DAYANANDA SAGAR UNIVERSITY

KUDLU GATE, BANGALORE-560068

Bachelor of Technology

in

COMPUTER SCIENCE AND ENGINEERING

Major Project Phase-II Report

CROP YIELD PREDICTION USING MACHINE LEARNING

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CERTIFICATE

This is to certify that the Phase-II project work titled **"CROP YIELD PREDICTION USING MACHINE LEARNING"** is carried out by **B PRATHIVAL (ENG19CS0057), S M MAHONYA (ENG19CS0268), S P CHITRA SHREE (ENG19CS0269), SAGAR S M (ENG19CS0274)** bonafide students of Bachelor of Technology in Computer Science and Engineering at the School of Engineering, Dayananda Sagar University, Bangalore in partial fulfillment for the award of degree in Bachelor of Technology in Computer Science and Engineering, during the year **2022-2023**.

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Date:	Date:	Date:

Name of the Examiner **Signature of Examiner**

1.

2.

DECLARATION

We, **B PRATHIVAL(ENG19CS0057), S M MAHONYA(ENG19CS0268), S P CHITRA SHREE(ENG19CS0269), SAGAR S M (ENG19CS0274),** are students of eighth semester B. Tech in **Computer Science and Engineering**, at School of Engineering, **Dayananda Sagar University**, hereby declare that the Major Project Stage-II titled **"CROP YEILD PREDICTION USING MACHINE LEARNING"** has been carried out by us and submitted in partial fulfilment for the award of degree in **Bachelor of Technology in Computer Science and Engineering** during the academic year **2022-2023**.

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LIST OF ABBREVIATIONS

GDP	Gross Domestic Product
RNN	Recurrent Neural Network
KNN	K Nearest Neighbors
GUI	Graphical User Interface
NPK	Nitrogen Phosphorous Potassium

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ABSTRACT

India is an Agriculture based economy whose most of the GDP comes from farming. The motivation of this project comes from the increasing suicide rates in farmers which may be due to low harvest in crops. Climate and other environmental changes have become a major threat in the agriculture field. Machine learning is an essential approach for achieving practical and effective solutions for this problem. Predicting yield of the crop from historical available data like weather, soil, rainfall parameters and historic crop yield. We achieved this using the machine learning algorithm. We will do a comparative study of various machine learning algorithms, i.e. K Nearest Neighbour, Random Forest, Linear Regression , decision trees and chose random forest Algorithm which gave an highest accuracy.

Our system has overcome the drawbacks of the primitive methods used. Farmers can test the soil multiple number of times during cultivation process and take necessary precaution to get good yield. At the end reports will be generated so farmers can keep record of fertility.

CHAPTER 1

INTRODUCTION

CHAPTER 1 INTRODUCTION

India is an Agriculture based economy whose most of the GDP comes from farming. In recent times, it has become inevitable to use technology to create awareness about cultivation. The seasonal climatic conditions are also being changed against the fundamental assets like soil, water and air which lead to insecurity of food.

In a scenario, crop yield rate is falling short of meeting the demand consistently and there is a need for a smart system which can solve the problem of decreasing crop yield.The motivation of this project comes from the increasing suicide rates in farmers which may be due to low harvest in crops.

The crop yield of plants relies on different factors like on climatic, geographical, organic, political and financial elements. For farmers, it is difficult when there is more than one crop to grow especially when the market prices are unknown to them. Citing the Wikipedia statistics, the farmer suicide rate in India has ranged between 1.4 and 1.8 per 100000 total population, over a 10-year period through 2005. While 2014 saw 5650 farmer suicides, the figure crossed 8000 in 2015.

Therefore, to eliminate this problem, we propose a system which will provide crop selection based on economic and environmental factors to reap the maximum yield out of it for the farmers which will sequentially help meet the elevating demands for the food supplies in the country.

The proposed system uses machine learning to make the predictions. The system will provide crop yield and crop selection based on weather attributes suitable for the crop to get the maximum yield out of it for the farmers. The system makes predictions of the productions of crops by studying the factors such as rainfall, temperature, area (in hectares), season, etc. The system also helps in suggesting whether a particular time is the right one to use fertilizers.

Crop yield prediction is an important agricultural problem. Every farmer always tries to know how much yield will be produced and whether it meets their expectations. In the past, yield prediction was calculated by analysing a farmer's previous experience on a particular crop. Accurate information about the history of crop yield is an important thing for making decisions related to agricultural risk management.

Fig.1.1. Factors affecting of crop yield

These are the factors required to predict the yield of crops in a particular area when given inputs of soil, weather and crop area to predict the yield.

1.1 OBJECTIVE

Crop yield prediction is an essential task for the decision-makers at national and regional levels (e.g., the EU level) for rapid decision-making. An accurate crop yield prediction model can help farmers to decide on what to grow and when to grow

i. To help the government of fix the price of different commodities.

ii. To know the actual situation of crop production.
iii. To make a future plan.
iv. To help the farmer/government to store appropriate quantities of produce.
v. To decide whether food will imported or exported of assessing of the crop

1.2 SCOPE

Crop yield is the measure of crop produced per area of land. It's an important metric to understand because it helps us understand food security and also explains why your crops can cost more one year and then less the following year. Predicting crop yield is crucial to addressing emerging challenges in food security, particularly in an era of global climate change.

Accurate yield predictions not only help farmers make informed economic and management decisions but also support famine prevention efforts.Farmers require accurate yield estimates for a number of reasons: crop insurance purposes. delivery estimates. planning harvest and storage requirements.

Properly integrated, predictive analytics enables the farmer to not only conduct better practices but also to be able to make predictions and extemporaneous adjustments due to factors such as weather, as well as more accurate calculations regarding product and fertilizer type, amounts, and application rates.Previous year‘s production data is an essential element for predicting the current yield.

The goal of this project is to help the farmers by combining agriculture and technology.To help in cultivation of the agricultural practices of our country.Further it can be used to reduce the loss faced by the farmers and improve the crop yield to get better capital in agriculture.

SOCIETAL/ENVIRONMENTAL IMPACT/NOVELTY OF IDEA

- Agriculture is a major source of GHGs which contribute to the greenhouse effect and climate change.
- Farmers require accurate yield estimates for a number of reasons: crop insurance purposes. delivery estimates, planning harvest and storage requirements.
- Helpful for organic soil cultivation (ploughing and overturning of soils).

CHAPTER 2

PROBLEM DEFINITION

CHAPTER 2 PROBLEM DEFINITION

Looking at the current situation faced by farmers in India, we have observed that they are facing problems related to crop yield. They are not able to predict the yield properly. Hence they suffer a huge loss even after investing a lot of amount and time into it. The reason behind this is change in weather conditions and farmers are not able to predict the price of the farm accurately. The goal of the project is to help the users choose a suitable crop to grow in order to maximize the yield and hence the profit. The system proposed tries to overcome the drawbacks of existing systems and make predictions by analysing structured.

CHAPTER 3

LITERATURE REVIEW

CHAPTER 3 LITERATURE REVIEW

1. A Crop Yield Prediction Using Deep Reinforcement Learning Model for Sustainable Agrarian Applications [1] Authors :- P.M. Durairaj Vincent.

Year of Publication :- 2020

Methodology :- A First step is Data collection - crop dataset. Splitting the data into training and test set. Second step is pretraining of rnn(building rnn with n hidden layers). Next step is to Build deep Q network, initialize the parameters utilizing the weights from pre-training and add a linear layer converting RNN output to Q-value. End of training. Testing starts. Add new layer that cut puts maximum Q value. Input the testing set to the agent. The agent provides the crop yield result.

Merits -

- The proposed method makes it feasible for the agent to identify and learn the crop yield prediction through self-exploration and experience replay.

Demerits: -

- Can Further improvement in the computing efficiency of the training process is an intriguing option to be concentrated

2. Crop yield prediction using machine learning algorithms[2] authors: Anakha Venugopal, Aparna S

Year of Publication: 2021

Methodology: Data pre-processing, By applying different techniques like replacing missing values and null values, we can transform data into an understandable format. The final step on data pre-processing is the splitting of training and testing data. Factors affecting Crop Yield and Production.

This paper we include factors like Temperature, Rainfall, Area, Humidity and

Windspeed Comparison and Selection of Machine Learning Algorithm

In this paper we include the following machine learning algorithms for selection and accuracy.

a)Logistic Regression b)Naive Bayes c)Random Forest

There is API where we fetch the data such as temperature, humidity, rainfall etc.The data gets stored on to the database on the server. Using the mobile application, the user can provide details like location, area, etc.The trained Random forest model deployed on the server uses all the fetched and input data for crop yield prediction,finds the yield of predicted crop with its name in the particular area.

Merits:

- This work is employed to search out the gain knowledge about the crop that can be deployed to make an efficient and useful harvesting.

Demerits:

- Integrating soil details to the system needs to be done, as for the selection of crops knowledge on soil is also a parameter

3. Crop yield Prediction using Machine Learning [3]

Authors:-Chaitanya Chandvidkar,Mayank Champaner

Year of Publication :-2020

Methodology :

- Data collection and data partition
- Data collection we collect the data from various sources and prepare data sets.

- Data Partitioning: The Entire dataset is partitioned into 2 parts.

Merits:

- The developed webpage is user friendly
- The accuracy of predictions are above 75 per cent

Demerits:

- Needs improvement to get better accuracy.

4. Design and Implementation of crop yield Prediction Model In Agriculture[4]

Authors :-Sangeeta,Shruthi G

Year of Publication:-2020

Methodology: Machine learning mainly consists of three learning methods, namely supervised learning, reinforcement learning and unsupervised learning methods of training a model. This model gives clear picture of huge amount of data capture and pre-processing of data to remove the unwanted data such as NULL etc presented in it. Train dataset to detect the crop yield present in the dataset. Apply the machine learning techniques which are helpful for finding crop yield for any of new data occurred in the data. data acquisition - suitable machine learning algorithm must be applied to compute efficiency and capability of the model, Random Forest, as the name says it is a combination of number of decision trees and an ensemble classification model. decision tree employs greedy method, attribute chosen in the first step cannot be used later to give better classification of data.

Merits:

- The Further it can be used to reduce the loss faced by the farmers and improve the crop yield to get better capital.

Demerits:

- The model needs improvement by integrating this with other departments like horticulture, sericulture, and others towards the agricultural development of our country.

5. Crop Yield Prediction using Different Machine Learning Techniques[5]

Authors: Pallavi Shankarrao Mahore , Dr. Aashish A. Bardekar

Year of Publication: 2021

Methodology:

- information collection from soil
- feed the information to the system
- run the programme and wait for the output
- observe the output
- matching the observed output with predicted data.

Dataset: This dataset consists of factors like temperature, rainfall, moisture, humidity, alkaline, sandy.The datasets have been obtained from the Kaggle website and other different websites. The data set has instance or data that have taken from the past historic data. It includes 8 parameters or features like the temperature, rainfall, moisture, humidity, alkaline, sandy etc.

Merits:

- This paper presented the various machine learning algorithms for predicting the yield of the crop on the basis of temperature, rainfall, season and area. Random Forest gives the highest yield prediction accuracy. By combining rainfall, temperature along with other parameters like season and humidity, land type can be made.

Demerits:

- Improvement needed in the system for greater yield.

6. Crop yield prediction using machine learning techniques [6]

Authors: Ashwini I. Patil, Ramesh A. Medar, Vinod Desai

Year of Publication:2020

Methodology: First step is to input an experimental information set, may be the crop information and soil information along with their outcomes. Second step is to collect the data and then pre-process the dataset for the junk or noise removal. Third step is to separate the data into training and testing datasets. The information must be partitioned into two datasets. The training dataset is having the greatest rate of information, so it will train most of the example datasets to produce the yield. The training samples are collected and the testing set will use the remaining information to see the system performance. The fourth step is to apply the linear regression on the trained datasets last step is to apply the trained linear regression model on the test datasets and calculate the R values, and then compare the values with the unique models of linear regression models.

Merits:

- Effectiveness which carries with it techniques with categories of Effectiveness, Precision, accuracy of the model through the optimization LR proposed model.

Demerits:

- Improvement needed in the system for greater yield and utilization for crop importance.

7. Crop yield prediction using supervised learning techniques[7]

Authors: M. Suganya, Dayana R, Revathi.R

Year of Publications:2020

Methodologies: The first step is classification. Classification algorithms uses classifiers to classify a group of similar objects under one type and when a new object is introduced, prediction is made so as to put that object into one of the class. This technique helps in categorizing data in different classes. Next step is to use five different classifiers namely Logistic Regression, K-Nearest Neighbor, Random Forest, Decision Tree, Support Vector Machine.

Merits:

- As maximum types of crops will be covered under this system, farmer may get to know about the crop which may never have been cultivated and lists out all possible crops, it helps the farmer in decision making about the crop to cultivate
- Experimental results and its analysis: Logistic Regression is the best Algorithm and Support Vector Machine is the worst Algorithm for Crop Yield Prediction.

Demerit:

- Data collection, data analysis, addressing data content, quality, and structure adds up to a time-consuming to-do list.

After analysing the papers we have found some drawbacks in the current system.The current system does not provide recommendation of suitable crop and predict the yield for thatcrop. We will be testing with different algorithms like linear regression ,decision tree,knn and random forest to suggest the best model with high accuracy.

CHAPTER 4

PROJECT DESCRIPTION

CHAPTER 4 PROJECT DESCRIPTION

In the project, we introduce a scalable, accurate, and inexpensive method to predict crop yield using available climatic data and machine learning. Our machine learning approach can predict collected temperature, rainfall, crop yield from various sources like kaggle . Machine learning algorithms like linear regression algorithm,random forest,decision tree,knn to predict crop yield based on factors like temperature, rainfall, and pressure.

In the proposed method, initially the raw data set was collected and it is subjected to preprocess for noise removing (removal of missing values) and computational methods From that dataset, it is subjected to Feature selection for make a predictive modeling.

In this proposed approach it is mainly focused on Regression Techniques .

4.1 SYSTEM DESIGN

Soil PH , Temperature , Humidity, Rainfall and Crop data are collected. Data preprocessing is done by data cleaning and data transformation. We then use the random forest to predict the yield in the current year with the help of dataset. We then check if the model is best fit for the given problem and corresponding data.

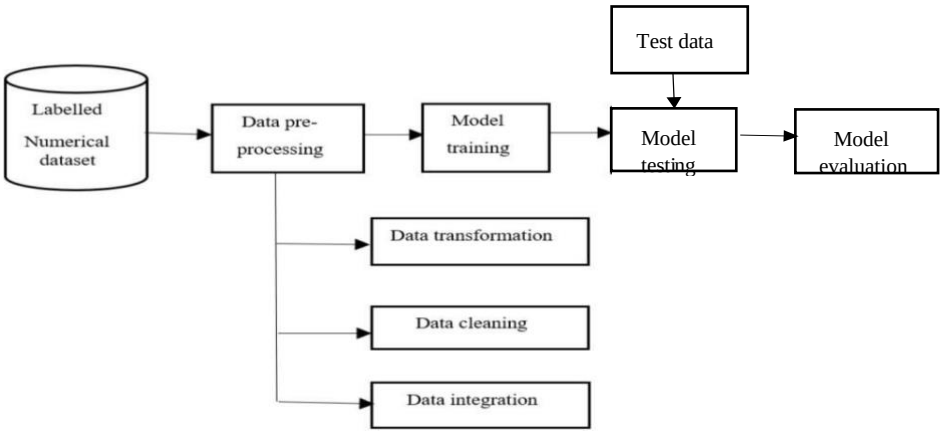


Fig 4.1 flowchart for the working of the designed project

We will first import the data. Then perform data pre-processing which has 3 steps-data cleaning, data integration and data transformation. We then build and train the model. We split data into two sets, such as 'training set' and 'testing set'. You train a model over a set of data, providing it an algorithm that it can use to reason over and learn from those data and then the prediction of yield and recommendation of crop is done.

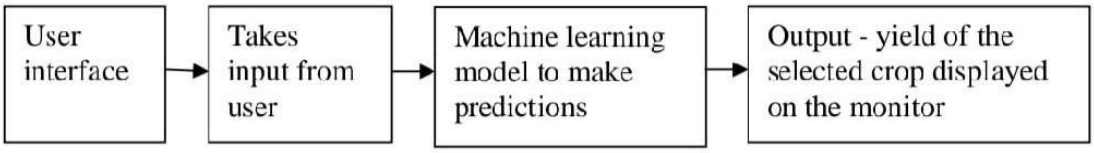


Fig 4.2 testing design

A user interface is created so that the users can use it to predict the yield of a crop efficiently. User needs to give inputs of soil, weather and crop area . Based on these inputs our model predicts the yield with the help of dataset. The predicted yield is shown on the monitor itself.

CHAPTER 5

REQUIREMENTS

CHAPTER 5 REQUIREMENTS

5.1 Functional Requirements

Functional requirements refer to the functionalities that apply to a software /application.

The functional requirements of crop yield prediction are listed below:

The main function of our project is to analyse the crop yield in unconstrained scenarios.

- Take data input into the application.
- Processing the input data with the dataset.
- Predicting the yield with the help of a machine learning algorithm.
- Display the appropriate results after predicting.

5.2 Non-functional requirements

- Low Response time - The time the system takes to load and the time for responses on any action the user does.
- Correctness: It follows a well-defined set of procedures and rules to compute and also rigorous testing is performed to confirm the correctness of the data.
- Ease of Use: The front end is designed in such a way that it provides an interface which allows the user to interact in an easy manner.
- Robustness: This software is being developed in such a way that the overall performance is optimized and the user can expect the results within a limited time with utmost relevancy and correctness.

5.3 HARDWARE AND SOFTWARE REQUIREMENTS

Hardware requirements :

- Intel Processor: minimum 1GHz.

- Memory (RAM): Minimum of 2gb RAM.
- Hard drive: 32gb or higher.
- Windows XP and above

Software requirements:

- Programming language: Python 3.6 and above version
- Platform - visual studio
- Python libraries - numpy, pandas,matplotlib.pyplot

CHAPTER 6

METHODOLOGY

CHAPTER 6 METHODOLOGY

The data is accessed to do comparison and data analysis of collected data with the possible historical data collected based on region, climate by applying different machine learning algorithms we get the Predicted results through web application.

Data collection

Data collection is the most efficient method. We have collected the dataset from Kaggle. This dataset must contain the following attributes i)Soil PH ii) Temperature iii) Humidity iv) Rainfall v) Crop data vi) NPK values, those parameters will consider for crop prediction. For the annual rainfall prediction, we collect previous year rainfall data.

Pre-processing of Data

After gathering data from a variety of resources. Before training the model, the dataset must be pre-processed. Data pre-processing can be done in stages, beginning with reading the collected dataset and progressing to data cleaning.

Cleaning the Data

In data cleaning Some attributes in the datasets are redundant those characteristics are not taken into account in crop prediction. As a result, we must remove undesirable attributes and datasets that contain some missing values. we need to remove undesirable attributes by using some machine learning techniques in order to improve precision. Then specify the model's goal. Using the sklearn library, the dataset will be split into training and test sets after it has been cleaned.

Transformation Data

Transformation of Data is the mathematical dataset transformation; data is transformed into appropriate forms for the data mining procedure. This enables us to better

comprehend the data by planning the dozens of records. Normalization is a type of transformation. Model Training with Random Forest Regressor Model training We split the Training data set into 25 percent and testing data set in to 75 percent.

MACHINE LEARNING ALGORITHMS ARE USED

Random Forests, KNN, linear regression, decision tree algorithms are compared to find which gives the accuracy. We found that random forest gives the best accuracy with 98%. Using this algorithm we performed yield prediction and recommendation of crop.

Architecture of the Prediction Model

Soil moisture, Temperature , Humidity, Rainfall and Crop data are collected. Data preprocessing is done by data cleaning and data transformation. We then use the random forest to forecast the yield in this current year with the help of dataset. We then check if the model is best fit for the given problem and corresponding data. The data is acquired to do comparison and data analysis from the collected data with the possible historical data collected based on region, climate, and soil parameters by applying different machine learning algorithms we get the Predicted results through web application.

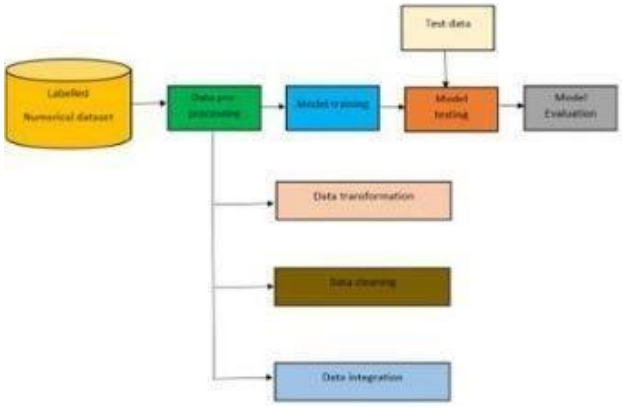


Fig.6.1 Architecture of the Prediction Model

Feature selection

Crop production is influenced by a number of factors like variables i.e. weather circumstances, soil characteristics, the availability of irrigation, the demand for fertiliser, farm capacity, etc. In general, early prediction is carried out by applying machine learning algorithms to analyse the aforementioned data, which has been archived over a number of years. Before beginning the prediction process using machine learning algorithms, it is crucial to narrow down the collection of all accessible qualities to those that are relevant and more helpful (referred to as feature selection), as these are the attributes that actually effect the yield.

Classification technique

This work utilises Random forest classifier, Decision tree classifier, KNN by analyzing the three classifiers we recommend the Random forest classifier because its giving a higher accuracy compared to others We used the test features and each random decision tree to predict the output and the outcome that is stored. We then calculated the vote that each decision tree provides for each predicted outcome. Finally, we looked at highly predicted outcomes, which represent the random forest algorithm's final forecast.

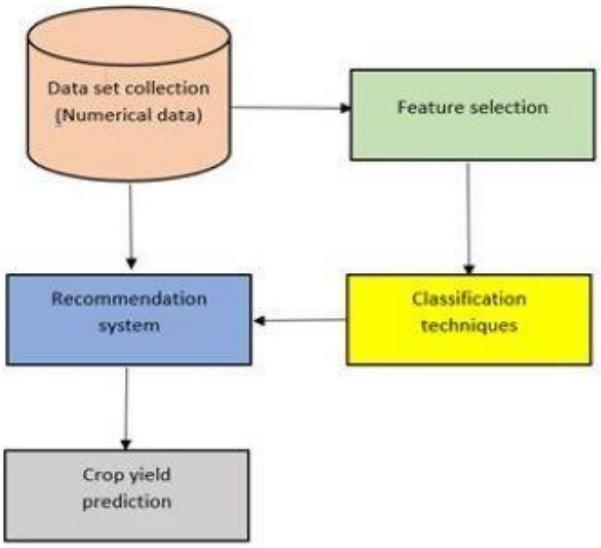


Fig 6.2 Architecture of Recommendation System

Test design

User Interface is created where inputs are taken from user like temperature, rainfall, humidity, ph, NPK values . The model then recommends the crop based on these factors. The user can choose the state and district they want to cultivate , and even the season, then enter the area to get the yield prediction.

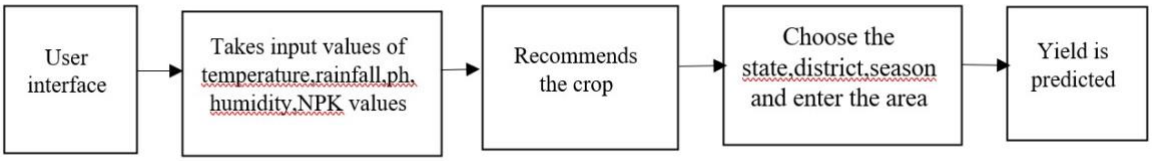


Fig.6.3 : Test Design

CHAPTER 7

EXPERIMENTATION

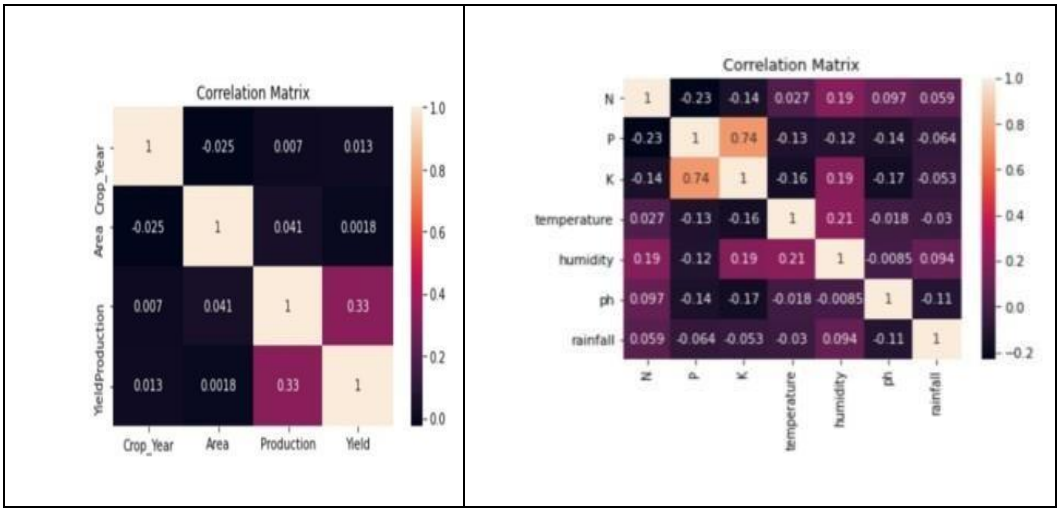
CHAPTER 7 EXPERIMENTATION

We have taken a dataset and analysed it. We import all required packages. We have done data pre-processing steps to remove null values and clean the dataset. The data is split into testing and training dataset. We use different algorithms to find which gives the best results.

In this section we will be discussing about the datasets used, the set up of the experimention and the analysis of the result.

7.1 Data set experimented

The datasets were acquired from Kaggle and include information on the name of the crop, the area, the quantity produced, the temperature, the amount of rainfall, the humidity, and the pH in several states of India. There are 2,46,092 records in the collection. The data preprocessing steps has given us a precise dataset.



(a) **(b)**

Fig 7.1 (a) Heat map with yield attributes and (b) crop recommendation attributes

Machine learning techniques like linear regression, random forest, decision tree, and KNN were utilised for accuracy comparison, prediction, and recommendation. A graph was created to display the performance of these models after these methods were trained on the data set. Figures below display how these models performed. The most accurate of these algorithms was Random Forest.

7.2. Performance measures evaluated

The following performance measures are taken up

$$Adjusted R2 score : \quad 1–((1 − R2)(N − 1)/N − p − 1) \tag{1}$$

Where R2=sample R-square

P=quantity of predictors

N= sample size overall *Calculating*

$$R2 \text{ score } : \quad R2 = 1 − (anticipatedvariation/totalvariation) \tag{2}$$

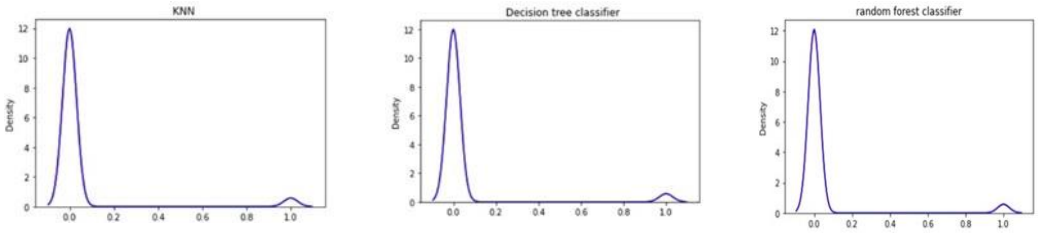
$$Accuracy : \quad Accuracy = correctlypredictedoutcomes/allotheroutcomes. \tag{3}$$

7.3. Results and discussion

Data pre-processing steps have given the accurate data set. Using this data set we have performed the following analysis.

Crop recommendation analysis. The crop that can be cultivated in a certain state at the proper time was predicted using Random Forest, which had the maximum accuracy. The most widely grown crops in India were selected, and their names and yields were computed based on the production area, humidity, temperature, rainfall, and PH values. The pre-processed data set was trained using Random Forest, which displays the accurate crop prediction for the chosen state.

Decision tree classifier model shows a model score of 0.94,KNN shows 0.97 and random forest classifier shows 0.98. Therefore random forest classifier is giving a higher accuracy compared to others



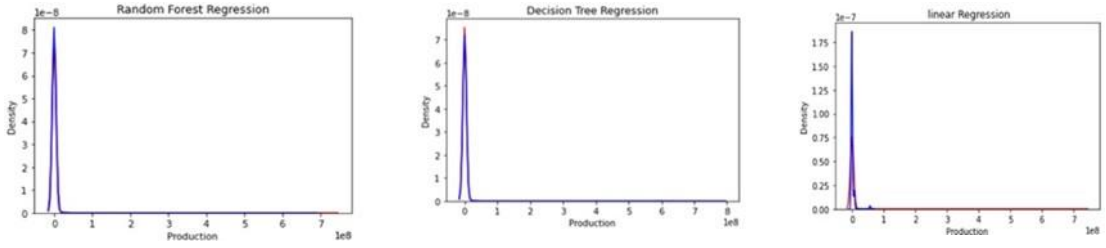
(a) **(b)** **(c)**

Fig.7.2 Performance of (a) KNN model (b) Decision tree classifier (c) random forest classifier

Table 7.3.1 Performance Scores

Algorithm	Model Score	R2Score	Adjusted R2Score
Random forest classifier	0.98	0.97	0.97
Decision tree classifier	0.94	0.93	0.97
KNN	0.97	0.94	0.97

Crop Yield Prediction Analysis. The production of the crop projected by Random Forest was mapped to that crop. To obtain the proper crop output, the user's entered area will be separated from the production. The graphs are plotted against density and production.



(a) **(b)** **(c)**

Fig.7.3 performance of (a) Random forest regression(b) Decision Tree Regreesion (c) linear Regression

Table 7.3.2Performance Scores

Algorithm	Model Score	R2Score	Adjusted R2Score
Random forest regressor	0.98	0.98	0.13
Decision tree regressor	0.95	0.95	0.13
Linear regressor	0.15	0.15	0.13

Linear Regression model shows a very low model score of 0.15, decision tree regressor shows 0.95and random forest regressor shows 0.98. Therefore random forest regressor is giving a higher accuracy compared to others. Yield equals Production/Area.

Our farmers may choose the proper crop to plant at the right time to receive the highest yield by using the appropriate crop name that is anticipated with its yield.

Analysing these algorithms, we have found that random forest gives a higher accuracy. Therefore, we have chosen random forest for recommendation of crop and crop yield prediction.

CHAPTER 8

TESTING AND RESULTS

CHAPTER 8 TESTING AND RESULTS

Here are some results we got on running our project. We first get this user interface where it asks the user to enter the values of temperature, humidity, ph, rainfall, NPK values and then recommends the crop suitable to grown . Then the user can even test how much yield the crop gives by choosing the state, district, season and by entering the area. The yield for that crop is then predicted as shown in the figures below.

Fig. 8.1 GUI OF CROP YEILD AND PREDICTION FOR CROP 1

Fig. 8.2 GUI OF CROP YEILD AND PREDICTION FOR CROP 2

CHAPTER 9

CONCLUSION

CHAPTER 9 CONCLUSION

With the aid of machine learning algorithms, this research focuses on crop forecast and yield computation. The current study showed how data mining techniques may be used to forecast agricultural yield based on the climate input factors. Accuracy is calculated using several machine learning approaches. The Random Forest classifier was applied to crop forecasting in the selected district. The implementation of a system for historical databased crop prediction. The suggested method helps farmers choose which crop to grow in the field. The user-friendly website created for crop yield prediction can be utilised by any user to anticipate crop yield for their favourite crop by entering climate data for that region.

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SAMPLE CODE

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import numpy as np
import pandas as pd
import matplotlib.pyplot as plt

import pickle

final = ['Apple', 'Banana', 'Blackgram', 'Coconut', 'Coffee', 'Cotton(lint)',
      'Grapes', 'Jute', 'Lentil', 'Maize', 'Mango', 'Moth', 'Orange',
      'Papaya', 'Pome Granet', 'Rice', 'Water Melon']



filename = 'random_forest_crop_rec.pkl'
with open(filename, 'rb') as file:
multi_target_forest = pickle.load(file)

filename = 'random_forest_model.pkl'
with open(filename, 'rb') as file:
   model = pickle.load(file)

# model.score(x_test,y_test)

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'Crop_other misc. pulses': [0], 'Crop_other oilseeds': [0]}

from tkinter import *
from tkinter import
ttk import tkinter as tk
from PIL import ImageTk, Image

root = Tk() root.title('Crop
Recommendation')
root.geometry('1000x800')
root.configure(background="#f0f0f0")

# Load the background image
bg_image = Image.open("bg.png")
bg_image = bg_image.resize((1000, 800), Image.ANTIALIAS)
bg_image = ImageTk.PhotoImage(bg_image)

# Create a label for the background image
bg_label = Label(root, image=bg_image)
bg_label.place(x=0, y=0, relwidth=1,
relheight=1)

# Define a consistent font for the UI
font = ('Helvetica', 16)

# Add a consistent color scheme for
the UI bg_color = "#f0f0f0" fg_color
```

```
= "#333333" btn_color = "#4b4b4b"
btn_fg_color = "#ffffff"

# Create a label for the title
title_label = Label(root, text="Crop Recommendation", font=('arial', 20, 'bold'), bg=bg_color,
fg=fg_color) title_label.grid(row=0, column=0, columnspan=2, pady=20)

title2_label = Label(root, text="Yeild Prediction", font=('arial', 20, 'bold'), bg=bg_color, fg=fg_color)
title2_label.grid(row=0, column=3, columnspan=2, pady=20)

# Create labels for the input fields
nitrogen_label = ttk.Label(root, text='Nitrogen:', font=font, background=bg_color, foreground=fg_color)
nitrogen_label.grid(row=1, column=0, padx=10, pady=10)

phosphorus_label = ttk.Label(root, text='Phosphorus:', font=font, background=bg_color,
foreground=fg_color)
phosphorus_label.grid(row=2, column=0, padx=10, pady=10)

potassium_label = ttk.Label(root, text='Potassium:', font=font, background=bg_color,
foreground=fg_color) potassium_label.grid(row=3, column=0, padx=10, pady=10)

temperature_label = ttk.Label(root, text='Temperature:(°C)', font=font, background=bg_color,
foreground=fg_color)
temperature_label.grid(row=4, column=0, padx=10, pady=10)

humidity_label = ttk.Label(root, text='Humidity:', font=font, background=bg_color, foreground=fg_color)
humidity_label.grid(row=5, column=0, padx=10, pady=10)

ph_label = ttk.Label(root, text='PH:', font=font, background=bg_color, foreground=fg_color)
ph_label.grid(row=6, column=0, padx=10, pady=10)

rainfall_label = ttk.Label(root, text='Rainfall:', font=font, background=bg_color, foreground=fg_color)
rainfall_label.grid(row=7, column=0, padx=10, pady=10)

# Create input fields
nitrogen_entry = Entry(root, width=30)
nitrogen_entry.grid(row=1, column=1, padx=10, pady=10)

phosphorus_entry = Entry(root, width=30)
phosphorus_entry.grid(row=2, column=1, padx=10, pady=10)

pottasium_entry = Entry(root, width=30)
pottasium_entry.grid(row=3, column=1, padx=10, pady=10)

temperature_entry = Entry(root, width=30)
temperature_entry.grid(row=4, column=1, padx=10, pady=10)
```

```
humidity_entry = Entry(root, width=30)
humidity_entry.grid(row=5, column=1, padx=10, pady=10)

ph_entry = Entry(root, width=30)
ph_entry.grid(row=6, column=1, padx=10, pady=10)

rainfall_entry = Entry(root, width=30)
rainfall_entry.grid(row=7, column=1, padx=10, pady=10)


def recommend():
    n = nitrogen_entry.get()      p =
phosphorus_entry.get()      k =
pottasium_entry.get()
temperature = temperature_entry.get()
humidity = humidity_entry.get()
ph = ph_entry.get()      rainfall =
rainfall_entry.get()      data = {'N':
[int(n)],
    'P': [int(p)],
    'K': [int(k)],
    'temperature': [float(temperature)],
    'humidity': [float(humidity)],
    'ph': [float(ph)],
    'rainfall': [float(rainfall)]}
    print(data)

    df = pd.DataFrame(data)
    print(df.head())
    out = np.argmax(multi_target_forest.predict(df))
print(out)
    crop_name.set(final[out])


ttk.Button(root, text='Recommendation', command=recommend, style='TButton').grid(row=10,
column=0, columnspan=2, pady=20)


crop_name = StringVar()
crop_name.set('')

# Create a Label widget to display the predicted crop name
crop_label = Label(root, textvariable=crop_name, font=font, background=bg_color, foreground=fg_color)
crop_label.grid(row=12, column=0, columnspan=2, padx=10, pady=10)

# Create the state label and dropdown
state_label = ttk.Label(root, text='State:', font=font, background=bg_color, foreground=fg_color)
state_label.grid(row=1, column=3, padx=10, pady=10)
```

```
state_var = StringVar()
state_dropdown = ttk.OptionMenu(root, state_var, *state_districts.keys())
state_dropdown.grid(row=1, column=4, padx=10, pady=10)

# Create the district label and dropdown
district_label = ttk.Label(root, text='District:', font=font, background=bg_color, foreground=fg_color)
district_label.grid(row=2, column=3, padx=10, pady=10)

district_var = StringVar() district_dropdown =
ttk.OptionMenu(root, district_var, '')
district_dropdown.grid(row=2, column=4, padx=10,
pady=10)

# Function to update the district dropdown when a new state is
selected def update_district_dropdown(*args):
   # Get the selected state
selected_state = state_var.get()

   # Update the district dropdown options based on the selected state
district_dropdown['menu'].delete(0, 'end')     for district in state_districts[selected_state]:
district_dropdown['menu'].add_command(label=district, command=lambda value=district:
district_var.set(value))

# Update the district dropdown when a new state is selected
state_var.trace('w', update_district_dropdown)

season_label = ttk.Label(root, text='Season:', font=font, background=bg_color, foreground=fg_color)
season_label.grid(row=3,column=3, padx=10, pady=10)

options_season = StringVar(root)
options_season.set("Select Option") # default value

om3 = ttk.OptionMenu(root, options_season, 'Kharif     ', 'Whole Year ', 'Autumn     ', 'Rabi       ', 'Summer
',
'Winter     ')
om3.grid(row=3, column=4, padx=10, pady=10)

area_label = ttk.Label(root, text='Area:', font=font, background=bg_color, foreground=fg_color)
area_label.grid(row=4,column=3, padx=10, pady=10)

area_entry = Entry(root, width=30)
area_entry.grid(row=4, column=4, padx=10, pady=10)


def predict():        crop = 'Crop_' +
crop_name.get()        district =
```

```
'District_Name_' + district_var.get()        area
= area_entry.get()
       season = 'Season_' + options_season.get()
       # model.predict()
data[crop] = [1]
data[district] = [1]
data[season] = [1]
data["Area"] = [float(area)]
       print(data[crop]," ",data[district]," ",data[season],"
",data["Area"])        df = pd.DataFrame(data)        print(df.shape)
out = model.predict(df)
       out = str(out) + ' Quintals/Hectars'
     #   out = float(out)


       Yeild_value.set(out)
data[crop] = [0]
data[district] = [0]
data[season] = [0]
data["Area"] = [0]
     #   print(data[crop]," ",data[district]," ",data[season]," ",data["Area"])
     #   print(data)
ttk.Button(root, text='Yield Prediction', command=predict, style='TButton').grid(row=5, column=3,
columnspan=2,padx=150, pady=10)



Yeild_value = StringVar()
Yeild_value.set('            ')

# Create a Label widget to display the predicted yeild value
yeild_label = Label(root, textvariable=Yeild_value, font=font, background=bg_color,
foreground=fg_color) yeild_label.grid(row=6, column=3, columnspan=10, padx=10, pady=10)

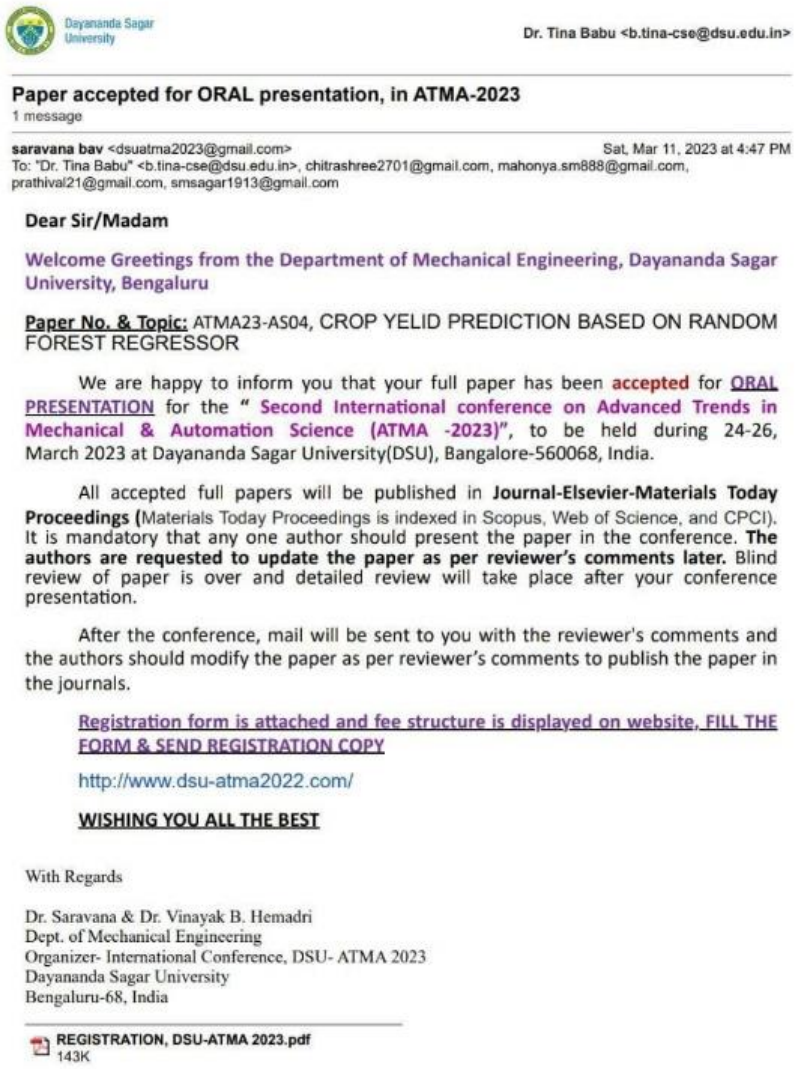


root.mainloop()
```

PAPER PUBLICATION DETAILS

S.P.Chitra Shree, S.M.Mahonya, B.Prathival, Sagar.S.M, Tina Babu Crop yield prediction using Random forest Regreesor, Journal Elsevier materials ATMA(2023).

We have submitted and presented in the journal conference.



Dayananda Sagar University

Dr. Tina Babu <b.tina-cse@dsu.edu.in>

Paper accepted for ORAL presentation, in ATMA-2023
1 message

saravana bav <dsuatma2023@gmail.com> Sat, Mar 11, 2023 at 4:47 PM
To: "Dr. Tina Babu" <b.tina-cse@dsu.edu.in>, chitrashree2701@gmail.com, mahonya.sm888@gmail.com, prathival21@gmail.com, smsagar1913@gmail.com

Dear Sir/Madam

Welcome Greetings from the Department of Mechanical Engineering, Dayananda Sagar University, Bengaluru

Paper No. & Topic: ATMA23-AS04, CROP YELID PREDICTION BASED ON RANDOM FOREST REGRESSOR

We are happy to inform you that your full paper has been **accepted** for **ORAL PRESENTATION** for the **" Second International conference on Advanced Trends in Mechanical & Automation Science (ATMA -2023)"**, to be held during 24-26, March 2023 at Dayananda Sagar University(DSU), Bangalore-560068, India.

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WISHING YOU ALL THE BEST

With Regards

Dr. Saravana & Dr. Vinayak B. Hemadri
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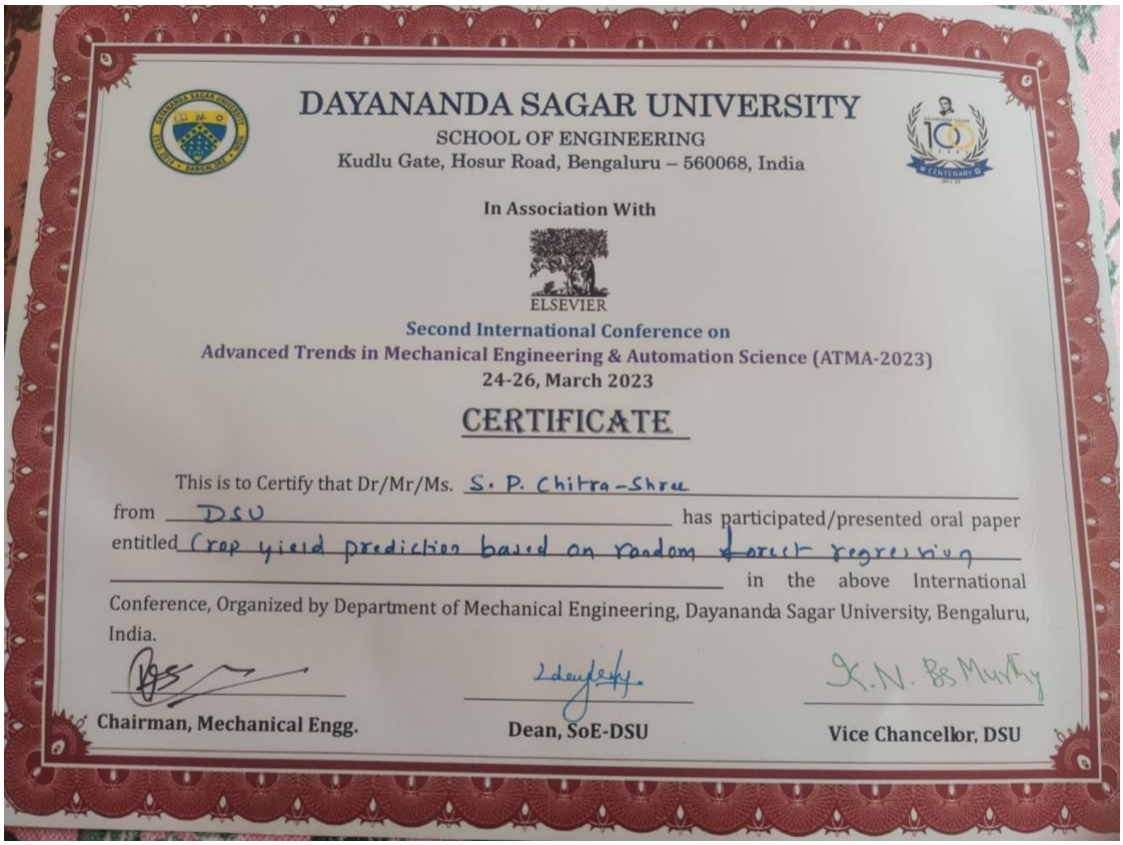

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CERTIFICATE

This is to Certify that Dr/Mr/Ms. S. P. Chitra-Shree

from DSU has participated/presented oral paper

entitled Crop yield prediction based on random forest regressing

in the above International Conference, Organized by Department of Mechanical Engineering, Dayananda Sagar University, Bengaluru, India.

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