers' information needs. ICT can continuously introduce newer sets of information services to agricultural markets where farmers can have a better control. Access to such new information sources is a crucial requirement for the sustainable development of the farming systems.

Why ICT in agriculture?

Agriculture is increasingly becoming more knowledge-intensive. Having access to timely, accurate information that is tailored to specific locations and conditions is critical in helping farmers make the most of their resources in often changing circumstances. Role of ICT in agriculture is important for:

- i. Economic development of agriculture producers.
- ii. Empowering rural communities.
- iii. E-commerce.
- iv. Employment generation
- v. Early warning system.
- vi. Easy access to government information and services.
- vii. Improving Market Access
- viii. ICTs may help poorly functioning markets work better and thereby increase incomes and/or lower consumer prices.

Unique Features of ICT

- Access to the astounding store-house of information is free
- The information is available instantaneously round the year and twenty-four hours a day
- Communication can also be interactive

- The information is available from any point on the globe
- The communication is dynamic and ever growing.

Use of ICTs has been put forth for:

- Bridging the knowledge deficit among farmers
- Enhancing the capabilities of extension personnel
- Strengthening the research-extension-farmer linkages

Information Needs of Farmers

The main focus of ICT in agriculture is meeting the vital needs of the farmers for information that seem to be imperative for the growth and development of agriculture. To meet the information needs of extension agents and growers, the ICT can provide:

Market information

Market information including price updates of agricultural commodities of surrounding districts on a daily basis. For farmers, the price updates of markets outside their villages have a higher priority so that they can compare the prices and choose to sell at the appropriate place.

Information on latest techniques and technologies

Continuous advancement in technology brings up gradation to agricultural machinery and techniques too. Up to date information regarding latest technologies in agriculture and animal husbandry is of immense importance for growth. Information about rural development programs and subsidies Provision of detailed information on Government initiatives for rural development for those the programs are addressed. The areas that suffer from droughts, floods or other natural disasters frequently receive grants and subsidies from the Government. Information related to these programs is particularly important to small and marginal farmers.

Weather forecasting

Updated information on weather such as temperature, humidity, forecasts on rains.

Latest (best) packages of practices

Information on best practices of cultivation is important need of the farmers. Information regarding drought resistant varieties of certain crops can be important for farmers to withstand longstanding droughts in some areas.

Post-harvest technology

Education on post-harvest technology and storage is as vital as pre-harvest. Farmers are getting aware of the value addition of food processing.

General agricultural news

General news and information related to various agricultural events in villages and districts.

Information on insurance / claim processing

Detailed information on crop insurance schemes, the type of damage covered and compensation offered premiums to be paid, etc.

Input prices and availability

Information relating to the availability of agricultural inputs like seeds, fertilizers, manures, etc. and prices.

Early warning and management of diseases and pests

In the areas of continuous droughts, pests and diseases do not generally pose a major threat. However, in other areas this information is useful. Also, early warning in case of some crops like sugarcane is important.

Soil testing and soil sampling information

Information related to testing of quality or nature of soil is very important for farmers as the soil directly relates to productivity of crops. If this information is easily available to the farmers, it prepares farmers to get the best produce given the resources.

Different ICT Initiatives in Indian Agriculture

AGRISNET: AGRISNET is a project funded by the DoA&C, MoA& FW, GoI. Under this scheme most, of the state government have establish information rich websites. eg; Sikkim AGRISNET (<http://www.sikkimagrisnet.org>), Andhra Pradesh agri portal (<http://www.apagrisnet.gov.in>), Uttar Pradesh AGRISNET knowledge portal (<http://agriculture.up.nic.in>) etc. Several initiatives have been taken by the central government and state level such as ASHA in Assam, KISSAN and e- Krishi in Kerala, Krishi Maratha Vahani in Karnataka etc. An infrastructure network existing at block level facilitating agricultural offices, agricultural extension services and agribusiness activities to enhance rural development.

Digital green: Digital Green is a Non-Governmental Organization (NGO) based in New Delhi. It produces videos of farm practices. The content of the video belongs to the farmer. Best practices followed by a farmer are captured in the video. Video is shot by the farmer. Validation is done by the Digital Green in consultation with the experts. This video is played to farmers in nearby villages. It is a farmer-to-farmer extension. Farmers are thrilled to see their fellow farmers in the video. The video is also uploaded in the website of Digital Green and freely accessible to all. Projection of video is done by using Pico projector, which is battery operated, easy to handle and less expensive. The video is edited using the COCO software. The agri. information of local relevance is disseminated through digital video. The system consists of a digital video database prepared for farmers by farmers with the help of experts. The recordings are shown to individuals or small groups using laptops, DVD player, television and to communities through village cable network.

eSagu: 'eSagu' is a web-based personalized agro-advisory system which uses Information Technology to solve the unscientific agricultural practices. Sagu means cultivation in Telugu -local language of Telangana Andhra Pradesh, the region in which the project started. E-Sagu means electronic cultivation. It exploits the advances in Information Technology to build a cost-effective agricultural information dissemination system to disseminate expert agriculture knowledge to the farming community to improve the crop productivity. It is a joint research project of Media lab asia and IIT Hyderabad lunched in 2004. The eSagu system contains the following parts: (i) Farmers (ii) Coordinators (iii) eSagu local center (iv) Agricultural information system and (v) Communication system. eSagu provides personalised expert advice in a timely manner from sowing stage to harvest for small and marginal farmers at their door-step. The farm situation is brought to the expert in the form of digital photographs and text information. The expert advice after analysing the situation is prepared and is delivered to the concerned farmer on the same day or subsequent day.

Warana Wired Village Project: The Warana Wired Village Project was launched in 1998 as a collaboration between the National Informatics Centre (NIC), the Government of Maharashtra, as an attempt to modernize farmers' co-operatives in Warana Nagar, Maharashtra, India. Existing co-operatives have been ICT-enabled to increase farmers' capacities for information exchange in a government-driven experiment to discover the potential of rural ICT. The project provides access to a wide range of information including agriculture to the member of the cooperative in local language. It provides information on crops, market prices, employment schemes, educational opportunities, etc. The

information is provided through the village information kiosks. The operators of these kiosks are the main linkage between the farmers and the information centre.

IFFCO Kisan Sanchar Limited (IKSL) : BhartiAirtel Limited, India's leading integrated telecommunications services provider, and Indian Farmers Fertiliser Cooperative limited (IFFCO) launched a joint venture company IFFCO Kisan Sanchar Limited (IKSL) in 2008, that is set to provide a major boost to Indian agriculture and the rural economy at large. The relevant information is delivered to the farmers on mobile phones through five voice message in local language. Customized solutions are provided to the farmers through helpline. The farmers can also speak to the experts on specific subject through special 'phone-in' programmes. The farmers will also get access to a unique VAS platform that will broadcast five free voice messages on mandi prices, farming techniques, weather forecasts, dairy farming, animal husbandry, rural health initiatives and fertiliser availability *etc.* on a daily basis. In addition, the farmer will be able to call a dedicated helpline, manned by experts from various fields, to get answers to their specific queries. This is expected to promote community building within the society and rural community at large (<http://www.iffco.nic.in>).

Agmarknet: This initiative provides daily market price and arrival information in respect of 300 commodities and 2000 varieties in eight local languages. The wide range of information on prices, arrival and other related aspects like grades, standards, packaging, etc. is collected and disseminated by networking major agricultural produce markets operating in the country.

iKisan: iKisan project of the Nagarjuna group of companies (Andhra Pradesh). *iKisan* is the ICT initiative of the Nagarjuna group of companies, the largest private entity supplying farmers' agricultural needs. *iKisan* was set up with two components, the *iKisan.com* website, to provide agricultural information online, and technical centres at village level. iKisan is a one-stop solution for farmers in providing information on crops, crop management techniques, fertilizers, pesticides and other related information like market updates and weather forecasts. The major objective of *iKisan* is to provide need based wholly agricultural expertise at village level, to increase the productivity of selected crops in selected regions. Their online services include information on 20 crops, namely rice, chilli, cotton, soybean, maize, groundnut, turmeric, banana, citrus, coconut, tomato, red gram, Bengal gram, green gram, black gram, aubergine, sunflower, sugarcane, castor and mango.

e-Arik: Single window to improve the access to agricultural information and technology in north eastern India. It provides expert consultation on production, plant protection and marketing aspects. The services provided under e-Arik are:

- Agriculture and allied sector information dissemination through ICTs at e-Arik: Village Knowledge Centre and also through e-Arik web portal
- Farm advisory services at the farmer's field
- Digital documentation of pest and diseases symptoms for the benefit of farmers and other farm stakeholders
- Documentation of tribal farmer's crop history for the ready reference
- Farm market and weather information
- Announcements and scroll messages on farm training programmes
- Information provision in the governance, health, and education through ICTs
- Digital publication and dissemination of farm advisory publications, survey reports, news letters and farmers training reports through web portal
- Computer education and awareness to the farmers and school children

- Organising farm multimedia shows
- Organising on-farm training and demonstrations
- Arranging scientist field visits and farmer-scientist-project staff interaction sessions.

Digital Mandi: Digital Mandi is an electronic trading platform for agri-commodities to bring the benefit of ICT to farmers and traders by eliminating geographical barriers and temporal limitation and removing cash crunch through active participation of various financial institutions. Digital Mandi is inspired by the vision of Media Labs Asia sustainable village through culturally appropriate use of new technologies.

Akashganga: The initiative taken by the AMUL dairy cooperative facilitates timely collection of milk, proper payments and generates higher income for dairy farmers. The system includes weighing of milk electronically, fat testing, capturing unique ID by the software and printing of pay slip and payment settlement. If phone number is being registered by AMUL AMCS software in the computer, he will be provided details of the milk procurement daily. In addition by AMUL AMCS application in members android phone by which member will get the details of his milk procurement on his mobile whenever he wants.

aAQUA (Almost All Questions Answered) (www.aaqua.org): aAQUA is a multilingual online problem-solving system that facilitate farmers getting their queries answered by experts. The reply to the queries raised by the farmers is sent in one to three days depending on the nature of the problem. aAQUA eAgri Service is a problem-solving system dedicated to find solutions to problems posed by Indian farmers - small and large. Answers to your agri-related queries are sent in 24 to 72 hours depending on the difficulty. Experts are employees of their respective organizations and serve without charge.

eKrishi: The communication network established under eKrishi is utilised to educate farmers, provide real time information on prices, arrivals and issue disaster warning and weather forecast. The aim is to enable farmers to take informed decisions on sale of their produce and bring transparency in the working of the Madhya Pradesh State Agricultural Marketing Board.

Mahindara Kisan Mitra: The initiate provide information on daily market prices, weather updates, crop advisories, agri related news, etc. The information is also available on other sections such as loans, insurance, Mandi database, cold storage and warehouses, etc. The farmers can also get motivated and take benefits from the success stories of other fellow farmers reported on the website.

Haryali Kisan Bazar: HKB has set up centre across different states to provide solutions to wide range of problems of farmers under one roof including agri-inputs, financial services, farm-output services and round the clock expert advice. The centres provide information on crops, latest technologies, weather forecast, market prices, customised services based on the farmer database maintained under the initiatives.

Fisher Friend Mobile Advisory: Fisher Friend is a BREW-based application offered on a low cost CDMA handset with a graphic interface, an icon-based menu and programmable shortcut keys. In addition to safety and weather information, fishermen can receive the locations of fishing areas and real time market prices with one-click in their local language. QUALCOMM, M. S. Swaminathan Research Foundation (MSSRF), Tata Teleservices and Asute System Technology jointly implemented mobile based advisory services. The information relevant for fishermen is provided in local language through mobile phones. The information covered are wave height, wind speed and director, potential fishing zones, relevant news, government schemes and market price.

Kisan Call Centre: The Kisan Call Centre utilises telecom infrastructure to provide customised information on various aspects of agriculture in local language using toll free number 1800-180-1551. The purpose of these call centres is to respond to issues raised by farmers, instantly, in the local language. There are call centres for every state which are expected to handle traffic from any part of the country. Queries related to agriculture and allied sectors are being addressed through these call centres. The Farmer Call Centre is a synthesis of two hitherto separate technologies namely, the Information and Communication Technology (ICT) and the Agricultural Technology- both have their specialized domains and work cultures. To optimally utilize the strengths of both these systems, it was proposed to take full advantage of professionally managed Call Centre mechanism and dovetail it with the specialized Subject Matter Specialists knowledge of Agricultural Scientists and Extension Officers, so as to facilitate its reach to the farming community.

Reuters Market Light: Reuters Market Light provides mobile phone based customised information according to the individual farmer's preferences on crops, markets, and location. The information in local language in respect of over 440 crops and varieties, more than 1400 markets and 2800 weather locations are available across 13 states through SMS.

e-choupal: An initiative by ITC provides alternative marketing channel, information on weather, agricultural practices, input sales, etc. It is a kiosk located in a village and equipped with computer with internet access managed by trained sanchalak. *e-choupal* initiative-whereby a choupal is equipped with a computer and Internet connectivity. The initiative was conceived to tackle the challenges posed by certain features of Indian agriculture, such as fragmented farms, a weak infrastructure, and the involvement of numerous intermediaries. Through e-choupals, these farmers can directly negotiate the sale of their produce with ITC. The PCs and Internet access at these centers enable the farmers to obtain information on mandi prices and good farming practices, and to place orders for agricultural inputs, such as seeds and fertilizers. This access to information helps farmers in improving the quality of produce and obtaining better prices. Elected from the village itself, a literate farmer acts as the interface between the illiterate farmers and the computer.

Gyandoot Project (Madhya Pradesh): Gyandoot is an Intranet based Government to Citizen (G2C) service delivery portal commissioned in Dhar district of Madhya Pradesh to extend the benefits of information technology to people in rural areas by directly linking the government and villagers through information kiosks. Each information kiosk or soochanalaya consists of a computer, a modem, a printer, an uninterruptable power supply (UPS) system which includes a backup battery in case of a loss of electricity, furniture, and stationery. These kiosks are located in government buildings or at prominent locations, such as markets, or along the main roads. The central hub is located in the district administrative headquarters at the collectorate. The information on the portal is in the local language, Hindi. Each kiosk provides services to 10 to 15 gram panchayats (village councils) covering 20 to 30 villages and a population of 20,000 to 30,000 people. The kiosks enable villagers to apply for different government services and file complaints online by sending e-mails in Hindi to the district headquarters. E-mails received by the official at the district headquarters (complaints and applications) are forwarded "by hand" to the concerned departments. These transactions are handled manually because most of the departments that need to act on the applications and complaints have not been computerized.

Conclusion

To provide timely, relevant and accurate information to the farmers and other stakeholders that will help them take optimum decisions, ICT plays a vital role in the efficient delivery of this

information. Several ICT based initiatives have been tried by different players and on the basis of the different initiatives it is concluded that to harness the full potential of ICT there is need to make assessment of information needs of the farmers and appropriate mode of reaching them as per local conditions before developing an ICT Model. The information dissemination model should be viable and user-friendly so that the initiatives may be sustained in long-run. A string backward and forward linkage should be in place for accurate information collection and its dissemination. There is need to integrate various agencies under one roof for providing vital information on various components of agriculture so that it will act as a one stop solution for the needs of the farmers. Introduction of delivery mechanism of information in the case of government initiatives like agmarknet.nic.in is need of the hour so that the information reaches the end user. It is also essential to create the requisite ICT infrastructure in rural areas for effective dissemination of information. The awareness among farmers and other stakeholders on the importance of information should be created and its optimum utilisation will help in the development of agriculture and overall, well-being of the farming community.

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Role of Artificial Intelligence in Agriculture

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The power of Artificial intelligence (AI) is undeniable and is reaching every research field across the globe. Agriculture is one of the most important and leading domains of research for its contribution to provide raw materials to industries, food for entire humanity, fodder for animals and a source of finance for government agencies. It has taken a huge advantage from AI, a revolutionary creation by the field of computer science, to improve its produce yield along with its quality, health and produce of livestock. A small survey is carried out to realize the extent of the role of AI in agriculture.

Plants existence is essential for human continued existence. They are directly or indirectly reliant on plants for food, shelter, and clothing. With the growing human population now, it becomes more important to protect them and keep their health good. There are very few experts who can recognize the species and assess the underlying health of the plants. This is where machine learning comes into fold. With its ability to do the classification, categorization, regression, decision making etc. it has become inevitable in nearly all research areas. Pertaining to plants, it has shown good results in its species recognition, disease recognition, health status, growth monitoring, yield prediction etc. Many user-friendly portable applications have been created for such purposes, but they all lack accuracy and wide coverage of species [1].

Artificial intelligence (AI) is the branch of computer science that deals with the simulation of human intelligence. Every vendor across the world wants to incorporate their product with AI for its more usability and acceptability. Deep learning is an advanced form of machine learning that works with huge amounts of data and comprises neural networks in its architecture. It has become a primary learning paradigm/tool of AI for its exceptional results in many areas. Convolutional Neural Network (CNN) is the most popular form of deep learning that deals with classifications, segmentation, object detection etc. Training a CNN model would require a large amount of image data which may take days to complete. Once the training phase is over, the CNN model having the weights adjusted in all the layers can be saved to be used later for similar types of problems. Artificial Intelligence is a discipline that deals with creating intelligent application programs and machines to do what the human cognitive mind does concerning vision, speech and reasoning. There are primarily two ways of programming by which computers learn to mimic humans' capabilities, these are: rule based and self-learned. In the former approach, pre-defined rules and logics enable the machines to act accordingly and learn. These are knowledge driven AI programs, whereas, in later systems a machine learns itself to extract out useful information from the data given to it. This way a computer formulates the appropriate combinations of rules to bring out most accurate results is called machine learning [2]. The most popular form of machine learning is through neural networks whose design is inspired from the

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working of the human brain. The image in figure 1 shows a diagram of a biological neuron marked to describe one artificial neuron's function.

Neuron receives input signals from other neurons via its dendrites and passes output signals through its axon. Axon then branches out to join other neurons. In the figure above, the x_0 is the input signal, this signal is multiplied ($w_0 \times x_0$) with the weight variable (w_0). The influence is determined by summing the signal input and weight ($\sum w_i x_i + b$) which is then calculated by the activation function f , if it is above a certain threshold the neuron fires.

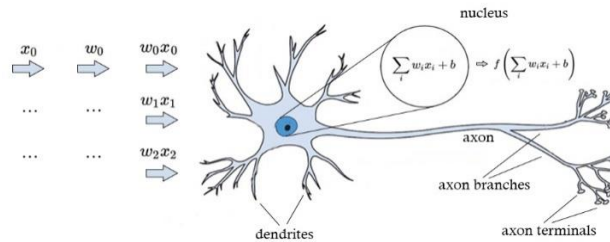


Figure1: Artificial neuron

Machine Learning (ML) is a subset of AI which enables the computer system to learn from the data given in the beginning and enhance its performance from experience with limited human interventions. It is helpful especially when the data is huge and humans are incapable to go through the details and find out the knowledge from its arrangement. Learning can be supervised, unsupervised or reinforced depending on the type of the application in which it will be used. Supervised learning models such as support vector machines (SVM), k nearest neighbor (kNN), naive-bayes (NB), decision tree, convolution neural network (CNN), etc. train the machine in accordance to the labelled output. During the learning period, output is obtained after every iteration which is compared with labelled output and depending upon the grade of similarity or dissimilarity, the weights are adjusted, and some bias value is introduced in the network. The weights and the bias are continuously altered until the desired output is achieved. Unsupervised learning models such as k-means, hierarchical clustering, CNN etc. cluster output values based on their similarity or dissimilarity measures to each other. In reinforcement learning, there are no predefined classes, but it is trained to learn from its experience. Action is taken in a particular situation to maximize reward. Based on the type of reward, it has two types, that is, negative and positive. Positive reinforcement is when the network output is in the desired direction whereas in negative reinforcement the output is not in the desired direction. This work focuses on the capacity of AI in the field of agriculture [3]. The role of AI in agriculture is comprehended from several research papers. AI is such a vast subject that it almost covers each problem that deals with the following:

- Finding patterns, trends, and associations'
- Implement plans
- Learn with experience and perform better
- Historical data-based knowledge discovery
- Assist in fact-based decisions
- Find inefficiencies.

There are some major areas where it has been and still used prevalently in the agricultural sector are:

Crop Management

Crop yield prediction: Machine learning has been beneficial for increasing crop productivity by evaluating yield estimations, yield mapping, and matching supply with demand [4].

Disease detection: Detection and identification of crop disease is one of the most important research projects works that concerns agriculture. It deals with automatic disease identification in the crops [5].

Weed Detection: Weeds presence in crops hinders its growth and productivity. Moreover, its presence is difficult to detect from crops. Apart from detection, its species can also be identified as done in work [6].

Crop quality: The quality assessment of crops helps in improving its yield and reduce its loss by correct classification and estimation of crop quality [7].

Species recognition: This is yet another important application of machine learning in agriculture which machine learning techniques help in automatic classification and identification of crop or plant species. [8].

Livestock management

Animal wellbeing: Machine learning helps in observing animals for diseases and health monitoring.

Animal behavior can be closely observed for their well-being as suggested by [9].

Livestock production: Animal produce like eggs, milk, yarn etc. can be observed for its quality and quantity assessment [10].

Other areas in agriculture where machine learning technologies has started to set strong hold are water and soil management for improved irrigations, evapotranspiration and various soil properties.

Case Study: In one of our research works [11], multiple component or input-based CNN is implemented to classify 10 similar looking citrus species. For input to CNN images of four different organs of the citrus plant namely leaves, fruits, flowers and entire plants were used. The dataset was self-created by capturing these images in natural environment from citrus orchard in SKUAST-Jammu. For leaves, fruits, flowers and entire plant 50, 30, 10 and 50 images per species were collected respectively. Some samples are shown in figure 2.



Figure 2: Samples of images of a. leaves, b. fruits, c. flowers and d. entire plant of Kinnow, Narangi, Grapefruit and Sweet orange citrus species (from left to right).

The methodology that was adopted is depicted in figure 3. The performance of the CNN model is evaluated for citrus plant species classification. The first experiment has been conducted using leaves, fruits, and entire plant organs of citrus plants separately as input for the convolution layer as shown in figure 2. Python 3.7 is used to build a CNN system with Sequential API of Keras library to construct the single input-based model

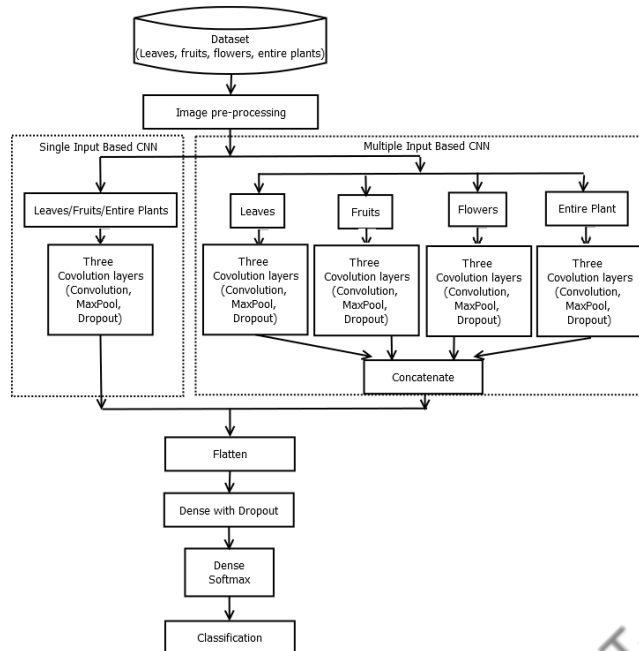


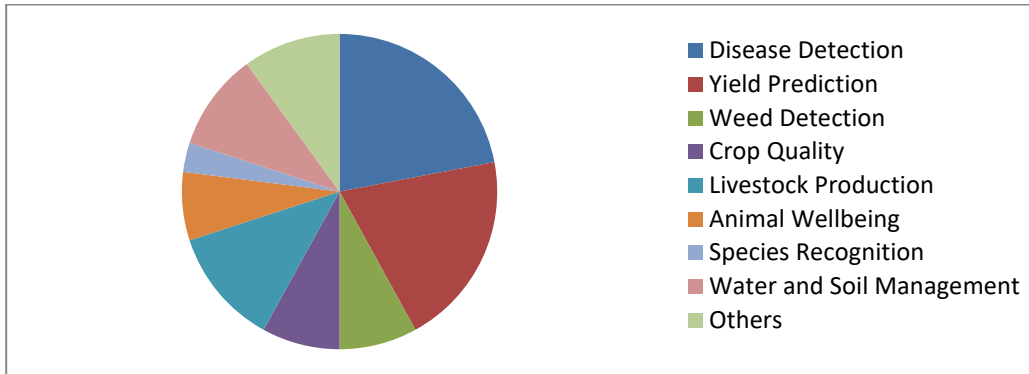
Figure3: Block Diagram for multiple input based citrus plant classification.

Result: First single organ was used to classify these species except flowers (because of a smaller number of its samples) and it was found out that Leaves were best in categorizing citrus species followed by fruits. Next the combinations of two organs were evaluated and then their combinations with flower input were tested and it was found that there was a drop in accuracy. The combination of three inputs of leaves, fruits and entire plants gave the best final classification accuracy of 91.4%. Multiple input-based CNN was able to classify 10 similar-looking citrus plants.

Conclusion of case study: The three main observations were made on the basis of results obtained. First, even though citrus species closely resemble each other, the results obtained, when its multiple organs are combined for CNN, are comparable to a similar type of work conducted earlier. Second, in the case of citrus plants, leaves give better classification accuracy than other organs. Third, citrus flowers closely resemble such an extent that they cause misclassifications and thus decrease final classification accuracy. In general, the final classification accuracy can further be improved by increasing training dataset size, using more other components of the plant like stem, branch, etc., and using deeper CNN models.

Conclusion:

Based on the studies executed in the contemporary research articles, it was observed that about 22% of the work has been done on disease detection, 20% on yield prediction, 12% on livestock production, 10% on water and soil management, 8% each on weed detection and crop quality, 7% on animal wellbeing, 3% on species recognition and rest on others like weather, fertilizers, smart field vehicles etc.



By applying AI techniques in various agricultural sectors, the ongoing research is giving improved insights and endorsing the decisions and actions with the aim to increase the quality and the quantity of the production. This will give a way for better knowledge-based agricultural techniques which will eventually result in better bio-product quality.

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Fundamentals of Website Design

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Web: An Overview

The Web is the common name for the World Wide Web, a subset of the Internet consisting of the pages/programs written in different programming languages that can be accessed by a Web browser. Web browsers like google, bing, raftaar, edge, mozilla etc. are just client tools to render/access information from the server to the user. The Web is just one of the ways that information is shared over the Internet; others include email, chatting, file transfer protocol. The Web has been playing a very crucial role in communication and delivery of information.

History of Web

By late 1990, Tim Berners-Lee (often referred to as TimBL) had created all the things needed to run the first version of the web HTTP(Hypertext Transfer Protocol), HTML(Hypertext Markup Language), the first web browser (World Wide Web), an HTTP server. In the next few years, the web exploded, with multiple browsers being released, thousands of web servers being set up, and millions of web pages being created. In 1994, TimBL founded the World Wide Web Consortium (W3C), an organization that brings together representatives from many different technology companies to work together on the creation of web technology specifications. After that other technologies followed such as CSS and JavaScript, and the web started to look more like the web we know today.

Web Standards

Web standards are the technologies we use to build web sites. These standards exist as long technical documents called specifications, which detail exactly how the technology should work. Web standards are created by standards bodies - institutions that invite groups of people from different technology companies to come together and agree on how the technologies should work in the best way to fulfill all of their use cases. The W3C is the best known web standards body, but there are others such as the WHATWG (who maintain the living standards for the HTML language), ECMA (who publish the standard for ECMAScript, which JavaScript is based on), Khronos (who publish technologies for 3D graphics, such as WebGL), and others.

The first iteration of the web represents **Web 1.0**, which, according to TimBL, is the “**read-only web.**” In other words, the early web allowed us to search for information and read it. There was very little in the way of user interaction or content generation. The latest in this field has been application of **Web 2.0** and **Web3.0**. Web 2.0, also known as “**read -write web**” or “**user-centered Web**” where blogs, wikis, social networks, multimedia applications, dynamic programming scripts are being used for collection, contribution and collaboration on the Web. The underlying principle is to share the resources collectively. Web 3.0 is knocking at the door! Web 3.0, also known as semantic Web, is smarter and can understand what you want. The searcher no longer needs to wade

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through a plethora of information or filter out search results but gets the target information straight by working on a combination of information based on his requirement as he understands and preferences he wants i.e. one needs to be less specific and more natural with his queries. This technology should aid the users obtain answers faster and accurately.

What is a Website?

A group of interlinked program files (a.k.a webpages) written in programming language (preferably HTML) is called a website. All the pages in a website are linked to each other by hypertext (a text that provides a link to another page). All the pages in a website are addressed relative to a common Uniform Resource Locator (URL), often consisting of only the domain name, or the IP address, and the root path ('/') in an Internet Protocol-based network.

eg. of URL: <https://www.gdcudhampur.in>

Here *https* is protocol, *gdcudhampur.in* is a domain name

The pages of a Web site can usually be accessed from the homepage or otherwise called Uniform Resource Locator (URL). The browser (the user's application to access homepage) with help of HTTP (the communication mode/programme to access files that are stored in the Web page) transfers and displays the page content according to its HTML markup instructions (on how the structured data/text should be presented) onto a display terminal. The user, thus, gets the view of the web content/pages. All publicly accessible Web sites collectively constitute the World Wide Web, commonly known as the Web (and abbreviated as WWW or W3). Web sites can be hosted/developed by anyone including individuals, organizations, business enterprises, and voluntary organizations etc. who have an interest in telling the world about themselves or about their products/services. While most Web sites are free, some are fee-based (subscription-based). In case of the latter, the access to some or all of the contents are restricted by password. Such include business, academic journal, and entertainment Websites.

Websites can be generally categorized as:

i. **Personal Websites(Like blogs, portfolio) :**

An individual can keep in touch with his close ones, seek jobs or express himself through a website. Web pages are also means of not only sharing but also finding out about other individuals, their culture, interests and life.

ii. **Commercial Websites(online shopping websites , Entertainment websites,)**

Business / commercial enterprises make good use of the Web to promote their business. They publish their products /services to millions of potential customers globally and at no extra cost for the additional target audience that emerge from time to time. It is done 24 hours a day, seven days a week in various languages as they choose. Unlike print materials the Web pages put into use multimedia and that too in color at no extra cost. They can update prices, and the latest news, faster, easier and at a much cheaper rate compared to brochures/ leaflets traditionally used. Web pages of other/ similar products or advertisers or advertising campaigns can be linked to their pages. The Web is also used as an extra outlet for sales. Web sites place all, big or small, on equal footing as the reach of one's Web is as good as that of any competitor.

The business/commercial Web sites are freely accessible to all. However, they needn't be so, if so wished. They can be restricted by password. Those that are on private networks are invariably inaccessible to outsiders.

iii. **Organizational Websites(Govt. Websites, Educational institution, NGO):**

Organizations, including governmental or volunteer groups, use the Web to promote their causes like education, social issues, health or for that matter any field conceivable. For instance, let us take the case of the CLUJ(Cluster University of Jammu) whose objective is promotion of education. It uses its Web site to reach out to the students, their parents, and teaching and staff community. The Web page functions as a much superior and cheaper alternative to the brochure informing about the university, location, organizational structure, centers/departments, and programmes. The latest news pertaining to exam results, time-table, admissions, convocations, and circulars to staff are made available on its Web site. Advertisements and tender notices find the Web as the most favorite location which, at times, provides for applying online.

iv. **Entertainment Websites (Audio,Video, Games)**

Entertainment sites are heralding an important development in the Web field as it is very often seen as the only reason for people, especially the youth, to use the Web. These may be cinemas, games, music, humor pages and the like. For this reason entertainment sites are deemed as the most demanding ones.(eg. www.netflix.com, www.youtube.com, www.gaana.com etc.)

There are different types of websites on the whole internet, most common categories for a brief idea with examples are as :

Portfolio: These types of websites acts as an extension of a freelancer resume. It provides a convenient way for potential clients to view your work while also allowing you to expand on your skills or services(www.sanjeevkapoor.com, www.bruisedpassports.com etc.)

Blogs: These types of websites are managed by an individual or a small group of persons, they can cover any topics, they can give you fashion tips, music tips, travel tips, fitness tips. Nowadays professional blogging has become an external popular way of earning money online.(Top blogs in india :www.mouthshut.com, www.labnol.org etc.)

News and Magazines: These websites needs less explanation, the main purpose of these types of websites is to keep their readers up-to-date from current affairs whereas magazines focus on the entertainment.(eg. www.timesofindia.com, www.zeenews.com, www.dailyexcelsior.com etc.)

Social Media: We all know about some famous social media websites like Facebook, Twitter, Reddit, and many more. These websites are usually created to let people share their thoughts, images, videos, and other useful components.(www.facebook.com, www.instagram.com, www.twitter.com etc.)

Portal: These types of websites are used for internal purposes within the school, institute, or any business, These websites often contain a login process allowing students to access their credential information or allows employees to access their emails and alerts.(www.byjus.com, www.swayam.gov.in etc.)

E-Commerce: These websites are well known as online shops. These websites allow us to make purchasing products and online payments for products and services. Stores can be handled as standalone websites.(Eg. www.amazon.com, www.flipkart.com etc.)

Static and Dynamic Websites

In a static website, the information is displayed in the same format as they are stored in the server. Such information is primarily coded in HTML (and the address ends in .htm). Most of the Web sites are static as they present pre-defined, static information, in the sense the pages retrieved by

different users at different times remain the same. To make a change to the content, the files need to be manually opened, data changed and the new version should be uploaded to the Web.

Dynamic Website pages are ones that retrieve fresh information each time you view (like the latest news you see or various games you play on the Web). How one retrieves examination results at Jammu University site may be cited as an example. The Results button at www.coeju.com can be described as dynamically built because it supplies different information (marks) to different students when the candidates search by entering their enroll numbers. The information, in fact, doesn't come from html pages but from databases (which may be updated minute by minute, day or week).

Working of Web

The fundamentals of *Web* includes knowledge of HTML, role of server and importance of the browser. HTML (Hypertext Markup Language) is a computer language that describes how a page/text should be formatted/presented in the Web site. It provides a means to create structured documents by denoting structural semantics for text such as headings, paragraphs, lists, links, quotes and other items. Many languages with varying complicities have evolved later to HTML for creation of websites. However, HTML will suffice to create good websites. The knowledge of others will be required when you intend to create more complex web designs.

We access the Web pages from the Web server(s) using a program called Web browser (like Microsoft Internet Explorer, Firefox, Safari or Netscape). When we make a request (search), the Web browser (with help of HTTP: the communication mode/protocol to access any files that are stored in the Webpage) collects and assembles files from one or more Web servers (could be hundreds at times) into one page in your machine. (And this is how you see many pages of sites on any search you make on any subject).

To illustrate, let us take the case of collecting information about the location of Cluster University Jammu(<https://clujammu.ac.in/>). There are two situations: one is when you do not know the Web site name (URL) - you make a search on a browser and will be provided with a list of servers from which you select the right one (by double clicking) to get the pages opened for information. The other is when you know the URL - you enter it: <https://clujammu.ac.in/> or click on the link. The browser contacts the Web server of Cluster university indicated by the name (<https://clujammu.ac.in/>) in the url requesting for the specific file.

The browser, in turn, displays the document in its window (according to the formatting specified in the documents' HTML tags). The browser will contact the server again for each graphic (identified by ``) separately. Each graphic stored in different files are sent individually and assembled into the final page by the browser. All these activities (transfers and assembling) take seconds to accomplish and you will not feel a difference. (Of course, in case of slow connection, large graphic files lag behind the rest of the pages and takes time to fully display)

The Web Server is a computer that holds and serves a Website. The Web server includes the hardware, operating system, Web server software, TCP/IP protocols and site content (Web pages, images and other files). Using the HTTP protocol, the Web server delivers Web pages to browsers. If the Web server is used internally within an organization and is not exposed to the public, it is an intranet server and if it serves to external machines (outside the organization) it will be called an Internet (Web) server.

Web Hosting/Publishing

Where and How to host your Web Site?

Free and Fee-based ?

Hosting/Publishing a website means to install or set up a website on a computer/server that remains ON 24x7. A website can be hosted on a private network (accessible inside organization only i.e Intranet) or public network(accessible to the whole world i.e Internet) .

Initially one can develop a website using one's personal computer but for public use one has to host/install it on a machine that is connected to the network and accessible to the whole world.) Following components are needed for hosting a website for public use:

1. **IP Address of server** (*It is the unique address(IP) of the computer that remain 24x7 ON*).
2. **Web Server** (*used to compile web pages eg.Example of commonly used web servers Apache, Nginx,IIS etc.*).
3. **Storage space**(*for storing content of the website eg. html files, Images and other related material*).
4. **Domain Name** (*is a unique name purchased by the website owner for his website. This domain name is used as an alias to an IP address. Eg. Domain name facebook.com has an IP address as 157.240.198.35 and we can access facebook either by using domain or IP address*).

Web Hosting can be divided into three main categories:

Free Hosting : There are many agencies (Internet Service Providers) that provide you with free hosting facilities. The drawbacks of free hosting are that the traffic/visibility of the site could be poor as the natural search engines won't place/rank you well. Besides, the ISPs tend to place advertisements on your Web site to cover their expenses which may not be to your liking. (Eg. Google sites, Wix sites etc.)

Virtual or Shared Hosting: Its a web hosting service where many website reside on one web server connected to the internet. This type of hosting is provided under one's own domain name, www.yourname.com. With this hosting plan with , one can present oneself as a fully independent identity to his/her web audience.

Dedicated Hosting:Hosted on a dedicated server, this type of hosting is best suited for large websites with high traffic. In this, the company wishing to go online, rents an entire web server from a hosting company. This is suitable for companies hosting larger websites, maintaining other's sites or managing a big online mall etc.

4. Steps in Hosting a website

This section is discussed in the background of the second option i.e Virtual or shared hosting.

There are many online Websites that offer domain, hosting and other related services. You need to search the Web sites and choose the one of your liking.(e.g. Godaddy, Bluehost, hostgator, Amazon, Google etc.)

1. **Buying a hosting plan:** In this we have to choose a hosting plan on the basis of requirements like(storage space, RAM size, No. of databases, Linux/Windows etc.). The basic hosting plan costs Rs.1500/year(Approx.).
2. **Searching and registering domain name:** First of all we have to search for a domain whether it is available or not, if available, we have to register it by providing details of buyer and it costs around Rs.1000/year(Approx.).

After purchasing Domain and Hosting, a control panel has been provided by the registrar company with login credentials. This company will provide you with necessary software and instructions in uploading, updating and maintaining the Web site. There are different options in

Control Panel to set up a database, ftp credentials for uploading a website, binding domain name to IP address etc. After setting up desired configuration the next step is:

3. **Upload the Site:** The next step is to upload the Web site to a Web-hosting company server that will display the site on the Internet, 24 hours a day, all days of the year. After uploading the required files, the website becomes ready for public use.
4. **Modify the Site:** Once hosted you can update/modify the Web site as you require. You may display the information, add email links for feedback, or provide chat-rooms /bulletin boards as you please.

5. Important Web Issues

There are many points one should keep in mind while designing and hosting a Web site. Adherence to these will help evolving sites which are liked by users and, thereby, attract more visits.

Usability Issues: A Web site can be rated as usable if the users return to the site again and again. If a visitor has to work hard to find information /details of a product, he is not going to do that. Hence reaching the information should be made easier for the user. What are the parameters that make a site usable/ easily accessible to the users? They are discussed below:

Information Availability: All the information that helps a visitor make informed decisions should be in the Web site. The general benchmark of a good Web site is that it should be providing 80-90 % of what a user/visitor is looking for. To illustrate, take the case of sale of a product like 'pen drives', a brief one line summary with a further link to a page detailing the features and price and arrangement for the purchase should attract the buyers. b) Page layout: How the content is displayed on the page -- The page should be laid in such a way people should be able to find relevant content quickly. Else they lose interest and leave the site. Page should be clean and simple. Keep only those elements that enhance the usability of the page.

Colours: Standard colors should be used as colors can affect the usability of the site. For example, the standard colors used for links (blue for links; violet for visited links; and red for active links) should be maintained as one runs the risk of confusing the visitors

Download Speed: The speed of the download is very important as delays can weary away the visitors. As you, as a Web designer, can't determine the speed, do what you can that will not slow down the download. Some considerations are optimizing the graphics (images not larger than 10 kb), making smaller pages (say, not more than 30 kb), and avoiding nested tables though they improve the layout enormously. It is also to be noted that advertisements served from different servers may slow down your site. Also check the condition of the Web server periodically as to whether it needs upgradation which should include the bandwidth too.

Web Accessibility: Web accessibility means accessibility to all including people with disabilities (like visual, audio, physical, speech, cognitive, neurological, including people with waning abilities due to advanced age) can interact and /or contribute to the Web. As more and more accessible Web sites and software are made available, people with disabilities should be able to use and contribute to the Web more effectively. Web accessibility provides equal access and opportunity to all enable people to participate more actively in society.

User-friendly Site: Your audience is the key. You must know the pulse of the audience when it comes to gauging their information requirements. Create content of what they require. Also make the content of your site easily reachable. Easy access or reachability presupposes creation of intelligent/logical navigational systems. Some general rules are given below:

- a) make navigation bar/panel in all pages,
- b) provide shortcuts to pages/contents where visitors are likely to want to go. Do not force them to go to the main page or the Site Map if they need to visit another page in the site i.e put direct links to the logical places
- c) make sure your site is visible to all visitors i. e your menu is not confined to a particular browser but to as many as possible like Microsoft Internet Explorer, Firefox Netscape and Safari.
- d) Use Site Map: Site Map is one page where you list all the contents of your site and the visitor can easily navigate to the one he wants i.e it provides another route to other pages.
- e) Provision of search box (implying provision of a search engine on your site) - where the site has a large number of pages the search box will be much helpful in finding relevant information faster. You could find most of all these facilities provided in the Web site of IGNOU, which is quite a large site in itself.

Search Engine Visibility

If your site cannot be found through search engines, you do not exist to the world. How to make the site visible to search engines is the biggest issue you will encounter. Hence find more information on the topic from the net or from books on how to get listed in the search engines.

Summary

The basic concepts of the web have been discussed in this session. Web refers to the subset of the Internet consisting of the pages/programs written in different programming languages that can be accessed by a Web browser. A brief insight into the development and history of Website is also attempted. The concept of website covers the fundamental elements of the Web and various types of Websites. It also strives to distinguish between static and dynamic Websites. Various steps in hosting a website including purchasing a domain name, selecting a hosting plan and uploading a website are also covered. The final part deals with matters that should be kept in mind while designing a Web, with a view to creating more functional usable web pages.

GIS: A way to Spatially Intelligent Agriculture**Anshu Bharadwaj***Corresponding Author: anshu.bhardwaj@icar.gov.in***Introduction**

Agricultural sustainability has the highest priority in all countries, whether developed or developing. Use and analysis of geospatial technologies is gaining importance for sustainable agricultural management and development. Agriculture is more sophisticated than it ever was. Farmers do lots of planning and analysis. Information like soil type, soil characteristics, water sources and climate are important for strategic planning. Soil fertility and historic crop yield are important for precision farming purposes. The solution for providing food security to all people of the world without affecting the agro ecological balance lies in the adaptation of new research tools and combining them with conventional as well as frontier technologies like geospatial data, remote sensing, Geographic Information Systems (GIS) etc. Together they are called as Geospatial Infrastructure. The Geospatial Infrastructure brings the people, data, workflows, process together in a single platform as in the common framework, in terms of talking through Maps and Apps. At the micro level implementation of geospatial tools/technology is mainly used for mapping of ground water resources, drainage patterns, variable rate application and management of fertilizers, pesticides and insecticides. Geospatial technologies play a significant role in enabling the location intelligence and supporting us in many of our decisions making process and how easily it can disseminate the information to various users. In the agriculture sector Geospatial technologies plays a significant role by increasing yields, managing of resources, prediction of outcomes, in assisting in improved farm practices such as precision agriculture and many more and these are some other use cases. By using GIS in agriculture, farms can be more profitable because informed farmers can achieve higher crop yields and can have reduced waste. A Geographic Information System (GIS) is a tool that creates visual representations of data and performs spatial analyses in order to make informed decisions. It is a technology that combines hardware, software, and data. The data can represent almost anything imaginable so long as it has a geographic component.

What is a GIS?

"GIS" is an acronym meaning Geographic Information System. A Geographic Information System is basically a computer-based tool for mapping and analyzing geographic information. GIS can be thought of as maps on a computer but remember that it is more than just a map. It's possible to combine many maps or "layers" of information and then analyze and manipulate them to create a new map. These new maps are often used for making decisions about land use, resources, transportation, real estate, retailing, etc.

A Geographic Information System is a multi-component environment used to create, manage, visualize and analyze data and its spatial counterpart. It's quite interesting to know that most datasets that we come across in our lifetime can all be assigned a spatial location whether on the earth's

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surface or within some arbitrary coordinate system (such as a farmer's field or a gridded ground). Thus, we can say that, any dataset can be represented in a Geographical Information System (GIS). Next question arises that "does it need to be analyzed in a GIS environment?" The answer to this question depends on the purpose of the analysis.

Maps are ubiquitous: we can find them online and offline in various printed version. The important part of a map is its boundaries and we need to know how the boundaries of the map features are encoded in a computing environment. When we require that a software should assist us in the analysis, the spatial aspect /elements of that data should be readily available in a digital form. That makes us realize that simple tables or spreadsheets are not enough for the analysis of this data and a more specific and complex data storage mechanism is required. This is the core of a GIS environment: a spatial database that facilitates the storage and retrieval of spatial data which defines the spatial boundaries, lines or points of the entities that are to be analysed. This may seem trivial, but without a spatial database, most spatial data exploration and analysis would not be possible.

This ability to incorporate spatial data, manage it, analyze it, and answer spatial questions is the distinctive characteristic of a geographic information system. Map making and geographic analysis is not new, but GIS makes it possible to do this type of work faster and more efficiently because of the power and ease of using modern computers. It allows virtually anyone to create a map to help explain historic events, plan for the future, and predict outcomes. The following explains the three components of a Geographic Information System.

Geographic: This is the part of GIS that explains "spatially" where things are such as the location of nations, states, counties, cities, schools, roads, rivers, lakes, and the list can go on and on. Spatially means where on the earth's surface an object or feature is located. This can be as simple as the latitude and longitude of a feature. The geographic feature or object can be anything of interest.

Information: GIS information is the "data" or "attribute" information about specific features that we are interested in. The name of the feature, what the feature is, the location of the feature, and any other information that is important. An example could be the name of a city, where it is located, how big it is in square feet (area), its population, its population in the past, and any other information that is important.

System: The system in GIS is the computer and the software that is written to help people analyze the data, look at the data and combine it in various ways to show relationships or to create geographic models. A GIS can be made up of a variety of software and hardware tools, as long as they are integrated to provide a functional geographic data processing tool.

A GIS is a particular form of Information System applied to geographical data. It uses geographically referenced data as well as non-spatial data and includes operations which support spatial analysis

- in GIS, the common purpose is decision-making, for managing use of land, resources, transportation, retailing, oceans or any spatially distributed entities
- the connection between the elements of the system is geography, e.g. location, proximity, spatial distribution

In context of the above, a geographical information system can be defined as a computer- based tool for mapping and analyzing geographic phenomenon that exist, and events that occur, on Earth. GIS technology integrates common databases operations such as query and statistical analysis with the

unique visualization and geographic analysis benefits offered by maps. These abilities distinguish GIS from any other information system and make it valuable to a wide range of public and private enterprises for explaining events, predicting outcomes, and planning strategies. Map making and geographical analysis are not new, but a GIS performs these tasks faster and with more sophistication than traditional manual methods.

Overall, GIS should be viewed as a technology, not simply as a computer system.

A geographic information system, commonly referred to as a GIS, is an integrated set of hardware and software tools used for the manipulation and management of digital spatial (geographic) and related attribute data.

Feature Representation in GIS

Data Types in GIS

The basic data type in GIS reflects traditional data found on a map. Accordingly, GIS technology utilizes two basic types of data. These are:

1. **Spatial data:** These are datasets that have been prepared through field surveys or remote sensing data that is referenced on the earth's surface. Spatial data is the spatially referenced data that acts as the model of reality. Spatial data represents the absolute and relative geographical location of features e.g. points, lines, area etc.
2. **Non-Spatial Data:** They are attributes as complimentary to the spatial data and describe what is at a point, along a line or in a polygon and also socio-economic characteristics from other sources. Describes characteristics of the spatial features. These characteristics can be quantitative and/or qualitative in nature. Attribute data is often referred to as tabular data.

Nature of Geographical Data

- Geographical position (spatial location) of a spatial object is represented by 2-, 3-, or 4 dimensional coordinates in a geographically referenced system (latitudes and longitudes)
- Attributes are the descriptive information about the specified spatial objects. They have no direct information about the spatial location but can be linked to spatial objects they describe. Therefore they are often referred to as “ nonspatial” or “aspatial” information.
- Spatial relationship specifies inter-relationship between spatial objects. (e.g. distance between object A and object B, direction of object A in relation to object B, whether object A encloses object B etc.)
- Time records the time stamp of data acquisition, specifies the life of the data and identifies the locational and attribute changes of the spatial objects.

Spatial Data Structures: Vector and Raster

To work in a GIS environment, real world observations (objects or events that can be recorded in 2D or 3D space) need to be reduced to spatial entities. These spatial entities can be represented in a GIS as a **vector data model** or a **raster data model**.

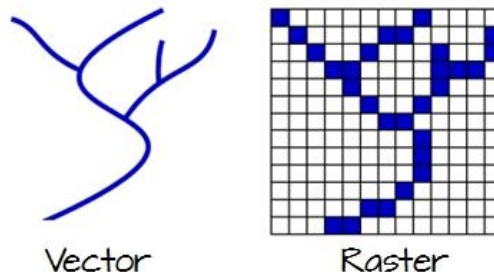


Figure 1: Vector and raster representations of a river feature.

Vector

Vector features can be decomposed into three different geometric primitives: **points**, **polylines** and **polygons**.

Point

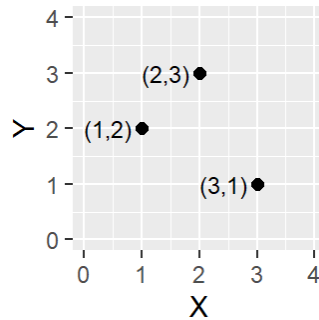


Figure 2: Three point objects defined by their X and Y coordinate values.

A point is composed of one coordinate pair representing a specific location in a coordinate system. Points are the most basic geometric primitives having no length or area. By definition a point can't be "seen" since it has no area; but this is not practical if such primitives are to be mapped. So points on a map are represented using *symbols* that have both area and shape (e.g. circle, square, plus signs).

We seem capable of interpreting such symbols as points, but there may be instances when such interpretation may be ambiguous (e.g. is a round symbol delineating the area of a round feature on the ground such as a large oil storage tank or is it representing the point location of that tank?).

Polyline

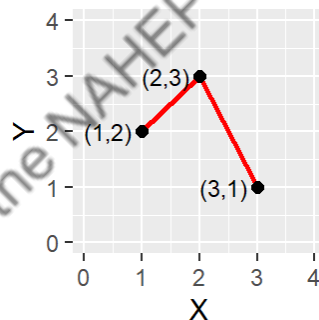


Figure 3: A simple polyline object defined by connected vertices.

A polyline is composed of a sequence of two or more coordinate pairs called vertices. A vertex is defined by coordinate pairs, just like a point, but what differentiates a vertex from a point is its explicitly defined relationship with neighboring vertices. A vertex is connected to at least one other vertex.

Like a point, a true line can't be seen since it has no area. And like a point, a line is symbolized using shapes that have a color, width and style (e.g. solid, dashed, dotted, etc...). Roads and rivers are commonly stored as polylines in a GIS.

Polygon

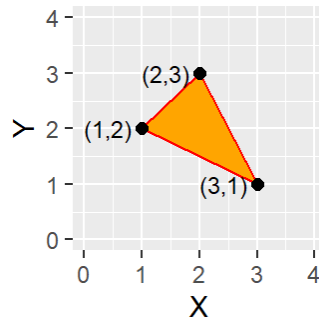


Figure 4: A simple polygon object defined by an area enclosed by connected vertices.

A polygon is composed of three or more line segments whose starting and ending coordinate pairs are the same. Sometimes you will see the words *lattice* or *area* used in lieu of ‘polygon.’ Polygons represent both length (i.e. the perimeter of the area) and area. They also embody the idea of an inside and an outside; in fact, the area that a polygon encloses is explicitly defined in a GIS environment. If it isn’t, then you are working with a polyline feature. If this does not seem intuitive, think of three connected lines defining a triangle: they can represent three connected road segments (thus polyline features), or they can represent the grassy strip enclosed by the connected roads (in which case an ‘inside’ is implied thus defining a polygon).

Raster



Figure 5: A simple raster object defined by a 10x10 array of cells or pixels.

A raster data model uses an array of cells, or pixels, to represent real-world objects. Raster datasets are commonly used for representing and managing imagery, surface temperatures, digital elevation models, and numerous other entities.

A raster can be thought of as a special case of an area object where the area is divided into a regular grid of cells. But a regularly spaced array of marked points may be a better analogy since rasters are stored as an array of values where each cell is defined by a single coordinate pair inside of most GIS environments.

Implicit in a raster data model is a value associated with each cell or pixel. This is in contrast to a vector model that may or may not have a value associated with the geometric primitive.

Also note that a raster data structure is square or rectangular. So, if the features in a raster do not cover the full square or rectangular extent, their pixel values will be set to no data values (e.g. NULL or NoData).

Coordinate Reference System

A Coordinate Reference System (CRS) defines with the help of coordinates, how the two dimensional, projected map in GIS is related to real places on the earth. There are various map projection and

coordinate reference systems which are used, depending upon the regional extent of the area under study, analysis to be undertaken and the data that is available.

Map Projection

Map Projection is used to represent the 3- dimensional surface of the earth or other round body on a 2- dimensional plane (map making or cartography). It is a generally a mathematical procedure but some methods are graphically based.

A map projection is a system in which locations on a curved surface of the earth are displayed on a flat sheet or surface according to some set of rules.

Scale

How one chooses to represent a real-world entity will be in large part dictated by the **scale** of the analysis. In a GIS, scale has a specific meaning: it's the ratio of distance on the map to that in the real world. So a **large scale** map implies a relatively large ratio and thus a small extent. This is counter to the layperson's interpretation of *large scale* which focuses on the scope or extent of a study; so a large scale analysis would imply one that covers a *large* area.

The following two maps represent the same entity: the Boston region. At a small scale (e.g. 1:10,000,000), Boston and other cities may be best represented as points. At a large scale (e.g. 1:34,000), Boston may be best represented as a polygon. Note that at this large scale, roads may also be represented as polygon features instead of polylines.



Figure 6: Map of the Boston area at a 1:10,000,000 scale. Note that in geography, this is considered small scale whereas in layperson terms, this extent is often referred to as a large scale (i.e. covering a large area).



Figure 7: Map of the Boston area at a 1:34,000 scale. Note that in geography, this is considered large scale whereas in layperson terms, this extent is often referred to as a small scale (i.e. covering a small area).

Attribute Tables

Non-spatial information associated with a spatial feature is referred to as an **attribute**. A feature on a GIS map is linked to its record in the attribute table by a unique numerical identifier (ID). Every feature in a layer has an identifier. It is important to understand the one-to-one or many-to-one relationship between feature, and attribute record. Because features on the map are linked to their records in the table, many GIS software will allow you to click on a map feature and see its related attributes in the table.

Raster data can also have attributes only if pixels are represented using a small set of unique integer values. Raster datasets that contain attribute tables typically have cell values that represent or define a class, group, category, or membership. NOTE: not all GIS raster data formats can store attribute information; in fact most raster datasets you will work with in this course will not have attribute tables.

Measurement Levels

Attribute data can be broken down into four **measurement levels**:

Nominal data which have no implied order, size or quantitative information (e.g. paved and unpaved roads)

Ordinal data have an implied order (e.g. ranked scores), however, we cannot quantify the difference since a linear scale is not implied.

Interval data are numeric and have a linear scale, however they do not have a true zero and can therefore not be used to measure *relative* magnitudes. For example, one cannot say that 60°F is twice as warm as 30°F since when presented in degrees °C the temperature values are 15.5°C and -1.1°C respectively (and 15.5 is clearly not twice as big as -1.1).

Ratio scale data are interval data with a true zero such as monetary value (e.g. \$1, \$20, \$100).

Data type

Another way to categorize an attribute is by its **data type**. ArcGIS supports several data types such as **integer, float, double and text**. Knowing your data type and measurement level should dictate how they are stored in a GIS environment. The following table lists popular data types available in most GIS applications.

Type	Stored values	Note
Short integer	-32,768 to 32,768	Whole numbers
Long integer	-2,147,483,648 to 2,147,483,648	Whole numbers
Float	-3.4 * E-38 to 1.2 E38	Real numbers
Double	-2.2 * E-308 to 1.8 * E308	Real numbers
Text	Up to 64,000 characters	Letters and words

While whole numbers can be stored as a float or double (i.e. we can store the number 2 as 2.0) doing so comes at a cost: an increase in storage space. This may not be a big deal if the dataset is small, but if it consists of tens of thousands of records the increase in file size and processing time may become an issue.

While storing an integer value as a float may not have dire consequences, the same cannot be said of storing a float as an integer. For example, if your values consist of 0.2, 0.01, 0.34, 0.1 and 0.876, their integer counterpart would be 0, 0, 0, and 1 (i.e. values rounded to the nearest whole number). This can have a significant impact on a map as shown in the following example.

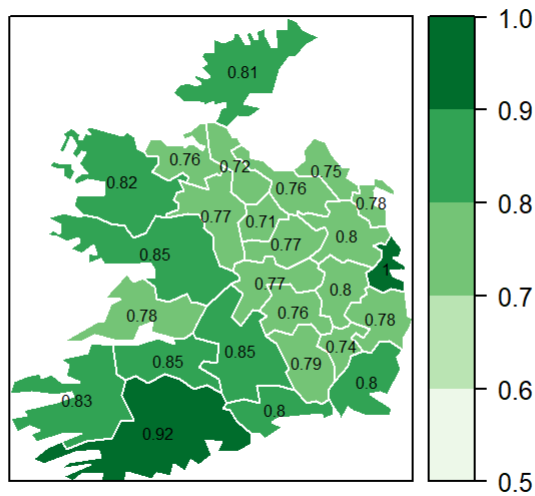


Figure 8: Map of data represented as decimal (float) values.

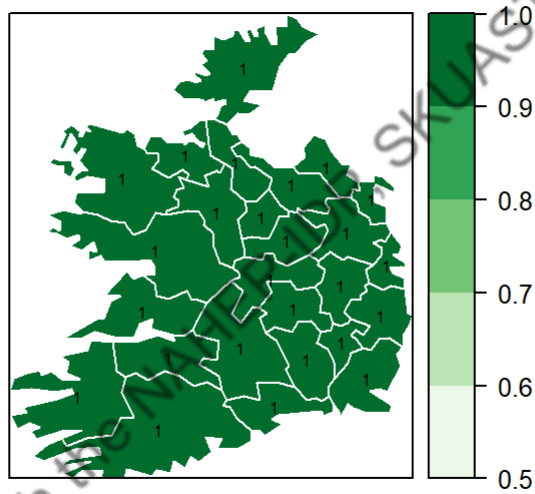


Figure 9: Map of same data represented as integers instead of float.

Spatial Analysis

Spatial Analysis is the process of manipulating spatial information to extract new information and meaning from the original data. Usually spatial analysis is carried out with a GIS. A GIS provided manipulation and spatial analysis tools for calculating feature statistics and carrying out geoprocessing activities as data interpolation. For example: the tool can compute an area of land under cultivation, proximity to farmed land to the sensitive ecosystems and update layers etc.

GIS software

Many GIS software applications are available—both commercial and open source. Two popular applications are **ArcGIS** and **QGIS**.

ArcGIS

A popular commercial GIS software is **ArcGIS** developed by ESRI (ESRI, pronounced *ez-ree*), was once a small land-use consulting firm which did not start developing GIS software until the mid 1970s. The ArcGIS desktop environment encompasses a suite of applications which include ArcMap, ArcCatalog, ArcScene and ArcGlobe. ArcGIS comes in three different license levels (basic, standard

and advanced) and can be purchased with additional *add-on* packages. As such, a single license can range from a few thousand dollars to well over ten thousand dollars. In addition to software licensing costs, ArcGIS is only available for Windows operating systems; so if your workplace is a Mac only environment, the purchase of a Windows PC would add to the expense.

QGIS

A very capable open source (free) GIS software is **QGIS**. It encompasses most of the functionality included in ArcGIS. If you are looking for a GIS application for your Mac or Linux environment, QGIS is a wonderful choice given its multi-platform support. Built into the current versions of QGIS are functions from another open source software: **GRASS**. GRASS has been around since the 1980's and has many advanced GIS data manipulation functions however, its use is not as intuitive as that of QGIS or ArcGIS (hence the preferred QGIS alternative).

Use of GIS in Agriculture

- Offering a huge potential for the scientist to use in the planning of crop management through effective collection of data on soil type, plant phenology and topography that is vital for maximizing crop yield.
- Interpolate soil values for the non-sampled using the collected and analysed figures.
- Mapping production areas, protected areas, land use pattern, crop yield estimation, water shed management, irrigation management. A
- Strategic planning of crop production areas, crop suitability analysis based on agro-ecological area, crop residual burning mapping.
- Scenario building of various agricultural resources like, water, soil, weather etc.

Challenges of Agriculture in India

The performance of Indian agriculture depends on many socio-economic factors. The key drivers of Indian agriculture are:

1. Government policies for funding, crops specific programmes, Education and awareness for Farmers
2. Farming and Crop Technologies, Cropping pattern for profitability
3. Environmental factors such as water availability, soil degradation and climate change
4. Market forces such as public-private ecosystems
5. Infrastructure such as irrigation, electricity, storage and raw materials such as seeds
6. Improper land use as there is huge fragmentation of land due to traditional land holding pattern
7. Suitable agricultural skills development and Availability of labour
8. Valuation and Benefit Realization for Farmers

Information technology, Geographical information systems and a complete ecosystem of services for agriculture sector can make a big difference in improving the performance of the sector.

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IT Initiative in Agriculture Higher Education

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ICAR has played a pioneering role in ushering Green Revolution and subsequent developments in agriculture in India through its research and technology development, thus making a visible impact on the national food and nutritional security. The Council is the apex body for coordinating, guiding and managing research and education in agriculture including horticulture, fisheries and animal sciences in the entire country.

Indian NARES comprises of Indian Council of Agricultural Research and its 111 Central institutes/National Research Centers and their regional stations including ICAR Headquarters and ASRB at National Level and 74 State Agricultural Universities and their colleges/centers besides other general universities/institutions working in agriculture at State level. ICAR-IASRI is a premier institute in carrying out research, teaching and training in the areas of Agricultural statistics and Informatics. Large number of Database/Knowledgebase/Model base, Information Systems, Decision Support Systems, Expert/ Advisory Systems are developed to facilitate dissemination of research information among various stakeholders including students and farmers.

Education Portal-ICAR (<https://education.icar.gov.in>) has been developed as a single window platform for providing vital education information/announcements/event schedules/e-learning resources from Agricultural Universities across the country to the rural youth in an easy and fast way on their doorsteps. Effective e-implementation of agriculture education schemes of Govt. of India is another important component of the portal.



The Author is working as Principal Scientist and Head, Department of Computer Applications, IASRI – New Delhi

The portal helps in management, monitoring and promoting activities/schemes of Education Division, ICAR. The system has following functionalities :

- Provides information about all programmes of Strengthening, Scholarships, Trainings, e-learning resources and Faculty Strengthening managed by Education Division, ICAR under section "Strengthening and Development of Higher Agricultural Education in India". Portal also acts as a repository for Annual reports.
- Financial sanction and release of funds on the basis of online demand and relevant data submitted by universities
- Provides link and covers vital information of Agricultural universities for the benefits of students. Provides information and search facility about "Events" organized by universities under "Event" menu. It also provides Advance Search Facility with multiple search options such as Stream, Subject, Course Category and University/College information on Courses along with seats, eligibility criteria and other information.
- Provides information about Courses (Bachelor, Master and Doctoral), Facilities, Student Strength, Faculty Strength and Scholarships. Admission Announcements uploaded by universities under "Notifications" can also be accessed.
- Provision for generation of Unique Student ID (US-ID) by the universities/colleges and the information on the same is displayed university wise under different categories on the home page under the link US-ID. All the scholarships schemes provided by ICAR can be tracked by using US-ID and 1.93 lakh students have been registered for US-ID.

KRISHI MEGH- KRISHI MEGH is the integration of the ICAR data Centre (DC) at ICAR-IASRI with the Disaster Recovery Centre (DRC) at the ICAR-NAARM, Hyderabad. The existing Data Centre (ICAR-DC) built during 2012 has been strengthened with cloud computing infrastructure. NARES-Cloud Infrastructure and Services with its constituents ICAR-Data Centre at ICAR-IASRI, New Delhi and ICAR-Disaster Recovery Centre at ICAR-NAARM Hyderabad provide a robust and dynamic platform to meet the growing IT needs of the NARES system with the deployment of mission critical applications such as e-Office, ICAR-ERP, Education Portal, KVK Portal and mobile apps, ICAR institute websites, Academic Management System, Alumni Portal, e-Courses of UG and PG level etc. Under NAHEP, the out-reach of existing ICAR Data Center is broadened to cover the Agriculture Universities enabling them to host their websites and IT solutions. In the present COVID-19 situation, 24x7 availability of IT applications through have made it possible to work from home as well as to collaborate with fellow scientists. ICAR-DRC at NAARM Hyderabad synchronized with ICAR-Data Center at ICAR-IASRI, New Delhi has been built to mitigate the risk, enhance the quality, availability and accessibility of e-governance, research, extension and education in the field of agriculture in India. ICAR-NAARM, Hyderabad has been chosen for ICAR-DRC, as it lies in different seismic zone w.r.t. ICAR-Data Center. Hyderabad is also suitable as skilled IT manpower is available along with other suitable climatic conditions such as low humidity level which is controllable in the data center environment. The ICAR-DC has been strengthened with latest AI/Deep learning software/tools kits for building and deploying of deep learning based applications such as disease and pest identification using image analysis, detection of maturity and ripening of fruits through image analysis, disease identification in livestock etc. The ICAR-DRC solution has been designed on Nutanix Enterprise Cloud

Platform with Hyper Converge Infrastructure (HCI) that provide integrated compute, network and storage resources to the applications. Network integration between the ICAR-DRC, NAARM, Hyderabad and ICARDC, ICAR-IASRI is provided for seamless access to the application services running on these centers to the users. ICAR-DRC has 8 HCI nodes synchronized with 4 HCI nodes at ICAR-DC. HPE ProLiant DX380 Gen10 server is configured as a HCI node and HPE MSA 2050 Storage is deployed to provide 290TB of storage which can be scaled up easily. Both HCI nodes and storage are scalable. 8 Racks with precision cooling architecture has been installed seeing the future IT needs of the NARES. Krishi Megh was inaugurated by Honourable Agriculture Minister.

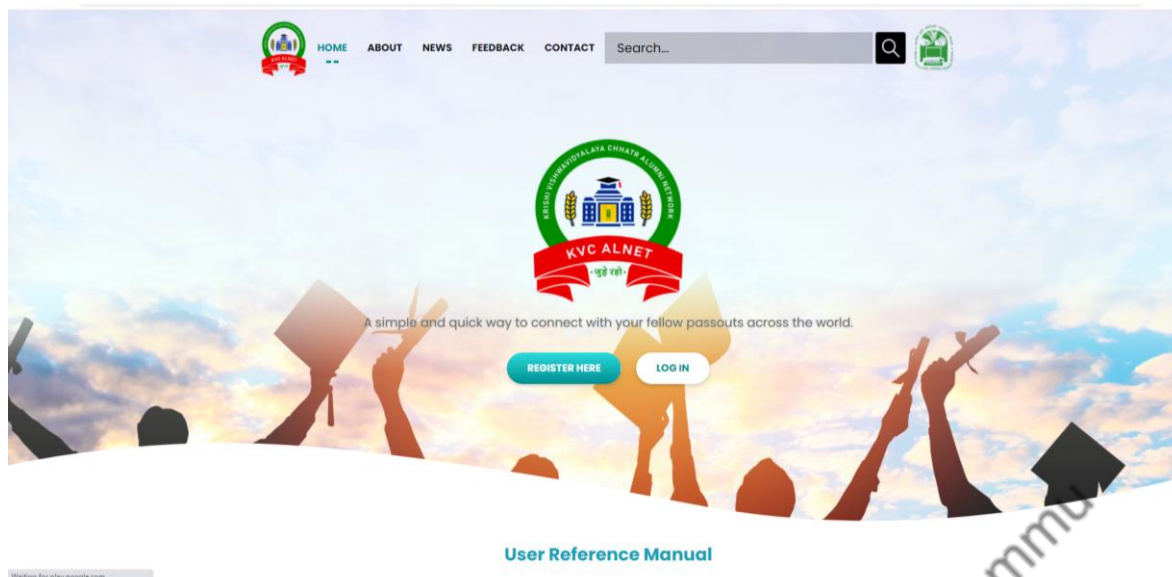


ACCREDITATION PORTAL has been developed that allows both Government and Private Agriculture Universities/Colleges (HAEI) to apply for online accreditation by submitting relevant documents to National Agriculture Education Accreditation Board (NAEAB) Secretariat for approval. The ICAR accreditation improves the quality and relevance of higher education in agriculture universities through effective regulation and peer review processes. It is available at - <https://accreditation.icar.gov.in>.

The HAEIs encompass State Agricultural Universities, State Veterinary Universities, State Fisheries Universities, State Horticultural Universities, Central Agricultural Universities, State General Universities having Agricultural Faculties and offering degrees in agriculture and allied sciences subjects, State Private Universities having agricultural Faculty and offering degrees in agriculture and allied sciences subjects, ICAR/UGC Deemed Universities offering degrees in agriculture and allied sciences subjects, Central Universities with Agricultural Colleges, State Autonomous/Private Colleges offering degrees in agriculture and allied sciences subjects and Colleges of agriculture and allied sciences subjects affiliated to the Universities. The HAEIs can submit a Letter of Intent (LoI) along with Institutional Eligibility for Accreditation (IEA) and Statement of Compliance (SoC) to the National Agricultural Education Accreditation Board (NAEAB) Secretariat through this portal. LoI and IEA is then processed at the NAEAB Secretariat regarding eligibility and other basic requirements for accreditation and the decision in this regard are communicated to the HAEI online. After receiving positive response from the NAEAB, the institutions submit Self Study Report (SSR) to the respective Regional Center of the NAEAB through this portal. 6. Regional Center examines the SSR online and ensure that the SSR meets the requirement of the NAEAB accreditation. In case, some improvement is required, the report is modified by the University and resubmitted to the Regional Centre online. After receiving the satisfactory SSR from the University, the Regional Centre forwards it to the Board Secretariat through this portal. After receiving the SSR, the NAEAB Secretariat constitutes a Peer Review Team for on-spot verification to the HAEI and the remaining process of accreditation is done in offline mode. All the stakeholders in the accreditation system are now using this portal in a workflow manner. Hence, this portal is able to reduce time and cost in the overall accreditation system of ICAR.

KVC-ALNET is one of a kind portal “Alumni Network”, has been developed as a result of an idea of a full fledged, “social networking” for alumni of Agricultural Universities. It has been developed to allow all the ex-students and present students to connect and collaborate on an exclusive online platform developed to facilitate strategic networking among agriculture

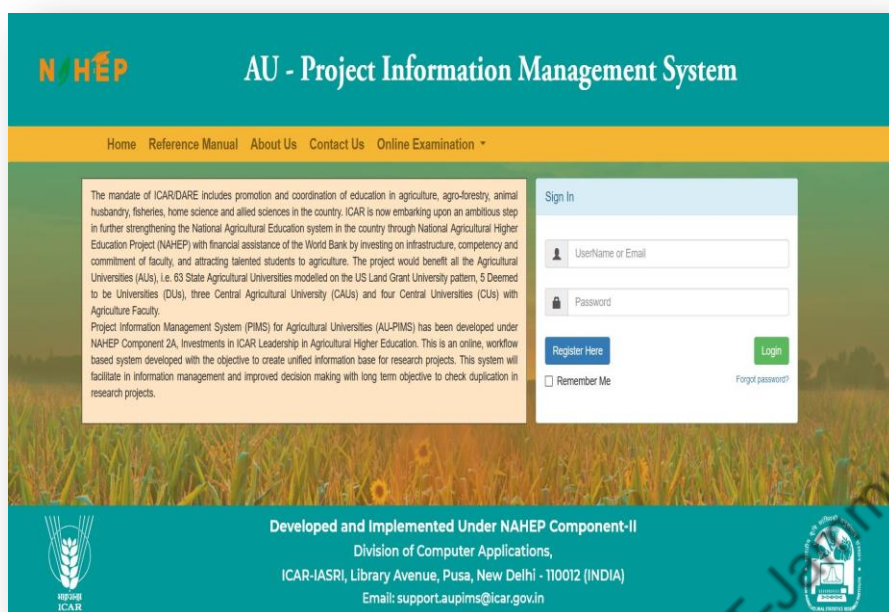
professionals to stay in touch with their fellow alumnus specialized in multiple fields of work across all agriculture universities and colleges. It is available at URL - <https://alumni.icar.gov.in>. This is an enhanced cloud based University alumni web portal with, enhanced automation, making the whole process of registration easy and effective. The alumni details of the past students from any of the Agriculture Universities/ICAR Deemed Universities/Colleges, will be uploaded onto Alumni Network by the corresponding University. This multifaceted portal incorporates all the resources that offer real time update, of chat interactions, post, notifications, membership access, with emphasis on all the benefits of a top-niche professional networking site. The KVC ALNET home page consolidates information, of all the updates of events such as seminars, webinars, online conferences, images and lectures, organized by various Alumni Chapters of Universities. Access of contact information and profile view are the other options in menu, which is limited to only, “verified members” after a successful registration. The verified members are the users, who are duly approved by the University Admin. The home page also displays all member details and assists users to find University student and alumni with a search window. With all the facility of chat room, messaging with media attachments and status updates, the home page is rich with all the dynamic features of news feed of members activities displaying their posts, likes and shares of their posts giving an option to connect with the more active alumnus as follower. Fellow alumni can easily follow the relevant threads of real-time event updates. Alumni members can interact with Agriculture Universities and guide students into polishing their career. The portal gets updates of multimedia enabled conferences, seminars, webinars which garners excellent linkage with domestic and international industry. Members can view all the updates between members and profit from internship opportunities, as referred by other members. The University students’ network extensions ease employment enhancement and placement progress, as they can view internal hiring in the corporate where the member alumni are working. It enables one-to-one communication and interactions between passed out students, as members sharing their views, ideas, corporate experiences, mentorship guidance and overall motivational interactions with fellow member alumni. The KVC ALNET offers its alumni to efficiently connect, effectively interact in real-time, participate in events, webinar, conferences for ongoing research contributions with researchers, college students and faculties as Alumni members. The web presence of KVC ALNET is compatible, to its nascent use on Smartphone, Android, IOS, Mac, MS Windows desktop and tablet.



Agriculture University Ranking System (AURS) has been under the guidance of Education Division, ICAR, in line with the National Initiative on Ranking of Indian Institutions. Ranking of Agricultural Universities has been initiated by ICAR with a larger objective to drive the universities towards improving quality standards and enhance their visibility to enable them for participation in global rankings. It is available on URL <https://education.icar.gov.in/auranking/>. The system is operational since last two years and the ranking of AUs are done through this system.



Agriculture University- Project Information Management System (AU-PIMS) has been developed with in-built workflows for effective information management related to research projects. System enables creation of research projects repository for universities as well as at the national level. System has provision for document management related to projects. It is available on <https://education.icar.gov.in/aupmis/index/asp>



E-Learning Portal has been developed with an objective to strengthen the Agriculture Higher Education in India by developing and disseminating the e-courses for undergraduate and postgraduate Agriculture Courses. The portal allows agriculture higher education faculty to develop and revise digital learning content for undergraduate, post graduate and Ph.D. courses. It is available on <https://education.icar.gov.in/eLearningHomePage.aspx>



NAHEP- Grievance Redressal Mechanism System (GRMS) has been developed with an objective to have fair and transparent system for NAHEP participating agricultural universities to report grievance with respect to procurement, social, environmental and other issues. This system encourages, stakeholders to raise concerns without fear of reprisal and provide a fair and speedy means of dealing with complaints and prevents minor disagreements developing into more serious disputes. It is available on <https://nahep.icar.gov.in/creatgrm.aspx>. The system has been institutionalized for all the universities and at education division of ICAR.

NAHEP National Agricultural Higher Education Project

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GRM NAHEP / GRM Officer

GRIEVANCE REDRESSAL MECHANISM (GRM) IN NAHEP

INDIAN COUNCIL OF AGRICULTURAL RESEARCH NATIONAL AGRICULTURAL HIGHER EDUCATION PROJECT (NAHEP)
KISRI Anusandhan Bhawan -II, Pusa, New Delhi-12

A Grievance Redressal Mechanism (GRM) has been setup in NAHEP to establish a fair and transparent system. In the system of GRM, the following mechanism is adopted:

Complete list of Nodal Officers (GRM) for AUS/SAUs is as shown below:

LEVEL 1 (AT SAUs)

Nodal Officers for GRM have been identified at every sub-project level. The concerned National Coordinators will maintain this data base. The Nodal Officer (GRM) at sub-project implementing units/ SAU shall be responsible for redressing grievances in the context of IDP, CAAT and Innovation Grants and other sub-projects.

COMPONENT 1 A: INSTITUTIONAL DEVELOPMENT PLAN (IDP)

S.No.	University/College	GRM Officer	Contact No.	Email ID
1	Acharya N.S. Rangra Agricultural University (ANGRAU)	Dr. N. Venugopal Rao	967878654	drnppmangou@gmail.com
2	Agricultural College, Bapatla (ANGRAU)	Dr. V. Sitarambabu	763262675	sitarambabuagcon@gmail.com
3	S.V Agricultural College, Tirupati (ANGRAU)	Dr. T. Lakshmi	9332362348	sivakrims77@gmail.com
4	Agricultural College, Nara (ANGRAU)	Dr. M. Suresh Kumar	9848062833	sureshkumarimustag@gmail.com
5	Agricultural College, Mahabubnagar (ANGRAU)	Dr. K. Swarnava Lakshmi	9440205689	swarnava.lakshmi@gmail.com
6	Dr. N.T.B College of Agricultural Engineering (ANGRAU)	Ms. N. Vinoda	9849726336	vinoda.nag@gmail.com
7	Assam Agricultural University (AAU)	Dr. Rana Prasad Bhuyan	9436053728	rp_buaprasad@gmail.com
8	College of Community Science, Jorhat (AAU)	Dr. P. Das	9436050543	prasadp1962@gmail.com
9	College of Agriculture, Jorhat (AAU)	Dr. U. Arozky	9436052660	uarozy@gmail.com
10	College of Veterinary Science, Khanapara (AAU)	Dr. B. Bhattacharya	9464044465	bhobhattacharya@gmail.com
11	College of Fisheries Science, Raha (AAU)	Dr. S. Borahkar	9363409457	sustanabornkar@yahoo.com
12	Biswaanath College of Agriculture - Biswanath Chariali (AAU)	Dr. D. Hazarika	9706056435	hazarikad@gmail.com
13	S.C.S College of Agriculture, Dibrui (AAU)	Dr. H. Disha	9301181377	cdhtrisi@gmail.com
14	Jonagadh Agricultural University (AAU)	Dr. S.K. Maham	9479300461	drskmaham@gmail.com

Clean and Green Award Portal has been developed to invite entries from Agricultural Universities to showcase the clean and green initiatives undertaken by them in order to promote sustainable living. The institutions are evaluated on pre-defined parameters by a panel of dignitaries and best universities are awarded with cash prizes.

NAHEP Green and Clean Campus Awards

A Green Campus is a place where environmental friendly practices and education combine to promote sustainable and eco-friendly practices in the campus.

1st prize - INR 10 lakhs 2nd prize - INR 8 lakhs 3rd prize - INR 6 lakhs

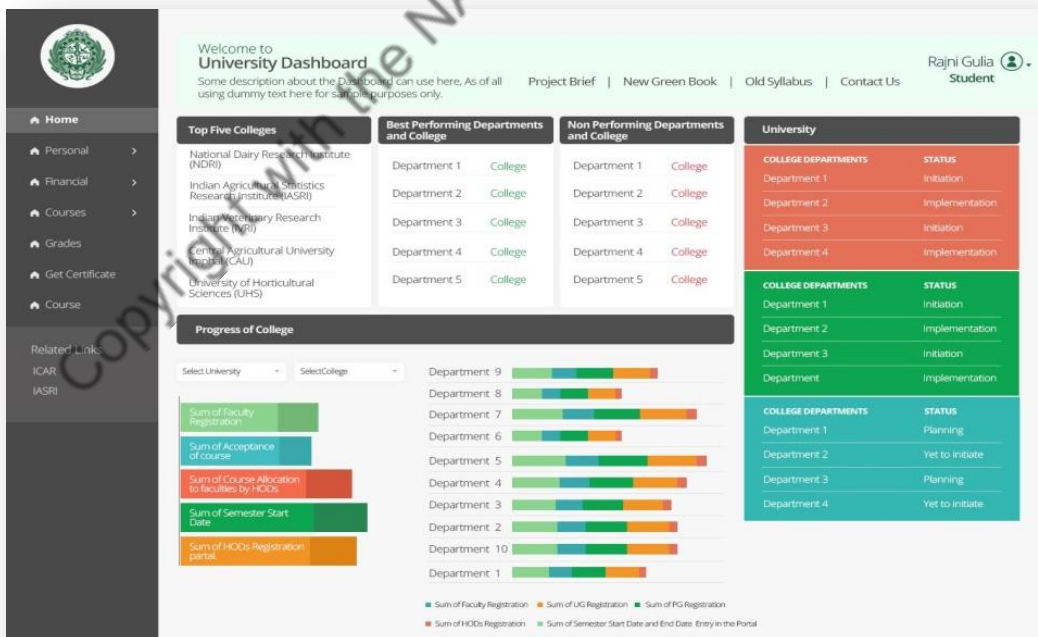
Consolation prize of INR 4 Lakhs

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KRITAGYA Portal has been developed with an objective to automate end to end modules of national level ag-tech hackathons. KRI-TA-GYA explains KRI for Krishi (Agriculture), TA for Taknik (Technology) and GYA for Gyan (Knowledge). It is available on : <https://nahep.icar.gov.in/kritagya.aspx>. The system has been used for last two years and two hackathons have been conducted through this system in the sector Agriculture Engineering and Animal Sciences. More than 1000 teams have registered in the portal.



AMS Academy Management System for 52 Universities has been developed, customized and implemented with an objective to automate all the academic activities in the Agricultural Universities to enhance the efficiency of the overall academic system by saving time and efforts involved in manual process. It is available on - <https://auams.icar.gov.in> There are 52 Registered Universities, 200 registered institutes/colleges, 15,000+ approved students, 6000+ Faculty approved . The system enables regular monitoring and provides University Academic Health Index as a decision support tool for the top management of the university.



University Academic Health Index (UAHI) in AMS

Training Management Information System (TMIS) has been designed, developed and implemented in all ICAR institutes catering to the complete training data management and online decision support in ICAR. The training processes implemented are: Training Needs Assessment (Annual Training Plan), Training Application Process (Application Submission and Approval), Training Feedback Process and Training Evaluation Process (Performance indicators). It is available is on <https://hrm.icar.gov.in>

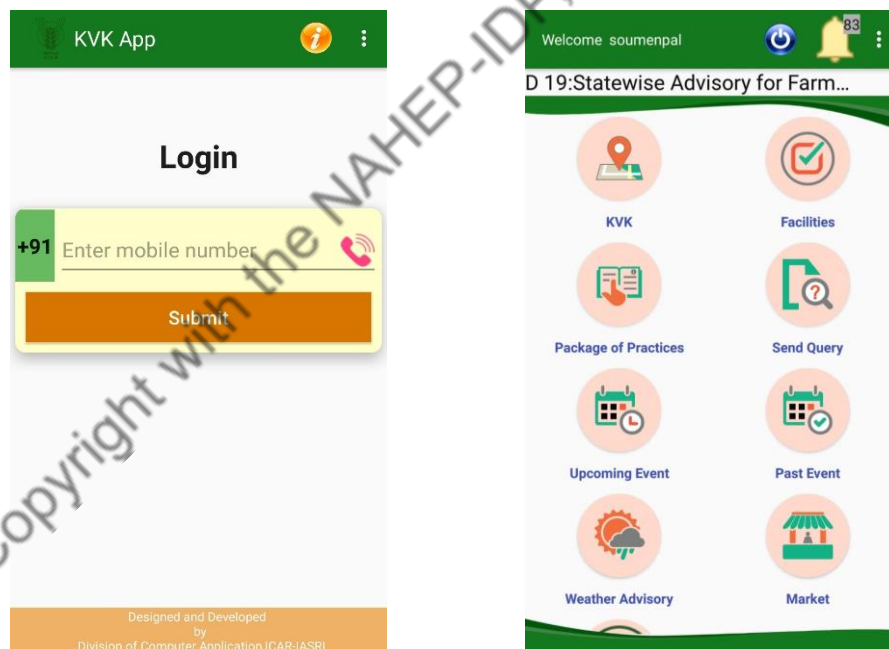


NAHEP Component-2 Website has been designed and developed to provide information pertaining to the project objectives and activities under NAHEP Component 2. Its URL is <https://nahep.icar.gov.in/>



KVK Portal and Mobile Application has been developed and are being used for dissemination and management of information at the KVK level. KVK Portal was used for e-governance of major events like Garib Kalyan Rojgar Abhiyaan (GKRA), Krishi Kalyan Abhiyan-III, Monthly Progress

Report(MPR) management of KVK's and data exchange with Darpan dashboard. Advisories were issued during COVID19 lockdown times through KVK portal and mobile App.



Service Plus configuration for ICAR-DARE DBT Scheme has been configured for agricultural schemes. ServicePlus is a meta-data based e-Service framework developed by NIC for delivering electronic-services to citizens. This provides all types of components and modules to define, configure and commission an e-service. It involves modules like Service Definition, Service Coverage, Target Beneficiary, Creation of application forms, Work Flow Player's and tasks mapping and others. DBT Applicable schemes of DARE-ICAR are being configured (in demo server of ServicePlus) following Service Definer Guide (SDG) for each identified scheme for the beneficiaries for accessing service, track submitted applications, subscribe to alerts

and integration with PFMS for transferring the money into beneficiaries' accounts. It is available on URL <https://dbtdare.icar.gov.in>

The screenshot displays the 'ServicePlus' web application interface. At the top left is the 'ServicePlus' logo with the tagline 'Metadata-based Integrated eService Delivery Framework'. The top right shows the user profile 'Aabhas Bhardwaj' and options for 'Themes' and 'Language'. The main header identifies the organization as the 'Indian Council of Agricultural Research' and the specific program as 'AgEdn- IASRI Scholarship for MSc and PhD'. A left-hand menu contains options like 'Manage Profile', 'Apply for services', 'View all available services', 'View Status of Application', and 'Messages & Alerts'. The central area is a 'Personal Information' form with the following fields: Full Name (text input), Date of Birth (calendar icon), Category (dropdown), Address (Address Line 1, 2, 3), State (dropdown), Postal / Zip Code (text input), E-Mail (text input), Photo (upload button), Gender (dropdown), State of Domicile (dropdown), Country (dropdown), District (dropdown), and Mobile Number (text input). At the bottom of the form, there are radio buttons for 'Current Student' and 'Ex-Student'. A large diagonal watermark 'Copyright with the IASRI-DBT SK IAST-Jammu' is overlaid on the page.

DBT DARE MIS has been developed for reporting details of beneficiaries and the transactions under all DBT applicable schemes of DARE-ICAR. The schemes include student centric schemes i.e. various scholarships and fellowships, faculty schemes and farmer centric schemes. The information is collated at the scheme level and 20 Monthly Progress Reports (MPRs) are generated on a monthly basis for the 20 schemes in the system. Once approved, the information is moved to DBT Bharat Portal (<https://dbtbharat.gov.in/>), a national level portal under DBT Mission of India, on each month on a fixed date. The data exchange between two portals is done through Web Application Programming Interface (WebAPI). This MIS is available at <https://dbtdare.icar.gov.in>.

Transaction of Beneficiaries uploaded in the MIS under their respective schemes

Direct Benefit Transfer
DEPARTMENT OF AGRICULTURAL RESEARCH AND EDUCATION
INDIAN COUNCIL OF AGRICULTURAL RESEARCH

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DARE/ICAR
ORGANISATIONS
SAUs, ICAR Institutes, Deemed Universities, KVKs
SCHEMES - 20
BENEFICIARIES
Student, Faculty, Farmer

Previous FY: 2019 - 20

Month wise data in MPR table is pulled by the web service and uploaded on DBT BHARAT Portal

SNo.	Scheme Name	Scheme Type	Benefit Type	MPR updated last on	Action
1	AgEds - ICAR Emeritus Professor	Central Sector	Cash	14/01/2020 16:42:24	Add/Edit Data

E-Krishishiksha contains standardized course material in the area of Agriculture and Allied sector for undergraduate level. The e-courseware content span across seven disciplines viz. Agriculture Science, Fisheries Science, Dairy Science, Veterinary Science and Animal Husbandry; Horticulture, Home Science and Agriculture Engineering have been developed at SAU/DU and other organizations in India. It is available on <https://ecourses.icar.gov.in/Home1.aspx>.

e-Learning Portal on Agricultural Education
(e-KrishiShiksha)

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All online eCourses are operational and for improved access the courses are updated on the Linux platform

Agricultural Education Division of ICAR **New User Registration** NEW

Education Division undertakes planning, development, coordination and quality assurance in higher agricultural education in the country and, thus, strives for maintaining and upgrading quality and relevance of higher agricultural education through partnership and efforts of the components of the ICAR-Agricultural Universities (AUs) System comprising State Agricultural Universities (SAUs), Deemed to be universities (DUs), Central Agricultural University (CAU) and Central Universities (CUs) with Agriculture Faculty. >> [More information](#)

Under financial support of NAIP, all the e-Course Contents available on this website have been developed by subject matter specialist of the respective disciplines at State Agricultural Universities in India and Deemed Universities of ICAR, New Delhi. The courses material is prepared as per ICAR approved syllabus for the benefit of under-graduate students already enrolled in Indian Agricultural Universities.

To Access Online e-Courseware

[HelpGuide](#)

To Downloads Offline e-Courseware

[HelpGuide](#)

SNo	Online e-Courses	To Download Offline e-Courses
1	B.Sc.(Agriculture)	B.Sc.(Agriculture)
2	B.V.Sc.(Veterinary & AH)	B.V.Sc.(Veterinary & AH)
3	B.F.Sc.(Fisheries Science)	B.F.Sc.(Fisheries Science)
4	B.Tech. (Dairy Technology)	B.Tech. (Dairy Technology)
5	B.Sc.(Home Science)	B.Sc.(Home Science)

With these IT initiatives, ICAR-IASRI endeavours to create an enabling environment to nurture partnerships/linkages with higher education institutions, industry, governments across the globe for enhancement of the performance of agricultural higher education in the country. It also provides directions for the improvement of quality and relevance of agricultural education through global practices and curricular review processes on par with global standards. The faculty and students' empowerment on the emerging areas of digital solutions in agriculture contribute to the efficiency of NARES.

These initiatives also bring in the much-required boost to inculcate IT culture in AUs. The project has enabled ICAR Education Division to provide technical and financial help to AUs in a better way assisted with technology. It has enhanced the capacity of the universities to adopt and implement IT solutions. It also helps students studying in remote colleges to access quality video lectures and content, bridging the geographical divide of the country. Policy frameworks developed in the project are helping in building a more robust Higher Agriculture Education System in India. The outcomes of the present initiatives are multi fold and their contribution to the production, profitability and sustainability of the target system i.e. NARES is significant.

Role of Computer and IT in Entrepreneurship**Sourabh Srivastava**Associate Professor, School of Business,
Shri Mata Vaishno Devi University, Katra, J&K

Imagine the thought of purchasing a gift for your friend while you are surfing the internet. Suddenly you find the list of gift options as per the preference, liking and lifestyle of your friend along with your purchasing limit and best of purchasing options flashed in front of your screen, without your touching the screen. You think of choosing a gift and payment confirmation order is ready for your final verbal command, (or would you like it to be based on the thought transmission). You are in front of your notepad, in your leisure suit with a nuro-transmitter Bluetooth headphone attached to your head. You simultaneously wish to have a juice and the juicer is ready pouring the juice and the bell sends you a message that a secret donor has send you a festive gift since you had participated in the secret angel gift campaign of the website, where you had spent few bucks for registering yourself in the campaign for the eligibility of receiving a secret gift. You are elated for the gift as it is from Ratan Tata. You decide for celebration, the cognitive tracker transmitter books a restraint and your car engine is started with the destination mapped and you reach to your favorite destination for lunch. You enjoy your lunch in a most precisely cooked meal and it's time for the meeting that is scheduled in next ten minutes that you are reminded of by your nuro-transmitter. You conduct your meeting on a virtual display and you return home through the automated driverless vehicle, duly updated of the world routine, your family and colleagues. Your refrigerator has ordered the deficit of the routine items that are off the shelf and fresh dairy and farm products will be replenished before you rise in the morning. Well, did the initial sentence said 'imagine'? Perhaps the right beginning should be to look forward to the digital reality of an IT integrated automated world where the life is evolving to be with the due convergence of technology and human creativity. The business is moving towards the definition of the business of life coupled with the technological interface, duly enabled by the computers and information technology (IT).

Since the beginning when in 1943, the first mainframe computer was commissioned, the human race entered into the race for digitalization. The time, size, space and agility became the keywords for defining the competitiveness of the companies and countries. The new age innovations ride over the tide of emerging information technologies and computer revolution, where minimization of input of physical resources time, space and size and maximization of outcomes has become the center of focus for the business and non-business organization. Particularly the enterprises realized the productivity gains in 1990's and the investment in the IT was seen as a promising gain for the companies (Gordon, 2000). The entrepreneurs who had the ownership of computers and the knowledge of the spreadsheets, internet access, and information, gained the advantage and had a higher growth opportunities (Fairlie, 2006). They were able to create experimental business plans, have the knowledge of the specific, industry and competing firms, research for the competitive processes and mechanism for lowering the operating investment and the marketing cost. With the help of IT tools they understood that they would be agile in responding to the dynamics of the business and environment and create capabilities for the strategic response to the change.

The Author is working as Head, Business School, SMVDU, Katra

In India the business have seen the various disruptions since last few decades that included the political, economic, ecological and the technological disturbances including COVID. The eruption of IT and computers have been an enabling influence in the businesses in India. The new set of entrepreneurs have created the unicorns based on the IT and IT enabled services. Over the period the businesses including the new age startups and small businesses have been exposed to the new integration of technology and have been forced for the adoption of the IT and computers. It is estimated that by quarter of this century around ninety percent of the small and medium enterprises in India shall be digitally influenced. With around twenty five percent of the CAGR, the digital technology adoption in the medium and small industries shall grow around by \$85 billion by 2024. Out of the \$30 billion size \$16 billion i.e. is around fifty three percent had been used by 2019 for the communication tools and connectivity, enhancement of productivity and technology based discoverability of new products of MSMEs (Financial Express 2019).

In the spurt of new age IT based startups some of the ventures such as Zomato, Paypal, Paytm, Redbus, Swiggy, Ola, naukri.com, bookmyshow, Ninjacart, Dehaat, Crofarm (Otipy) etc are some of the e-commerce based success ventures that have paved way and enabled the traditional as well as new age entrepreneurs to embrace the IT and computers to explore the market based advantage along with increasing the productivity across the value chain. The entrepreneurs are using the innovative use of IT and systems for developing products and services. The conviction of the entrepreneurs and small and medium business in the digital transformation brings in the conviction for the future growth, (Economic Times, 2021) and prepares them for the strategic flexibility in responding to the disruptions. It enables the entrepreneurs for blitzscaling in the new world order.

Reasons for the blitzscaling and accelerated growth through IT:

Blitzscaling term has an inspiration from the war strategy of World War II derived of the sudden, encompassing and fast coordinated attack on the enemy, as in the battle of Blitzkrieg. Blitzkreig means lightning war. According to Hoffman (2018), *“It’s the science and art of rapidly building out a company to serve a large and usually global market, with the goal of becoming the first mover at scale.”* The firms enabled by the IT and computer expertise explore across the value chain with the focus on speed and responsiveness with no commitment to the formal structure and rules. They derive their entrepreneurial journey with the strategic flexibility of product fit, market fit and team fit with each and every new opportunity and emerging challenges. Ninjacart, a farmer to consumer (F2C) venture based on the app based supply to the consumers moved to the farmer to business (F2B) as soon as it realized that it needs to address the challenges related to the agro-food ecosystem and it could achieve high scale of operational benefits. The free to rule book approach allows the IT based experimentations and trying new innovative approaches in the traditional and conservative business operations. The hefty usage promotions of Groffers for the promotional references or transfer of the financial benefits on the credit card payment through CREED are against the accounting norms that could be termed as most risky in the traditional business approach. However the information technology based integrative business simulation helped it to experiment and experience the success.

It is often criticized that for the blitzscaling strategy the entrepreneurs prioritize speed over efficiency. With the scale of the operations and in order to take upon the competition or create a niche in the competitive space the companies often use the IT and computers to gain the speed. In 2018 Reditt.com

took over Facebook to become the third most visited website after Google and Youtube in USA. Founded in 2005, Reditt is a leading social media site that offers news aggregation, content rating and general discussion platforms and is ranked as 19th most visited website in the world. Due to its 'ask reditt' and 'sub reditt' and anonymity feature it has scaled to have 37.6 million app users on iOS in 2021. It has generated the advertisement revenue of \$100 million in competition with the Facebook, Twitter and Instagram. The speed of growth of the enterprises is unbounded of the traditional and conventional path. The higher rate of economic expansion is the core of expansion strategy of the entrepreneurs who use IT tools, computation and smart technologies for creating a higher customer outreach.

The accelerated growth coupled with IT and computers helps the firms to expand and attract the employees. However, the computer commitment, IT based innovation zeal leads to sharing the dream and value as well as culture across the organization. The dream of scaling and creating a big venture is shared across the employees and provides for the open culture for idea exchange, exploration and thus fosters the sense of belonging to the organization. The easy to accessibility to data and transparency transpires the rust among the stakeholders that allows the employees to align with the purpose of the organization and share the vision of the founder. Dehaati Beej Se Baazar Tak uses data science, agri-science and analytics to encourage the ecosystem for the farmers, micro-entrepreneurs and the institutional buyers in its B2F and F2B business model. The stakeholders benefit with the bricolage and networking and share the vision of growth together along with the share in the stakes of the business. The transparency of the information across the value chain leads to the trust across the front end and back end value chain.

The integrated use of the IT tools and embracing the computers has brought in the revolution in the way business has been done. The entrepreneurs have the digital power for bringing the positive change in the business of life. The new age startups and businesses have embraced the positive intervention of IT and digitalization to accelerate the growth of size and scope of the businesses. Some of the reasons that have attributed to the accelerated business growth along with the blitzscaling can be:

1. The use of the information technology can help in solving the complex business problems at a high rate of response. The minimum size of the hardware with higher storage and faster processing capacity, and innovation of computing applications, data mining and data processing software and applications has helped in easing the research, exploration, analysis and planning the new business ventures, product prepositions, marketing mix and scalability of the business. The computation process and big data analytics has helped in solving the complex problems in a real time.
2. Based on the real time data, verifiable facts and tools like mind mapping, virtual conferencing technology etc. It has become easier for the firms to make the better decisions. Also the response and corrective actions to the decisions can be made easily with strategic flexibility since the data and rate of information exchange is easier and at a high speed. The tools such as MicroSoft CRM Dynamics, Google Analytics, Apache Hadoop and Cloud computing etc. has provided to strength to the entrepreneurial and business decision making.
3. The entrepreneurs today have easy access to the internet that can be used for marketing and online advertising. With SEOs, PPC, Google Ads and Facebook, Reditt, Instagram etc. the

marketers can easily track their target audience and build a market campaign. With integration of the online financial tools and payment options they can persuade the transactions at a faster rate, after bridging their needs and designing the value proposition based on the artificial intelligence and creative combinations.

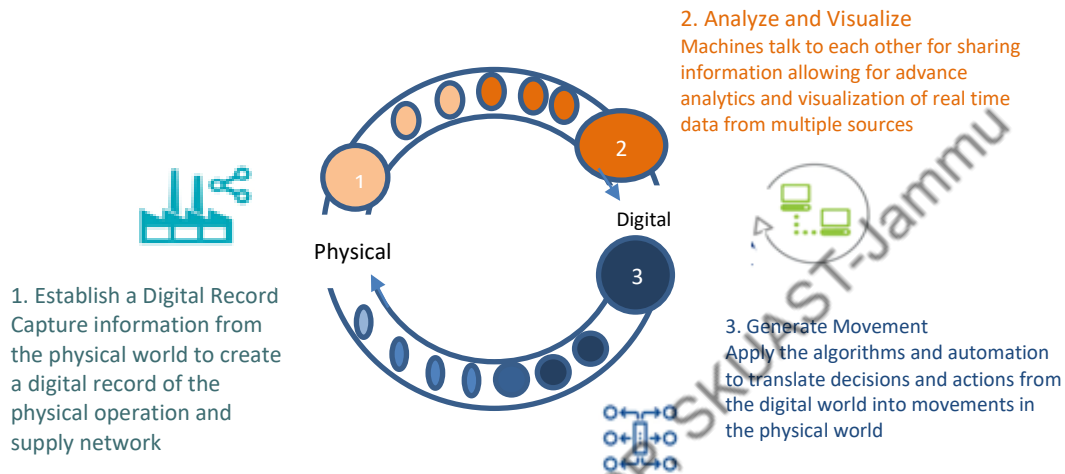
4. The entrepreneurs can easily track the changes in the industry with the help of the database such as IBEF, CMIE Prowess, Euromonitor and use the IT enables data analysis techniques in easy forecasting for strategic decisions.
5. Based on the IT systems and computers the entrepreneurs can have a wider outreach to the customers. The larger base of the customers available through the platforms of Amazon, Alibaba, Flipkart has been a blessing for the small scale entrepreneurs and new ventures. The systems of customer relationship management based on the database of the customers and neural networking techniques has opened new opportunities for the businesses. The benefit of the IT for the management of customers and marketing can be availed by both the technology based as well as non-technology based service or manufacturing firms. At one side we have the technology firms like Zomato, Ola etc. which are using the technology for creating the customer base and offering them the services, another side we have the traditional restaurants and retailers manufacturers who are using the services of IT for enhancing the customer base and improving the customer service experience.
6. The IT and computer systems in the business has made it easier for the resource planning and hence have a blitzscaling of operations. The enterprise resource planning, customized systems for the management of the enterprise, google sheets/documents/ virtual meetings have helped the entrepreneurs to evolve new innovation based on efficient usage of the resources. The delivery of the hot and warm pizza; tracking of the tour of the customer or with offering the fresh fruits and vegetables directly sourced from the farmers to the customers through the partner sellers by Crofarm's Otipy by a app based F2B2C social commerce platform, has been creating the economic value for the enterprises.

The blitzscaling of the business with the help of an IT and computation has redefined the business perspectives. The new age technology convergence with the business strategies has called for reengineering the IT for delivering the operational excellence as well as integrating and enabling the value network. The entrepreneurs are focusing from customer delivery to the outcome based issues and thus developing the enabling mechanisms for high responsiveness, agility and collaboration with the business partners and customers. With the use of artificial intelligence, cognitive science the business dimensions are looking for creating opportunities for integrated delivery. The computation with the help of AI and machine learning is shifting from the physical input to the cognitive input. It is shifting from reactive to proactive interactions. Today Alexa or Google home have been tracing your activity and smart home systems are creating the delivery models based upon your cognitive requirements. The ERP systems are becoming more responsive and the supply chain interaction is agile and flexible with high rate of responsiveness. The entrepreneurs need to understand the trends and the macro perspective for the effective use and integration of the IT and Computers in the business system.

Macro perspective of Integration IT and Computers for the Entrepreneurs

With the expansion of the technology, and its innovative application the world is shrinking and becoming small, with higher need for the improvement in quality of life. A small device of six centimeters or less controls, guides and steers our lives. The applications in the mobile phones and the connectedness with the smart devices is trying to regulate the complex functioning of the human systems. The complexities of the systems from farm to manufacturing to business to consumer and back to farm in view of the requirement of sustainable practices has been demanding for a creative

Figure 1. The Industry 4.0 physical-digital-physical loop



Source: The Deloitte Center for Integrated Research/Deloit Insights: Technology Trends 2021

infusion of ideas and mechanisms. The future of the IT is looking to embed the human emotions with the exponential intelligence where the combination of the technologies are going to increasingly try for recognizing and adopting with the human emotions. The quantum computing is going to be used to solve the complex problems of human and environment, through the ability to harness the properties of subatomic particles to process information and perform new types of computations. The quantum computations are going to supplement the classical computers. The large volume of data with the help of quantum computing has prepared us to fight with the COVID pandemic at a higher speed. The IT based data integration and computing has helped the researchers to synthesize the data and respond dynamics of industry 4.0. Industry 4.0 focuses greatly on interconnectivity, automation, machine learning, and real-time data.

Fig 1 describes the interaction of digital technology with the physical world. The enterprises have to design the physical interaction with the digital and develop an architecture for recording and capturing the information from the physical world. It includes the defining the operations processes and supply network. In the stage two the design needs to analyze and visualize the data, wherein the computing systems need to establish the trend and interaction protocol by sharing the information and the data from multiple sources. In the third stage the algorithm and automation translates the decisions and actions from the digital world to the physical world. Now we can revisit and realize the imagination made in the introduction section. From the choice of product in shopping on internet to the management of e-wallet and mapping the finances, involves the recording of data, integration, analysis and visualization to final automated delivery to the consumer.

In the new era the integration of technologies IT has provided the way for the development of new products and services with the evolution of the Internet of Things, advance analytics and blockchain. The emerging trend of cryptocurrency based on blockchain or farm to consumer (F2C) business models based on the blockchain has provided innovative opportunities for the investment a creating innovative business models. The macro perspective of the IT and computers is based on the:

1. Enabling technologies (digital experience, analytics and cloud computing) that have provided for the success full corporate strategies such as Dell, Amazon, Google etc., The enabling technologies have been used by the new age entrepreneurs as well as established businesses to foster the innovation and increase the reachability. The enabling technologies have to be customer centric and infuse trust. At Johnson and Johnson the data science is used to help doctors to deliver better patient care.
2. The foundational technologies need to be stable and strong and sustainable. The business of technologies based on the reengineering of technology or bringing a new modular innovation needs to be in sync with the ecosystem that involves human sensitivity, cross cultural empathy and creativity. The use of technology and process design for the financial institutions are defining the fundamental principles of safety and security that includes financial and non-financial data. The cyber security and protection is a challenge to be strengthened. Removing the ambiguity in the delivery models, ethical use of information and data, exchange of information, infusing the transparency and accountability, security and reliability in order to mitigate the risk are some of fundamental issues that require to be addressed through a sound architectural design and consistent improvement in the processes and core modernization.
3. Disruptors such as digital reality, cognitive technology, and blockchain have forced the business to adopt the changes and evolve such as that of Stich Fix in US, fashion apparel company, Bitcoin etc. The companies are using the digital reality technologies to deepen the emotional connect between the employees and customers. The disruptors like blockchain are to be explored in delivering the value to the customer, maintaining the trust among the stakeholders.
4. Future of the business is based on the ambient experiences, exponential intelligence and quantum technologies. With the complexity of operations due to the increased interdependencies and interconnectedness with the nuro-transmission shall shape the future of the business. With semantic and symbolic understanding the machines shall be able to respond based on the precise correlations.

In order to have the collective benefits of the macro forces, the entrepreneurs need to focus on the following shifts that would help them in organizing the business effectively (Macro Technology Trends: Deloitte Insight/ technology trends 2020):

1. Agility and speed: The IT based technologies and application that are enabling the agile capabilities, organization design, and culture at the workplace, workstyle, funding, and governance and sourcing; shall be able to help the enterprises innovate rapidly.
2. Innovation and Ecosystem: The entrepreneurs have to keep a vigilance on the disruptive technologies. They have to be with an innovative ecosystem and nurture the same with the pipeline of ideas and its continual innovation.
3. Blurred internal boundaries: The technologists and programmers have to be the part of business process and system so that they are able to extend the technology based funding and support

4. Future workforce: As the traditional IT task and capabilities are complete, with the shift in focus has to be in the acquisition of the new skills. The soft skills along with the trending technical skills need to be acquired and absorbed.
5. Governance and Funding: With the change in the technology it has to be supported with the governance structure and the funding required for the operations and future prospective. The strategic flexibility along with the functional flexibility shall ensure the adoption of the technology and enhance the learning.
6. Leadership and Culture: The leadership and supportive culture shall help the companies to create an ambient working environment. It would nurture trust, networking and performance. The use of computers and mutual learning of the systems shall be encouraged
7. Digital transition: The transition from digital experience to digital reality shall be unique. Hence replication of the business models may not provide for the right answers for the adaptation and outcome related issues.
8. Data Organization: Data focused enterprise shall extend the focus of analytics from the operational efficiency and risk management to value creation
9. Cloud adoption: Along with the operational excellence the innovative use of cloud with its ability to shrink the centralized IT organization to a more participative, democratic and innovative mechanism shall enable the enterprise to reduce the ambiguity and take more informed and real time decision.

The macro forces can create innovative and transformed business operations if they are well coordinated. The entrepreneurs need to look out for the market based need and be flexible in adjusting the strategic responses to the dynamic environment.

Conclusion:

The role of IT and computers is integrated in the design and growth of the business in the modern world. The most successful organizations are taking the advantage of simplest of the computing technologies and taking informed decisions for the innovative product development as well as responding to the market forces. The integration of the IT and systems in the business model and enterprise helps in improving the responsiveness and agility of the enterprise. The IT and IT enabled services as well as computational technologies has powered new business ideas, their implementation and simulations. They create the possibility of integrating systems of different nature and provide solution to the complex issues. The advance computing and digital designs with the digital reality and cognitive technologies have provided avenues for manufacturing and services with the integration of the data from the multiple systems, software platforms, applications and hardware. In the digital era that is looking forward for advance computing based on quantum technologies, the IT and computers have provided the unbounded possibilities for entrepreneurship. The entrepreneurs can use the digital twins for creation of new products, services and business models and blitzscaling. The only question that needs to be answered if the entrepreneurs and enterprises are ready to adopt the integration of IT and systems in the business process? If yes then what is the macro perspective, level of technology adoption, neo-skilling and business process reengineering that the entrepreneur is going to apply? The new age possibilities of technology powered with the IT and computing has the power to convert imagination into reality.

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