**Autonomous Reforestation Robot**

**(Machine learning model for crop prediction via Area analysis)**

**PDE4433 – Machine Learning for Robotics**

**Coursework 01**

N. G. Jayashanka Anushan

MISIS – M01037028

MSc in Robotics

Middlesex University Dubai

# Table of Contents

[Table of Contents 2](#_Toc192600996)

[1). Introduction 3](#_Toc192600997)

[2). Used Dataset 3](#_Toc192600998)

[3). Analysis 4](#_Toc192600999)

[3.1). Machine Learning for Robotics 4](#_Toc192601000)

[3.2). Methodology 4](#_Toc192601001)

[3.3). Used ML model and effectiveness 4](#_Toc192601002)

[3.3.1). First Stage: Image Processing Model 5](#_Toc192601003)

[3.3.2). Second Stage: Crop Type Prediction Model 5](#_Toc192601004)

[3.4). Model Evaluation 5](#_Toc192601005)

[4). Conclusion 5](#_Toc192601006)

[5). Future improvements. 5](#_Toc192601007)

[6). Live Demonstration 5](#_Toc192601008)

[7). References 5](#_Toc192601009)

***List of figures***

[Figure 2‑1 Dataset Sample Source:(Author Developed) 3](#_Toc193566657)

***List of tables***

# 

# ****Introduction****

This project focuses on the development of an Autonomous Reforestation Robot utilizing machine learning techniques. The primary objective is to develop a machine learning model that can integrate a robot which can analyze a given area by scanning it comprehensively and collecting essential environmental data through various sensors.

The robot will gather key parameters such as soil moisture, humidity, nitrogen, potassium, and phosphorus levels. These collected data points will then be analyzed to determine the most suitable crop type for the specified area. The analysis will primarily focus on identifying the suitable crop type followed by aggregating the sensor data to derive meaningful insights. The final predictions will be generated through a comprehensive reanalysis of all collected information.

All the data collected via sensors will be processed using a supervised learning model, which will predict the optimal crop type. This approach aims to enhance precision in crop recommendation, thereby contributing to efficient and sustainable agricultural practices.

# Used Dataset

For the analysis propose the data collected from Kaggle dataset.

Data Source: https://www.kaggle.com/datasets/varshitanalluri/crop-recommendation-dataset

This dataset consists of 8 features and one from these features is the target output.

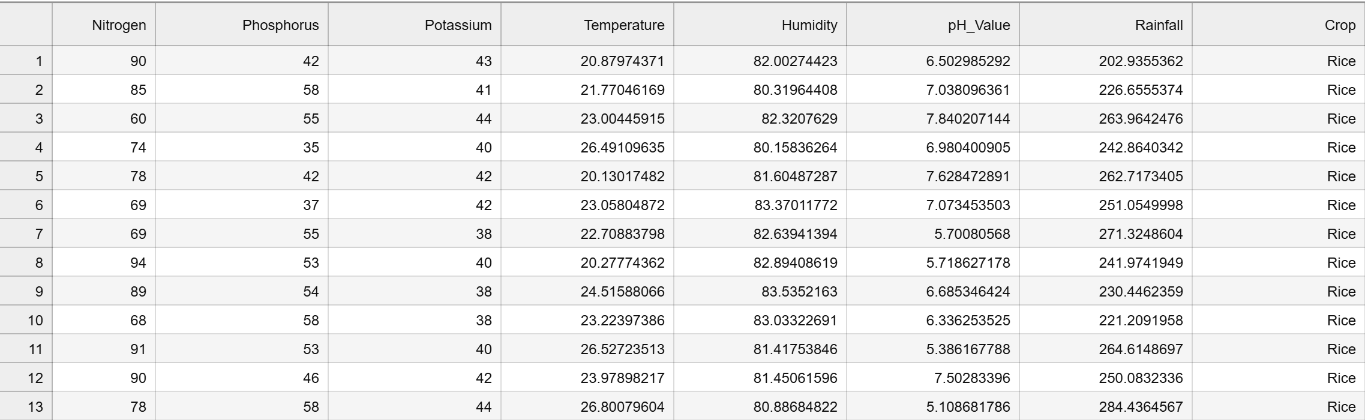


Figure ‑ Dataset Sample Source:(Author Developed)

Features;

Nitrogen, Phosphorus, Potassium, Temperature, Humidity, pH\_Value, Rainfall, Crop

# Analysis

## Machine Learning for Robotics

Main task of this project is to create a suitable machine learning model. Collecting real-time environmental data and processing the data to generate accurate predictions.

The collected data is analyzed to predict the most suitable crop type for the given area. To achieve this, a trained machine learning model is employed, capable of making accurate predictions based on the acquired data. Machine learning techniques are used to enhance the model's predictive capabilities, ensuring reliable and data-driven decision-making for the project.

By integrating machine learning into robotics, this project aims to develop an intelligent system that can autonomously collect, process, and analyze environmental data, contributing to more efficient and precise agricultural planning.

## Methodology

In this project, several types of data involve which are in tabular frame utilized to achieve the desired outcome. The data sources include text, and numerical data, which will be processed through different machine learning models.

## Used ML model and effectiveness

Since the final target outcome is categorical data, decided to train model with Decision Tree and Random Forest architectures.

**Crop Type Prediction Model**

The second model is responsible for predicting the most suitable crop type based on the analyzed data. To achieve optimal performance, multiple machine learning algorithms will be tested, and the best-performing model will be selected for the final implementation. The models considered for this phase include:

1. Decision Tree
2. Random Forest

By evaluating these models, the most accurate and efficient algorithm will be integrated into the project to enhance prediction reliability.

## Model Evaluation

From above those models, to mitigate the risk of overfitting and enhance prediction accuracy, training was halted at an optimal point, with extensive fine-tuning applied to achieve the best model performance. Both model brought same level accuracy for the training as below;

1. Model trained by Decision Tree
   1. Train Accuracy: 95.39%
   2. Test Accuracy: 95.00%
2. Model trained by Random Forest Model
   1. Train Accuracy: 95.58%
   2. Test Accuracy: 93.94%

As per the best accurate prediction, Decision Tree model selected for further Robotic development.

# Conclusion

5- conclusion and

# Future improvements.

How to improve this

# Live Demonstration

6- link to demo.

# References

**There are no sources in the current document.**