Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu (SKUAST-Jammu)
Offline Training Program
by
NAHEP IDP SKUAST-J

Machine Learning & AI in Agriculture Training Report

Title: Machine Learning & AI in Agriculture

Duration: 23rd Mar 2022 to 19th April 2022

Mode: Offline Training

No. of Participants attended: Total 11 students from UG

Faculty Coordinators :

Preface:

Machine Learning & AI for Agriculture training was arranged by SKUAST Jammu under NAHEP-IDP on Wednesday, 23rd March 2022 to Tuesday, 19th April 2022 for students of UG of SKUAST Jammu.

Resource Person:

Machine Learning & AI for Agriculture Training was delivered by Mr. Abhilash Chauhan (Lead Trainer) from Innovians Technologies, Noida. Mr. Abhilash has more than 4 years of experience in providing technical trainings on various technologies including Machine Learning, Python, Artificial Intelligence, Data Science etc. He has delivered more than 100 Workshops & Training and trained more than 10000+ Participants.

About the Training

Four Week Offline Training on Machine Learning & AI for Agriculture and its Application was arranged for SKUAST Jammu students from 23rd Mar 2022 to 19th Apr 2022 under the NAHEP-IDP program. Total 11 students were actively participated in this Training. A brief summary of training is given as follows.

Researchers in engineering and science require platforms that let them explore and express new ideas, solve difficult problems, and create tools, leveraging a robust and flexible computational foundation.

Machine learning is a core sub-area of artificial intelligence as it enables computers to get into a mode of self-learning without being explicitly programmed. When exposed to new data, computer programs, are enabled to learn, grow, change, and develop by themselves.

Artificial intelligence (AI, also machine intelligence, MI) is intelligence displayed by machines, in contrast with the natural intelligence (NI) displayed by humans and other animals. In computer science AI research is defined as the study of "intelligent agents": any device that perceives its environment and takes actions that maximize its chance of success at some goal.

How AI is transforming Agriculture

Agriculture and farming is one of the oldest and most important professions in the world. Worldwide, agriculture is a $5 trillion industry, and now the industry is turning to AI technologies to help yield healthier crops, control pests, monitor soil and growing conditions, organize data for farmers, help with workload, and improve a wide range of agriculture-related tasks in the entire food supply chain. The use of an AI in farming can be used in agricultural processes like harvesting, use of precise weed-killing chemicals, etc.

Applications of AI:
- AI helping analyze farm data
- AI tackles the labor challenge
- AI reduces farm workload
- Using AI systems to improve harvest quality and accuracy

Objective of Training

1. Introduction about Machine Learning & Artificial Intelligence
2. Application of ML & AI in Agriculture
3. How to determine and measure program complexity,
4. Python Programming
5. ML Library Scikit, Numpy , Matplotlib, Pandas , Theano , TensorFlow
6. Statistical Math for the Algorithms.
7. Learning to solve statistics and mathematical concepts.
8. Supervised and Unsupervised Learning
9. Classification and Regression
10. ML Algorithms
11. Machine Learning Programming and Use Cases in Agriculture.

Course Curriculum

Artificial Intelligence	
Problem Solving • Solving Problems by Searching • Beyond Classical Search • Adversarial Search • Constraint Satisfaction Problems	Knowledge and Reasoning • Logical Agents • First-Order Logic • Inference in First-Order Logic • Classical Planning • Planning and Acting in the Real World • Knowledge Representation
Uncertain Knowledge and Reasoning • Quantifying Uncertainty • Probabilistic Reasoning • Probabilistic Reasoning over Time	Learning • Learning from Examples • Knowledge in Learning • Learning Probabilistic Models • Reinforcement Learning

- Making Simple Decisions
- Making Complex Decisions

Machine Learning	
Introduction and ANN Structure • Biological neurons and artificial neurons • Model of an ANN • Activation functions used in ANNs • Typical classes of network architectures	Mathematical Foundations and Learning mechanisms • Re-visiting vector and matrix algebra • State-space concepts • Concepts of optimization • Error-correction learning • Memory-based learning • Hebbian learning • Competitive learning
Single layer perceptrons • Structure and learning of perceptrons • Pattern classifier – introduction and Bayes & classifiers • Perceptron as a pattern classifier • Perceptron convergence • Limitations of a perceptrons	Feedforward ANN • Structures of Multi-layer feedforward networks • Back propagation algorithm • Back propagation – training and convergence • Functional approximation with back propagation • Practical and design issues of back propagation learning
Competitive Learning and Self organizing ANN • General clustering procedures • Self organizing feature maps • Properties of feature maps	Fuzzy Neural Networks • Neuro-fuzzy systems • Background of fuzzy sets and logic • Design of fuzzy stems • Design of fuzzy ANNs
MACHINE LEARNING • Bias – Variance tradeoff • Regularisation • Over-fitting • Support Vector Machines • Kernel Trick • PCA and Kernel PCA • K Means Clustering • Self-Organization Maps (SOM) • Kernel induced vector space • Mercer Kernels and Kernel – induced similarity metrics • Reinforcement Learning	DEEP LEARNING • This will be taught in relation to above topics covered. • Logistic and Softmax Regression • Sparse Autoencoders • Vectorization, PCA and Whitening • Self-Taught Learning • Deep Networks • Linear Decoders • Convolution and Pooling • Sparse Coding • Independent Component Analysis • Canonical Correlation Analysis • Demos and Applications

Applications & Projects using Python Libraries

A few examples of Neural Network applications, their advantages and problems will be discussed

- OR Logic, AND Logic & XOR Logic Example using ANN
- **Agriculture Animal Detection like Cattle, Bull Dog etc or any object detection.**
- **Weather Prediction**
- **Soil Health Monitoring**
- **Monitoring Crop Health**
- Character Recognition using SVM
- Automatic Product Classification & Clustering based on Retails Context
- Predictive Analysis based on Datasets values

Using Datasets available on UCI, github and other opensource platforms.

Projects Covered During Training

Training was done with hands-on practical methodology where students were taught about python program, python libraries, machine learning, artificial intelligence, deep learning, regression, CNN, visualization etc. During the training, participants implemented many projects like **rainfall prediction in india**, **crop yield recommendation**, **classification projects** etc.

Students Project Work

After the completion of two weeks classroom hands-on training on Machine Learning & Artificial Intelligence application in Agriculture Domain, participants were assigned some project work in groups.

Project & Group Details

Groups	Group Member 1	Group Member 2	Group Member 3	Group Member 4	Project Name
1	Ninaad Mahajan	Garima Gupta	Shewani	Muskan Kapahi	Leaf Diseases Classification
2	Ankita Kumari Bhagat	Sudha Verma	Sonali Devi	Kashish Sharma	Lemon Quality Control
3	Baneet Kour	Tanishq Sharma	Sanchit Shahu	-	Rice Leaf Disease Classification

Students were asked to create projects on assigned topics and were asked to submit the program files, PPT & Project Report on the assigned project.

All participants submitted their project work within the assigned duration with the project outcome.

Group 1: Leaf Disease Classification
Dataset Used: https://www.kaggle.com/code/vad13irt/plant-disease-classification#Exploratory-Data-Analysis

EXPERIMENTS AND RESULT ANALYSIS:

Dataset

All of the experiments are done by using a leaf classification dataset containing 1472 images where we used 89.8% images for training and 10.1%images for testing purpose. That contains images of 3 classes.

Group 2: Lemon Quality Control
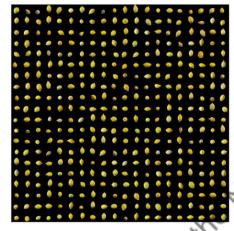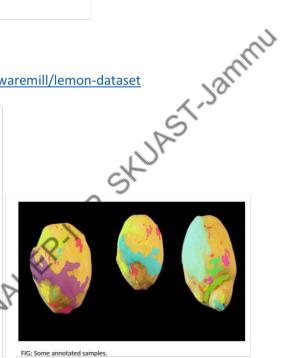Data Set Used: https://github.com/softwaremill/lemon-dataset

FIG: Raw unannotated data

FIG: Some annotated samples.

RESULT AND ANALYSIS:

- All of the experiments are done by using a lemon quality classification dataset containing 2689 images. It contains 8 categories and the shape of data is (200, 200, 3).
- 109 is the shape of the image's array, 2689 is the number of images, (200,200,3) is the shape of each image where 3 represents that image is in RBG format.

- On training the model, the number of epochs run are **200** with the accuracy upto **79.69%**. The following image contains the result.

FIG: Screenshot of trained model with final accuracy

Group 3: Rice Leaf Disease Classification
Dataset Used: https://www.kaggle.com/code/vad13irt/plant-disease-classification#Exploratory-Data-Analysis

Instructor Remarks

All Participants efforts during the training were quite impressive. Project report & program submitted by participants was as per the assigned project outcome. All groups submitted their projects program file & project report on time.

Conclusion

This training program was aimed to cater the needs of Undergraduate and Post Graduate Students of Engineering & Research Professional who have enthusiasm to become a dab hand in handling Machine Learning & AI. This training program covered Machine Learning, Python Programming, Supervised & Unsupervised Learning, Deep Learning, Fuzzy Neural Network, Projects related to applications of Machine Learning & AI in agriculture etc. Participants was also taught to assess and catalyze innovations, problem solving, and discover immediately to the problems that encounter in the field jobs. This was accomplished by the extensive use of intuition, graphical plots and real world examples. This course was designed

to not only cover all the aspects of modelling and simulation, experimentation but also guide the proper content requirement for research paper publications.

Projects related to applications of Machine Learning & AI in Agriculture training was successfully conducted in closed cooperation with all faculty members and students and concluded on 19th April, 2022. It was highly informative for all participants & everybody liked and appreciated it.

Participants List:

S.No	Full Name
1	Muskan Kapahi
2	Kashish Sharma
3	Sonali Devi
4	Baneet Kour
5	Tanishq Sharma
6	Ninaad Mahajan
7	Garima Gupta
8	Sudha Verma
9	Sanchit Shahu
10	Ankita Kumari Bhagat
11	Kashish Sharma

Sample Certificate

All Participants were awarded Certificate of Completion for Machine Learning & AI Training.