

CROP YIELD PREDICTION USING MACHINE LEARNING

Submitted in partial fulfillment of the requirements for the award of
Bachelor of Engineering degree in Computer Science and Engineering

By

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**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
SCHOOL OF COMPUTING**

SATHYABAMA

**INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)**

**Accredited with Grade "A" by NAAC | 12B Status by UGC | Approved by AICTE
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BONAFIDE CERTIFICATE

This is to certify that this project report is the bonafide work of **K GIRIDHAR SAI VASUDEV (Reg No.37110319)** who carried out the project entitled "**CROP YIELD PREDICTION USING MACHINE LEARNING**" under my supervision from August 2020 to March 2021

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DECLARATION

I K GIRIDHAR SAI VASUDEV hereby declare that the Project Report entitled “**CROP YIELD PREDICTION USING MACHINE LEARNING**” is done by us under the guidance of **Dr. USHA NANDINI., M.E., Ph.D.**, Department of Computer Science and Engineering at Sathyabama Institute of Science and Technology is submitted in partial fulfillment of the requirements for the award of Bachelor of Engineering degree in Computer Science and Engineering.

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ABSTRACT

Crop yield of a country has a direct impact on the economy of that country as well as on its overall development. It plays a very important role in determining every aspect that effects the growth of a country i.e., from insufficient yield to the economic trading of crops. So to understand the various factors that affects the crop yield as well as in order to predict the yield of the crop based on these factors we make use of machine learning algorithm and various packages that are available in it. In this approach, we consider the important factors that has the direct effect on the crop yield for analysis and prediction. For example, the basic factors on which the yield of crops depends are rainfall, temperature, humidity, soil characteristics, fertilizers, wind speed, sunshine and also on the farming practices. These factors varies for various crops as well as for various locations. Finally it will recommend the crop based on input values.

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LIST OF ABBREVIATIONS

ML	MACHINE LEARNING
KNN	K - NEAREST NEIGHBOUR
K	POTASSIUM
N	NITROGEN
P	PHOSPHORUS
PH	POTENTIAL OF HYDROGEN

CHAPTER 1

INTRODUCTION

N

1.1. MACHINE LEARNING

Machine learning is an application of artificial intelligence (AI) that provides systems the ability to automatically learn and improve from experience without being explicitly programmed. Machine learning focuses on the development of computer programs that can access data and use it learn for themselves. The process of learning begins with observations or data, such as examples, direct experience, or instruction, in order to look for patterns in data and make better decisions in the future based on the examples that we provide. The primary aim is to allow the computers learn automatically without human intervention or assistance and adjust actions accordingly.

1.2. MACHINE LEARNING METHODS

Machine learning algorithms are often categorized as supervised or unsupervised.

1. SUPERVISED MACHINE LEARNING ALGORITHMS

can apply what has been learned in the past to new data using labeled examples to predict future events. Starting from the analysis of a known training dataset, the learning algorithm produces an inferred function to make predictions about the output values. The system is able to provide targets for any new input after sufficient training. The learning algorithm can also

compare its output with the correct, intended output and find errors in order to modify the model accordingly.

2. UNSUPERVISED MACHINE LEARNING ALGORITHMS

These are used when the information used to train is neither classified nor labelled. Unsupervised learning studies how systems can infer a function to describe a hidden structure from unlabelled data. The system doesn't figure out the right output, but it explores the data and can draw inferences from datasets to describe hidden structures from unlabelled data.

3. SEMI-SUPERVISED MACHINE LEARNING ALGORITHMS

They fall somewhere in between supervised and unsupervised learning, since they use both labelled and unlabelled data for training – typically a small amount of labelled data and a large amount of unlabelled data. The systems that use this method are able to considerably improve learning accuracy. Usually, semi-supervised learning is chosen when the acquired labelled data requires skilled and relevant resources in order to train it / learn from it. Otherwise, acquiring unlabelled data generally doesn't require additional resources.

4. REINFORCEMENT MACHINE LEARNING ALGORITHMS

It is a learning method that interacts with its environment by producing actions and discovers errors or rewards. Trial and error search and delayed reward are the most relevant characteristics of reinforcement learning. This method allows machines and software agents to automatically determine the ideal behavior within a specific context in order to maximize its performance. Simple reward feedback is required for the agent to learn which action is best; this is known as the reinforcement signal.

1.3 ADVANTAGES OF MACHINE LEARNING

Machine Learning undoubtedly helps people to work more creatively and efficiently. Basically, you too can delegate quite complex or monotonous work to the computer through Machine Learning - starting with scanning, saving and filing paper documents such as invoices up to organizing and editing images. In addition to these rather simple tasks, self-learning machines can also perform complex tasks. These include, for example, the recognition of error patterns. This is a major advantage, especially in areas such as the manufacturing industry: the industry relies on continuous and error-free production. While even experts often cannot be sure where and by which correlation a production error in a plant fleet arises, Machine Learning offers the possibility to identify the error early this saves down times and money. Self-learning programs are now also used in the medical field. In the future, after "consuming" huge amounts of data (medical publications, studies, etc.), apps will be able to warn a in case his doctor wants to prescribe a drug that he cannot tolerate. This "knowledge" also means that the app can propose alternative options which for example also take into account the genetic requirements of the respective patient.

1.4. APPLICATIONS OF MACHINE LEARNING

1.Virtual Personal Assistants

Siri, Alexa, Google Now are some of the popular examples of virtual personal assistants. As the name suggests, they assist in finding information, when asked over voice. All you need to do is activate them and ask "What is my schedule for today?", "What are the flights from Germany to London", or similar questions. For answering, your personal assistant looks out for the information, recalls your related queries, or send a command to other resources (like phone apps) to collect info. You can even instruct assistants

for certain tasks like “Set an alarm for 6 AM next morning”, “Remind me to visit Visa Office day after tomorrow”. Machine learning is an important part of

these personal assistants as they collect and refine the information on the basis of your previous involvement with them. Later, this set of data is utilized to render results that are tailored to your preferences. Virtual Assistants are integrated to a variety of platforms. For example: Smart Speakers: Amazon Echo and Google Home Smartphones: Samsung Bixby on Samsung S8 Mobile Apps: Google Allo

2. Predictions while Commuting

Traffic Predictions: We all have been using GPS navigation services. While we do that, our current locations and velocities are being saved at a central server for managing traffic. This data is then used to build a map of current traffic. While this helps in preventing the traffic and does congestion analysis, the underlying problem is that there are less number of cars that are equipped with GPS. Machine learning in such scenarios helps to estimate the regions where congestion can be found on the basis of daily experiences.

Online Transportation Networks: When booking a cab, the app estimates the price of the ride. When sharing these services, how do they minimize the detours? The answer is machine learning. Jeff Schneider, the engineering lead at Uber ATC reveals in an interview that they use ML to define price surge hours by predicting the rider demand. In the entire cycle of the services, ML is playing a major role.

3. Videos Surveillance

Imagine a single person monitoring multiple video cameras! Certainly, a difficult job to do and boring as well. This is why the idea of training computers to do this job makes sense. The video surveillance system nowadays are powered by AI that makes it possible to detect crime before they happen. They track unusual behaviour of people like standing motionless for a long time, stumbling, or napping on benches etc. The system can thus give an alert to human attendants, which can ultimately help to avoid mishaps. And when such activities are reported and counted to be true, they help to improve the surveillance services. This happens with machine learning doing its job at the

backend.

4. Social Media Services

From personalizing your news feed to better ads targeting, social media platforms are utilizing machine learning for their own and user benefits. Here are a few examples that you must be noticing, using, and loving in your social media accounts, without realizing that these wonderful features are nothing but the applications of ML.

People You May Know: Machine learning works on a simple concept: understanding with experiences. Facebook continuously notices the friends that you connect with, the profiles that you visit very often, your interests, workplace, or a group that you share with someone etc. On the basis of continuous learning, a list of Facebook users are suggested that you can become friends with.

Face Recognition: You upload a picture of you with a friend and Facebook instantly recognizes that friend. Facebook checks the poses and projections in the picture, notice the unique features, and then match them with the people in your friend list. The entire process at the backend is complicated and takes care of the precision factor but seems to be a simple application of ML at the front end.

Similar Pins: Machine learning is the core element of Computer Vision, which is a technique to extract useful information from images and videos. Pinterest uses computer vision to identify the objects (or pins) in the images and recommend similar pins accordingly.

CHAPTER 2

LITERATURE SURVEY

1. A study on various data mining techniques for crop yield prediction Authors: Yogesh Gandge ; Sandhya, 2017 International Conference on Electrical, Electronics, Communication, Computer, and Optimization Techniques (ICEECCOT)

India is a country where agriculture and agriculture related industries are the major source of living for the people. Agriculture is a major source of economy of the country. It is also one of the country which suffer from major natural calamities like drought or flood which damages the crop. This leads to huge financial loss for the farmers thus leading to the suicide. Predicting the crop yield well in advance prior to its harvest can help the farmers and Government organizations to make appropriate planning like storing, selling, fixing minimum support price, importing/exporting etc. Predicting a crop well in advance requires a systematic study of huge data coming from various variables like soil quality, pH, EC, N, P, K etc. As Prediction of crop deals with large set of database thus making this prediction system a perfect candidate for application of data mining. Through data mining we extract the knowledge from the huge size of data. This paper presents the study about the various data mining techniques used for predicting the crop yield. The success of any crop yield prediction system heavily relies on how accurately the features have been extracted and how appropriately classifiers have been employed. This paper summarizes the results obtained by various algorithms which are being used by various authors for crop yield prediction, with their accuracy and recommendation.

2. Use Of Deep Neural Networks For Crop Yield Prediction: A Case Study Of Soybean Yield in Lauderdale County, Alabama, USA Authors: Anil Suat Terliksiz ; D. Turgay Altýlar, 2019 8th International Conference on Agro-Geoinformatics (Agro-Geoinformatics)

World population is constantly increasing and it is necessary to have sufficient crop production. Monitoring crop growth and yield estimation are very important for the economic development of a nation. The prediction of crop yield has direct impact on national and international economies and play important role in the food management and food security. Deep learning gains importance on crop monitoring, crop type classification and crop yield estimation applications with the recent advances in image classification using deep Convolutional Neural Networks. Traditional crop yield prediction approaches based on remote sensing consist of classical Machine Learning methods such as Support Vector Machines and Decision Trees. Convolutional Neural Network (CNN] and Long-Short Term Memory Network (LSTM] are deep neural network models that are proposed for crop yield prediction recently. This study focused on soybean yield prediction of Lauderdale County, Alabama, USA using 3D CNN model that leverages the spatiotemporal features. The yield is provided from USDA NASS Quick Stat tool for years 2003-2016. The satellite data used is collected from NASA's MODIS land products surface reflectance, land surface temperature and land surface temperature via Google Earth Engine. The root mean squared error (RMSE] is used as the evaluation metric in order to be able to compare the results with other methods that generally uses RMSE as the evaluation metric.

3. Fuzzy Logic based Crop Yield Prediction using Temperature and Rainfall parameters predicted through ARMA, SARIMA, and ARMAX models

Authors: Shivam Bang ; Rajat Bishnoi ; Ankit Singh Chauhan ; Akshay Kumar Dixit ; Indu Chawla, 2019 Twelfth International Conference on Contemporary Computing (IC3)

Agriculture plays a significant role in the economy of India. This makes crop yield prediction an important task to help boost India's growth. Crops are sensitive to various weather phenomena such as temperature and rainfall. Therefore, it becomes crucial to include these features when predicting the yield of a crop. Weather forecasting is a complicated process. In this work,

three methods are used to forecast- ARMA (Auto Regressive Moving Average), SARIMA (Seasonal Auto Regressive Integrated Moving Average)

and ARMAX (ARMA with exogenous variables). The performance of the three is compared and the best model is used to predict rainfall and temperature which are in turn used to predict the crop yield based on a fuzzy logic model.

4. Maize crop yield estimation with remote sensing and empirical models Authors: Yolanda. M. Fernandez-Ordoñez ; J. Soria-Ruiz, 2017 IEEE International Geoscience and Remote Sensing Symposium

(IGARSS) Crop yield estimation are topics of interest in Latin-American countries, for farmers and government officers responsible of managing agricultural national policies. Besides, modern remote sensing methodologies to obtain these predictions represent important steps towards attaining the goals of precision agriculture for the 21st century. Digital data from satellite images analyzed jointly with crop modelling parameters provide information that enables crop yield estimation. The objective of this study was the estimation of yield and total volume of maize production using Spot-5 satellite images and empirical models. These models expressed a) yield (Y) as a function of LAI, and b) yield as a function of NDVI. To determine the efficiency degree of the calculated predictions at the flowering stage of the crop, yield sampling was done at the physiological maturity stage in pilot plots. Regarding yield prediction in the flowering stage, the models $Y = f(\text{LAI})$ reported a value of 5.96 ton.ha⁻¹ and the model $Y = f(\text{NDVI})$ a value of 5.04 ton.ha⁻¹ was obtained. These data represent 114% and 97% respectively of the true yield recorded on the field. The models are specific to the maize crop and the cultivated plots location, and that the forecasts can be acceptably accurate provided the sown areas are precisely determined.

5. Prediction of major crop yields of Tamilnadu using K-means and Modified KNN

Authors: A Suresh ; P. Ganesh Kumar ; M. Ramalatha, 2018 3rd International Conference on Communication and Electronics Systems (ICCES)

Agriculture is the principal source of livelihood for more than 40 percent of the population of this state. According to Food and Agricultural Organization (FAO) researchers, between 2010 and 2050 the world population will increase by

one third. The demand for crop production will increase by 60percent higher than the current production. Hence prediction plays a major role to find out the demand of crop production for maximizing the yield. For that in this paper we propose a prediction method for the major crops of Tamilnadu using K-means and Modified K Nearest Neighbor (KNN). Matlab and WEKA are used as the tool for clustering and classification respectively. The number result shows that our method is better than traditional data mining approach.

CHAPTER 3

SYSTEM ANALYSIS

3.1 EXISTING SYSTEM

The Naive Bayes classifier assumes that the presence of a particular feature of a class is unrelated to the presence of any other feature. Applying Naive Bayes Data Mining Technique for Crop selection will depend on the nature of the Naive probability model. It can be trained very easily in a supervised learning section. In several practical applications, parameter estimation for naive Bayes uses the method of naive Bayes model with believing in Bayesian probability or using any Bayesian methods.

Disadvantages :

1. Must have Knowledge on Bayesian probability or Bayesian methods.
2. Time taken for the process is larger
3. Based on the assumption that features have same statistical relevance.

3.2. PROPOSED SYSTEM

In proposed we can use KNN can be used for both classification and regression predictive problems. Sensed data is compared with data set which are stored on past experience, and result is produced. As per the predicted result farmer will take decision from this system for profit gain. However, it is more widely used in classification problems in the industry. To evaluate any technique we generally look at 3 important aspects:

1. Ease to interpret output
2. Calculation time
3. Predictive Power

Advantages :

1. A supervised classifier can perform tasks which linear

program cannot.

2. It works even in the presence of noise with good quality output.

3.3. FEASIBILITY STUDY

The feasibility of the project is analyzed in this phase and business proposal is put forth with a very general plan for the project and some cost estimates. During system analysis the feasibility study of the proposed system is to be carried out. This is to ensure that the proposed system is not a burden to the company. For feasibility analysis, some understanding of the major requirements for the system is essential. Three key considerations involved in the feasibility analysis are

Economic feasibility

Technical feasibility

Social feasibility

3.3.1. *ECONOMICAL FEASIBILITY*

This study is carried out to check the economic impact that the system will have on the organization. The amount of fund that the company can pour into the research and development of the system is limited. The expenditures must be justified. Thus the developed system as well within the budget and this was achieved because most of the technologies used are freely available. Only the customized products had to be purchased.

3.3.2. *TECHNICAL FEASIBILITY*

This study is carried out to check the technical feasibility, that is, the technical requirements of the system. Any system developed must not have a high demand on the available technical resources. This will lead to high demands being placed on the client. A feasibility study evaluates the project's potential for success.

3.3.3. *SOCIAL FEASIBILITY*

The aspect of study is to check the level of acceptance of the system by the user. This includes the process of training the user to use the system efficiently. The user must not feel threatened by the system, instead must accept it as a necessity.

CHAPTER 4

EXPERIMENTAL METHODS AND ALGORITHMS

4.1. HARDWARE AND SOFTWARE SPECIFICATIONS

HARDWARE REQUIREMENTS

The most common set of requirements defined by any operating system or software application is the physical computer resources, also known as hardware. The minimal hardware requirements are as follows,

1. Processor : Pentium IV
2. RAM : 8 GB
3. Processor : 2.4 GHz
4. Main Memory : 8GB RAM
5. Hard Disk Drive : 1tb
6. Keyboard : 104 Keys

SOFTWARE REQUIREMENTS

Software requirements deals with defining resource requirements and prerequisites that needs to be installed on a computer to provide functioning of an application. The minimal software requirements are as follows,

1. Front end : python
2. Dataset : csv
3. IDE : anaconda
4. Operating System : Windows 10

4.2. SOFTWARE DESCRIPTION

4.2.1 PYTHON LANGUAGE

Python is an object-oriented programming language created by Guido Rossum in 1989. It is ideally designed for rapid prototyping of complex applications. It has interfaces to many OS system calls and libraries and is extensible to C or C++. Many large companies use the Python programming language include NASA, Google, YouTube, BitTorrent, etc. Python programming is widely used in Artificial Intelligence, Natural Language Generation, Neural Networks and other advanced fields of Computer Science. Python had deep focus on code readability & this class will teach you python from basics.

Python Programming Characteristics

It provides rich data types and easier to read syntax than any other programming languages

It is a platform independent scripted language with full access to operating system API's

Compared to other programming languages, it allows more run-time flexibility

It includes the basic text manipulation facilities of Perl and Awk

A module in Python may have one or more classes and free functions

Libraries in Python are cross-platform compatible with Linux, Macintosh, and Windows

For building large applications, Python can be compiled to byte-code

Python supports functional and structured programming as well as OOP

It supports interactive mode that allows interacting Testing and debugging of snippets of code

In Python, since there is no compilation step, editing, debugging and testing is fast.

4.2.2. APPLICATIONS OF PYTHON PROGRAMMING

1. Web Applications

You can create scalable Web Apps using frameworks and CMS (Content Management System) that are built on Python. Some of the popular platforms for creating Web Apps are: Django, Flask, Pyramid, Plone, Django CMS. Sites like Mozilla, Reddit, Instagram and PBS are written in Python.

2. Scientific and Numeric Computing

There are numerous libraries available in Python for scientific and numeric computing. There are libraries like: SciPy and NumPy that are used in general purpose computing. And, there are specific libraries like: EarthPy for earth science, AstroPy for Astronomy and so on. Also, the language is heavily used in machine learning, data mining and deep learning.

3. Creating software Prototypes

Python is slow compared to compiled languages like C++ and Java. It might not be a good choice if resources are limited and efficiency is a must. However, Python is a great language for creating prototypes. For example: You can use Pygame (library for creating games) to create your game's prototype first. If you like the prototype, you can use language like C++ to create the actual game.

4. Good Language to Teach Programming

Python is used by many companies to teach programming to kids and newbies. It is a good language with a lot of features and capabilities. Yet, it's one of the easiest language to learn because of its simple easy-to-use syntax.

4.2.3. ABOUT OPENCV PACKAGE

Python is a general purpose programming language started by Guido van Rossum, which became very popular in short time mainly because of its simplicity and code readability. It enables the programmer to express his ideas in fewer lines of code without reducing any readability.

Compared to other languages like C/C++, Python is slower. But another important feature of Python is that it can be easily extended with C/C++. This feature helps us to write computationally intensive codes in C/C++ and create a Python wrapper for it so that we can use these wrappers as Python modules. This gives us two advantages: first, our code is as fast as original C/C++ code (since it is the actual C++ code working in background) and second, it is very easy to code in Python. This is how OpenCV-Python works, it is a Python wrapper around original C++ implementation.

And the support of Numpy makes the task more easier. Numpy is a highly optimized library for numerical operations. It gives a MATLAB-style syntax. All the OpenCV array structures are converted to-and-from Numpy arrays. So whatever operations you can do in Numpy, you can combine it with OpenCV, which increases number of weapons in your arsenal. Besides that, several other libraries like SciPy, Matplotlib which supports Numpy can be used with this.

So OpenCV-Python is an appropriate tool for fast prototyping of computer vision problems.

4.2.4. ANACONDA NAVIGATOR

Anaconda is a free and open source, easy to install distribution of Python and R programming languages. Anaconda provides a working environment which is used for scientific computing, data science, statistical analysis and machine learning.

The latest distribution of Anaconda is Anaconda 5.3 and is released in October, 2018. It has the conda package, environment manager and a collection of 1000+ open source packages long with free community support.

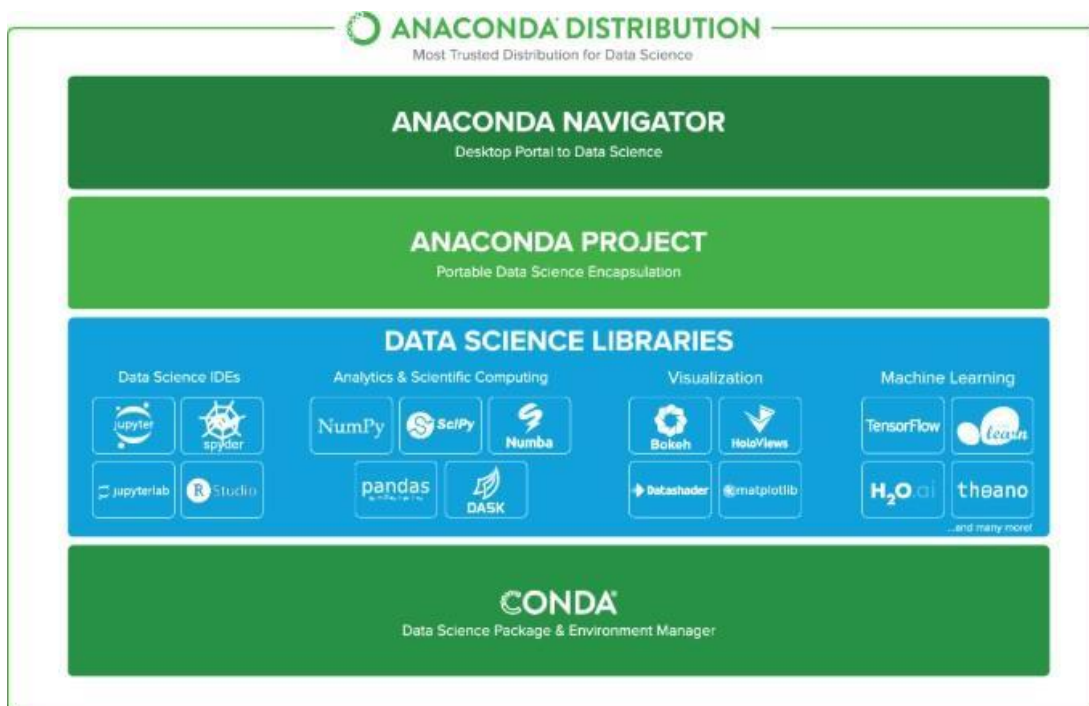
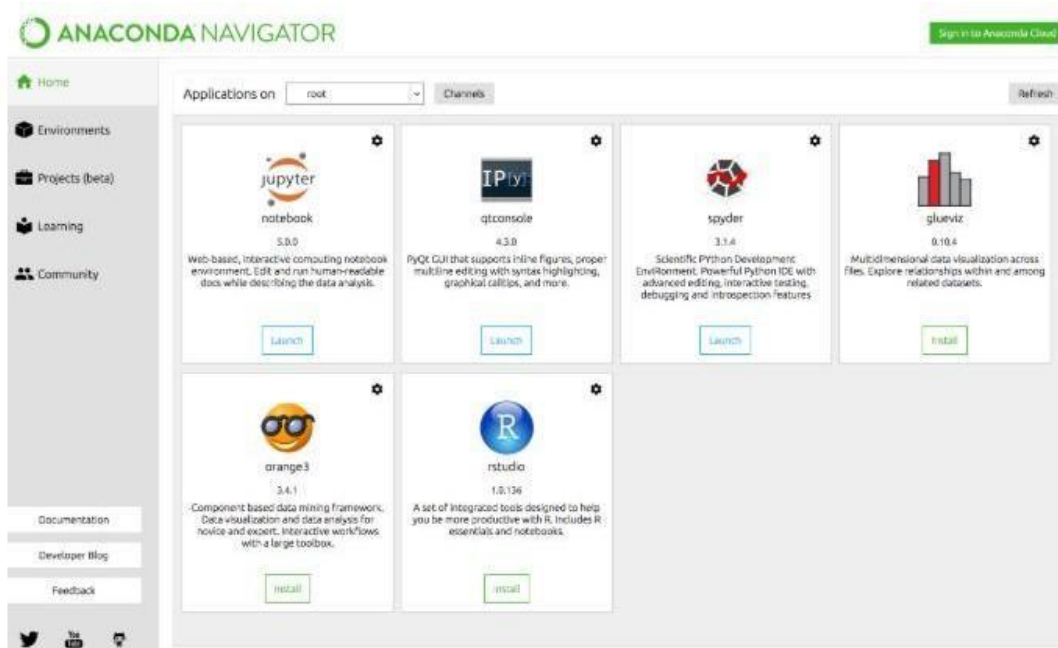


Fig 4.1. Anaconda Navigator

What is Anaconda Navigator?

Anaconda Navigator is a desktop graphical user interface (GUI) included in the Anaconda distribution. It allows us to launch applications provided in the Anaconda distribution and easily manage conda packages, environments and channels without the use of command-line commands. It is available for Windows, macOS and Linux.



Anaconda Navigator

Fig 4.2. Anaconda Navigator Interface

Applications Provided In Anaconda Distribution

The Anaconda distribution comes with the following applications along with Anaconda Navigator.

1. JupyterLab
2. Jupyter Notebook
3. Qt Console
4. Spyder
5. Glueviz
6. Orange3
7. RStudio

> JupyterLab: This is an extensible working environment for interactive and reproducible computing, based on the Jupyter Notebook and Architecture.

>Jupyter Notebook: This is a web-based, interactive computing notebook environment. We can edit and run human-readable docs while describing the data analysis.

> Qt Console: It is the PyQt GUI that supports inline figures, proper multiline editing with syntax highlighting, graphical calltips and more.

> Spyder: Spyder is a scientific Python Development Environment. It is a powerful Python IDE with advanced editing, interactive testing, debugging and introspection features.

> VS Code: It is a streamlined code editor with support for development operations like debugging, task running and version control.

> Glueviz: This is used for multidimensional data visualization across files. It explores relationships within and among related datasets.

>Orange 3: It is a component-based data mining framework. This can be used for data visualization and data analysis. The workflows in Orange 3 are very interactive and provide a large toolbox.

>Rstudio: It is a set of integrated tools designed to help you be more productive with R. It includes R essentials and notebooks.

New Features of Anaconda 5.3

Compiled with Latest Python release: Anaconda 5.3 is compiled with Python 3.7, taking advantage of Python's speed and feature improvements.

- ***Better Reliability:*** The reliability of Anaconda has been improved in the latest release by capturing and storing the package metadata for installed packages.
- ***Enhanced CPU Performance:*** The Intel Math Kernel Library 2019 for Deep Neural Networks(MKL 2019) has been introduced in Anaconda 5.3 distribution. Users deploying Tensorflow can make use of MKL 2019 for Deep Neural Networks. These Python binary packages are provided to achieve high CPU performance.
- ***New packages are added:*** There are over 230 packages which has been updated and added in the new release.
- ***Work in Progress:*** There is a casting bug in Numpy with Python 3.7 but the team is currently working on patching it until Numpy is updated.

4.3. SYSTEM DESIGN

4.3.1. SYSTEM ARCHITECTURE

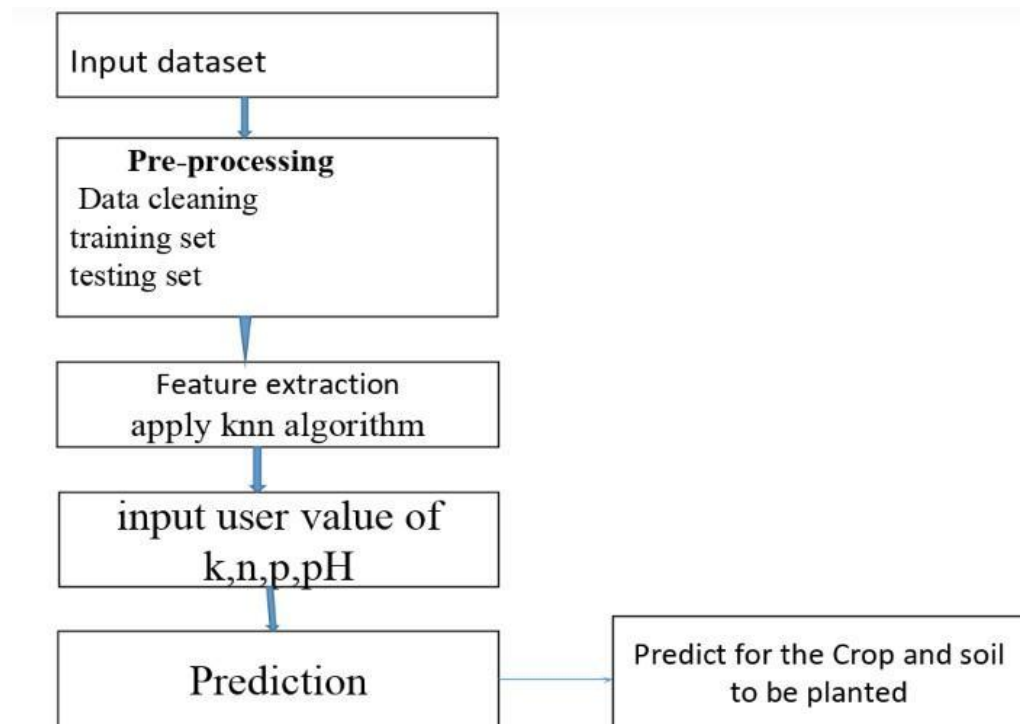


Fig 4.3. System Architecture

UML DIAGRAMS

UML stands for Unified Modeling Language. UML is a standardized general-purpose modeling language in the field of object-oriented software engineering. The standard is managed, and was created by, the Object Management Group.

The goal is for UML to become a common language for creating models of object oriented computer software. In its current form UML is comprised of two major components: a Meta-model and a notation. In the future, some form of method or process may also be added to; or associated with, UML.

The Unified Modeling Language is a standard language for specifying, Visualization, Constructing and documenting the artifacts of software system, as well as for business modeling and other non-software systems.

The UML represents a collection of best engineering practices that have proven successful in the modeling of large and complex systems.

The UML is a very important part of developing objects oriented software and the software development process. The UML uses mostly graphical notations to express the design of software projects.

GOALS:

The Primary goals in the design of the UML are as follows:

1. Provide users a ready-to-use, expressive visual modeling Language so that they can develop and exchange meaningful models.
2. Provide extendibility and specialization mechanisms to extend the core concepts.
3. Be independent of particular programming languages and development process.
4. Provide a formal basis for understanding the modeling language.
5. Encourage the growth of OO tools market.
6. Support higher level development concepts such as collaborations, frameworks, patterns and components.
7. Integrate best practices.

USE CASE DIAGRAM:

A use case diagram in the Unified Modeling Language (UML) is a type of behavioral diagram defined by and created from a Use-case analysis. Its purpose is to present a graphical overview of the functionality provided by a system in terms of actors, their goals (represented as use cases), and any dependencies between those use cases. The main purpose of a use case diagram is to show what system functions are performed for which actor. Roles of the actors in the system can be depicted.

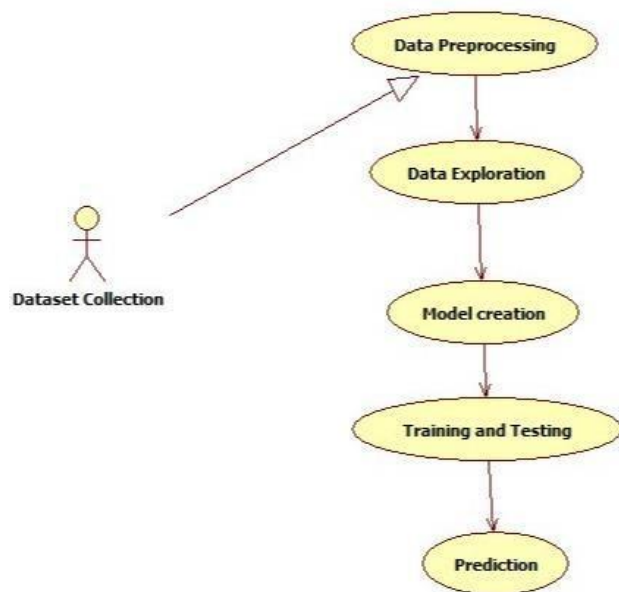


Fig 4.4. Use Case Diagram

SEQUENCE DIAGRAM:

A sequence diagram in Unified Modeling Language (UML) is a kind of interaction diagram that shows how processes operate with one another and in what order. It is a construct of a Message Sequence Chart. Sequence diagrams are sometimes called event diagrams, event scenarios, and timing diagrams.

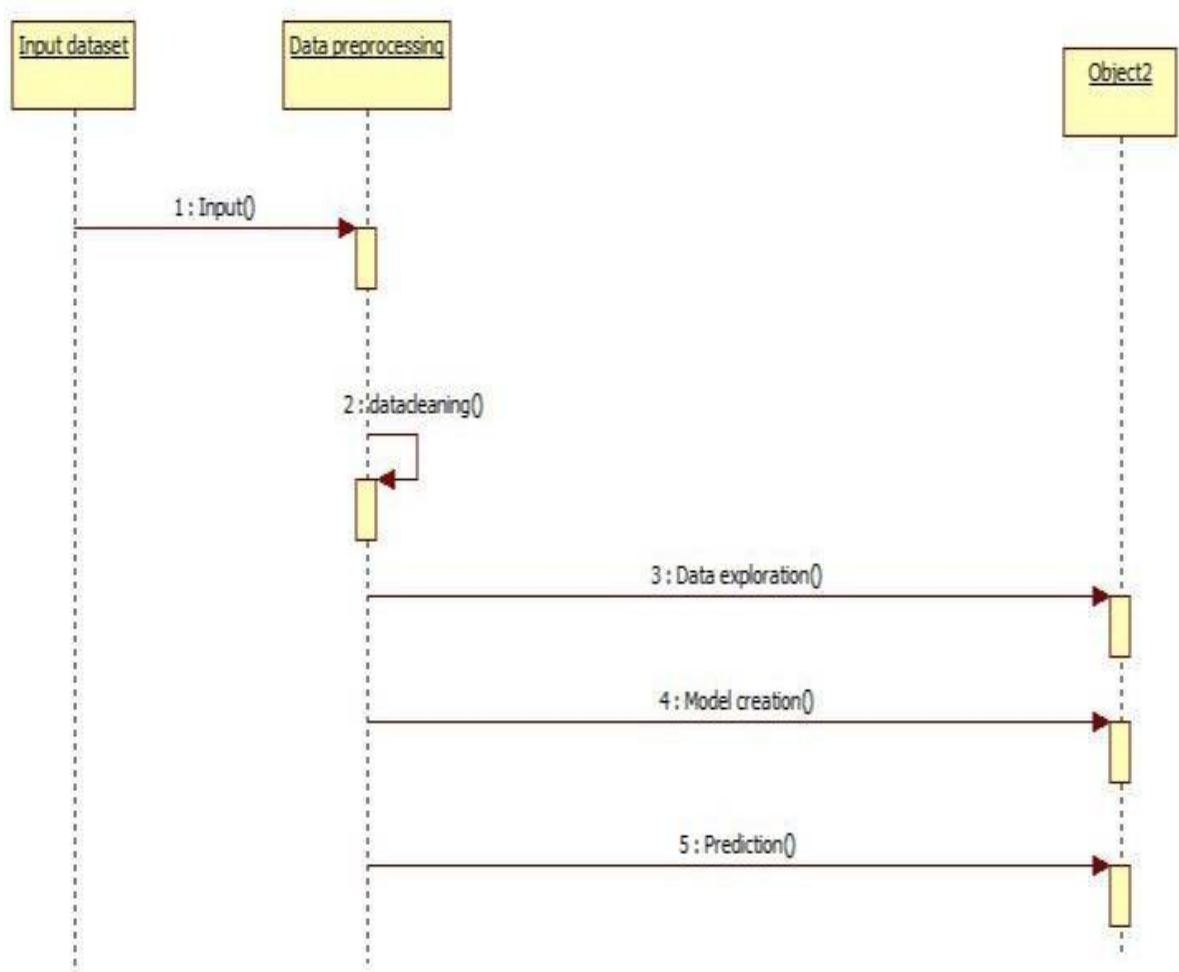


Fig 4.5. Sequence Diagram

ACTIVITY DIAGRAM:

Activity diagrams are graphical representations of workflows of stepwise activities and actions with support for choice, iteration and concurrency. In the Unified Modeling Language, activity diagrams can be used to describe the business and operational step-by-step workflows of components in a system. An activity diagram shows the overall flow of control.

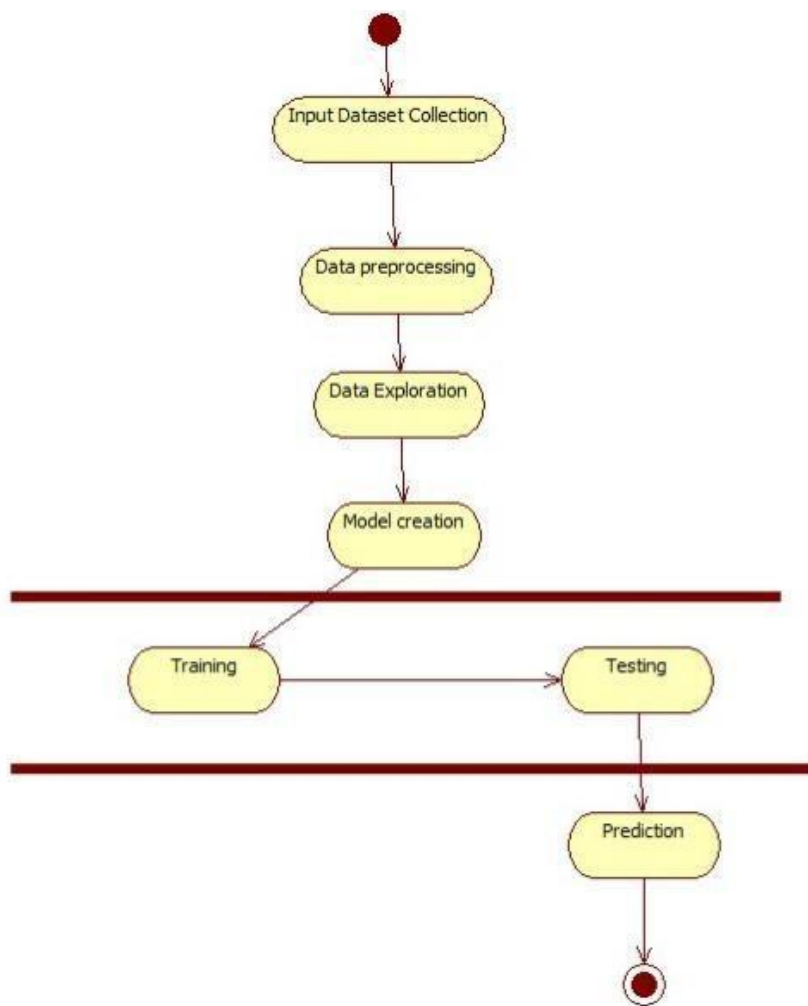


Fig 4.6 Activity Diagram

CHAPTER 5

RESULTS AND PERFORMANCE ANALYSIS

5.1. MODEULE DESCRIPTION

Data Pre-processing:

Here the raw data in the crop data is cleaned and the metadata is appending to it by removing the things which are converted to the integer. So, the data is easy to train. Hear all the data. In this pre-processing, we first load the metadata into this and then this metadata will be attached to the data and replace the converted data with metadata. Then this data will be moved further and remove the unwanted data in the list and it will divide the data into the train and the test data For this splitting of the data into train and test we need to import train_test_split which in the scikit-learn this will help the pre-processed data to split the data into train and test according to the given weight given in the code. The division of the test and train is done in 0.2 and 0.8 that is 20 and 80 percent respectively

Model Creation:

We create data sets into two models:

Training model

Testing model

The division of the test and train is done in 0.2 and 0.8 that is 20 and 80 percent respectively

Model evaluation:

We apply the machine learning algorithm for testing part and get the accuracy of this model.

Prediction:

This module based on Gui part. we create a web page using bootstrap. The web page like (enter the value of nitrogen, enter the value of phosphorus,

enter the value of potassium). Now we get the data's from user to compare the dataset values .finally it will predict for the Crop and soil to be planted.

Methodology:

First we select one places in google map. Give the value of nitrogen, phosphorus, potassium and pH value. we already trained the dataset. our value compared to dataset and finally result will displayed what seed we cultivated that particular place.

Data Set Description:

This is the sample data set used in this project. The data in Table I is data used to predict crop yield based on 8 factors. These 8 factors are Garlic, Onion, Orange, Peas, Potato, Rice, Tomato, sugarcane. we can create a machine learning model and train the model and we can predict the production and from Table II we can predict the amount of fertilizer should be used to get the proper yield the input parameters are the quantity of nitrogen, phosphorus, and the output is the amount of the respective fertilizer should be used. Hear in the input parameters 1, 2, 3, 4, 5, 6, 7, 8 represents the present in the soil respectively.

Necessary Packages:

1. NumPy
2. Pandas
3. Matplotlib
4. pyplot
5. Scikit-learn
6. Tensorflow
7. Jupyter

5.2. ALGORITHM:

KNN can be used for both classification and regression predictive problems. However, it is more widely used in classification problems in the industry. To

evaluate any technique, we generally look at 3 important aspects:

1. Ease to interpret output
2. Calculation time
3. Predictive Power

KNN algorithm fares across all parameters of considerations. It is commonly used for its easy of interpretation and low calculation time.

5.3. SOFTWARE TESTING

General

In a generalized way, we can say that the system testing is a type of testing in which the main aim is to make sure that system performs efficiently and seamlessly. The process of testing is applied to a program with the main aim to discover an unprecedented error, an error which otherwise could have damaged the future of the software. Test cases which brings up a high possibility of discovering an error is considered successful. This successful test helps to answer the still unknown errors.

Test Case

Testing, as already explained earlier, is the process of discovering all possible weak-points in the finalized software product. Testing helps to counter the working of sub-assemblies, components, assembly and the complete result. The software is taken through different exercises with the main aim of making sure that software meets the business requirement and user-expectations and doesn't fail abruptly. Several types of tests are used today. Each test type addresses a specific testing requirement.

5.3.1. TESTING TECHNIQUES

A test plan is a document which describes approach, its scope, its resources and the schedule of aimed testing exercises. It helps to identify almost other test item, the features which are to be tested, its tasks, how will everyone do

each task, how much the tester is independent, the environment in which the test is taking place, its technique of design plus the both the end criteria which

is used, also rational of choice of theirs, and whatever kind of risk which requires emergency planning. It can be also referred to as the record of the process of test planning. Test plans are usually prepared with signification input from test engineers.

(I) UNIT TESTING

In unit testing, the design of the test cases is involved that helps in the validation of the internal program logic. The validation of all the decision branches and internal code takes place. After the individual unit is completed it takes place. Plus it is taken into account after the individual unit is completed before integration. The unit test thus performs the basic level test at its component stage and test the particular business process, system configurations etc. The unit test ensures that the particular unique path of the process gets performed precisely to the documented specifications and contains clearly defined inputs with the results which are expected.

(II) INTEGRATION TESTING

These tests are designed to test the integrated software items to determine whether if they really execute as a single program or application. The testing is event driven and thus is concerned with the basic outcome of field. The Integration tests demonstrate that the components were individually satisfaction, as already represented by successful unit testing, the components are apt and fine. This type of testing is specially aimed to expose the issues that come-up by the component's combination.

(III) FUNCTIONAL TESTING

The functional tests help in providing the systematic representation that functions tested are available and specified by technical requirement, documentation of the system and the user manual.

(IV) SYSTEM TESTING

System testing, as the name suggests, is the type of testing in which ensure

that the software system meet the business requirements and aim. Testing of the configuration is taken place here to ensure predictable result and thus

analysis of it. System testing is relied on the description of process and its flow, stressing on pre driven process and the points of integration.

(V) WHITE BOX TESTING

The white box testing is the type of testing in which the internal components of the system software is open and can be processed by the tester. It is therefore a complex type of testing process. All the data structure, components etc. are tested by the tester himself to find out a possible bug or error. It is used in situation in which the black box is incapable of finding out a bug. It is a complex type of testing which takes more time to get applied.

(VI) BLACK BOX TESTING

The black box testing is the type of testing in which the internal components of the software is hidden and only the input and output of the system is the key for the tester to find out a bug. It is therefore a simple type of testing. A programmer with basic knowledge can also process this type of testing. It is less time consuming as compared to the white box testing. It is very successful for software which are less complex are straight-forward in nature. It is also less costly than white box testing.

(VII) ACCEPTANCE TESTING

User Acceptance Testing is a critical phase of any project and requires significant participation by the end user. It also ensures that the system meets the functional requirements

CHAPTER 6

CONCLUSION AND FUTURE WORK

It is found that by applying different machine learning algorithm and techniques on yields of crops, it is possible to predict crop yield information, which helps to government organization for making better decisions and applying different policies, also it's helpful for farmers to make better plan and increase their production. It's lead to increasing the Countries' overall profit. In our project we found that the accurate prediction of different specified crop yields across different districts will help to farmer. From this farmers will plant different crops in different districts. In the near future, geospatial analysis will be added to our data processing model to improve accuracy and also Implement better geographical data.

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APPENDIX

CODING:

Server.py

```
from flask import Flask , render_template , request , redirect , url_for
from sklearn.neighbors import KNeighborsClassifier
app = Flask(__name__)
```

```
_code = ""
```

```
@app.route('/')

```

```
def index2():

```

```
    return render_template('index.html')
```

```
@app.route('/Register')

```

```
def Register():

```

```
    return render_template('register.html')
```

```
@app.route("/users/index", methods=["GET","POST"])

```

```
def main():

```

```
    return render_template('index.html')
```

```
@app.route("/users/graph", methods=["GET","POST"])

```

```
def login():

```

```
    return render_template('chart.html')
```

```
@app.route("/users/logs", methods=["GET","POST"])

```

```
def logs():

```

```
    return render_template('logs.html')
```

```
@app.route("/users/analyse", methods=["POST"])

```

```
def analyse():

```

```
    if(request.method == "POST"):

```

```
        import pandas as pd
```

```
import numpy as np  
# import os
```

```
optimum = pd.read_excel(r"D:\Shahana\ML Project Correct\CROP\python UI 2.0\optimum2.xlsx", 'newData')
```

```
price = pd.read_excel(r"D:\Shahana\ML Project Correct\CROP\python UI 2.0\optimum2.xlsx", 'pricePerhr')
```

```
optimum['N'] = optimum.N.astype(float)
```

```
optimum['P'] = optimum.P.astype(float)
```

```
optimum['K'] = optimum.K.astype(float)
```

```
optimum['TEMPERATURE'] = optimum.TEMPERATURE.astype(float)
```

```
X = optimum.drop("CLASS",axis=1)
```

```
y = optimum.CLASS
```

```
from sklearn.neighbors import KNeighborsClassifier
```

```
clf = KNeighborsClassifier(n_neighbors=3)
```

```
clf.fit(X,y)
```

```
print(request.form.get('Potassium'))
```

```
if(request.form.get('Potassium') == None):
```

```
pred = pd.read_excel(r'D:\Shahana\ML Project Correct\CROP\python UI 2.0\optimum2.xlsx', 'Sheet3')
```

```
prediction = clf.predict(pred)
```

```
print(prediction)
```

```
optimum = optimum[optimum['CLASS'] != prediction[0]]
```

```
X = optimum.drop("CLASS",axis=1)
```

```
y = optimum.CLASS
```

```
clf = KNeighborsClassifier(n_neighbors=3)
```

```
clf.fit(X,y)
```

```
prediction1 = clf.predict(pred)
```

```
print(prediction1)
```

```
optimum = optimum[optimum['CLASS'] != prediction1[0]]
```

```

X = optimum.drop("CLASS",axis=1)
y = optimum.CLASS
clf = KNeighborsClassifier(n_neighbors=3)
clf.fit(X,y)
prediction2 = clf.predict(pred)
print(prediction2)
p1 = prediction1[0]
p2 = prediction2[0]
p1 = p1 -1
p2 = p2 -1
# print()

```

```

if(prediction == 7):
    return render_template('crops.html' , crop="TOMATO" , crop1=prediction1[0] , crop2=prediction2[0] , price=price["Price/hr"].iloc[6] ,price1=price["Price/hr"].iloc[p1] , price2=price["Price/hr"].iloc[p2])
elif(prediction == 1):
    return render_template('crops.html' , crop="GARLIC" , crop1=prediction1[0] , crop2=prediction2[0] , price=price["Price/hr"].iloc[[0]] ,price1=price["Price/hr"].iloc[p1] , price2=price["Price/hr"].iloc[p2])
elif(prediction == 2):
    return render_template('crops.html' , crop="ONION" , crop1=prediction1[0] , crop2=prediction2[0] , price=price["Price/hr"].iloc[[1]] , price1=price["Price/hr"].iloc[p1] , price2=price["Price/hr"].iloc[p2])
elif(prediction == 3):
    return render_template('crops.html' , crop="ORANGE" , crop1=prediction1[0] , crop2=prediction2[0] , price=price["Price/hr"].iloc[[2]] , price1=price["Price/hr"].iloc[p1] , price2=price["Price/hr"].iloc[p2])
elif(prediction == 4):

```

```

        return render_template('crops.html' , crop="PEAS" ,
crop1=prediction1[0] , crop2=prediction2[0] , price=price["Price/hr"].iloc[[3]] ,
price1=price["Price/hr"].iloc[p1] , price2=price["Price/hr"].iloc[p2])
    elif(prediction == 5):
        return render_template('crops.html' , crop="POTATO" , crop1=prediction1[0] , crop2=prediction2[0] , price=price["Price/hr"].iloc[[4]] ,
price1=price["Price/hr"].iloc[p1] , price2=price["Price/hr"].iloc[p2])
    elif(prediction == 6):
        return render_template('crops.html' , crop="RICE" , crop1=prediction1[0] , crop2=prediction2[0] , price=price["Price/hr"].iloc[[5]] , price1=price["Price/hr"].iloc[p1] , price2=price["Price/hr"].iloc[p2])
    elif(prediction == 8):
        return render_template('crops.html' , crop="SUGARCANE" , crop1=prediction1[0] , crop2=prediction2[0] , price=price["Price/hr"].iloc[[7]] , price1=price["Price/hr"].iloc[p1] , price2=price["Price/hr"].iloc[p2])
    else:
        return "no"

else:
    potassium = request.form.get('Potassium')
    phosphorous = request.form.get('Phosphorous')
    nitrogen = request.form.get('Nitrogen')
    pH = request.form.get('pH')
    temperature = request.form.get('Temperature')

    columns = ['N','P','K','pH','TEMPERATURE']
    values = np.array([ nitrogen ,phosphorous
,potassium , pH , temperature])

    pred = pd.DataFrame(values.reshape(-
1, len(values)),columns=columns)

    # print(pred.dtype)
    print(pred)

```

```
prediction = clf.predict(pred)
print(prediction)
```

```

optimum = optimum[optimum['CLASS'] != prediction[0]]
X = optimum.drop("CLASS",axis=1)
y = optimum.CLASS
clf = KNeighborsClassifier(n_neighbors=3)
clf.fit(X,y)
prediction1 = clf.predict(pred)
print(prediction1)

```

```

optimum = optimum[optimum['CLASS'] != prediction1[0]]
X = optimum.drop("CLASS",axis=1)
y = optimum.CLASS
clf = KNeighborsClassifier(n_neighbors=3)
clf.fit(X,y)
prediction2 = clf.predict(pred)
print(prediction2)

```

```

p1 = prediction1[0]
p2 = prediction2[0]
p1 = p1 -1
p2 = p2 -1
# print()

```

```

if(prediction == 7):
    return render_template('crops.html' , crop="TOMATO" , crop1=prediction1[0] , crop2=prediction2[0] , price=price["Price/hr"].iloc[6] ,price1=price["Price/hr"].iloc[p1] , price2=price["Price/hr"].iloc[p2])
elif(prediction == 1):
    return render_template('crops.html' , crop="GARLIC" , crop1=prediction1[0] , crop2=prediction2[0] , price=price["Price/hr"].iloc[0] ,price1=price["Price/hr"].iloc[p1] , price2=price["Price/hr"].iloc[p2])
elif(prediction == 2):

```

```

        return render_template('crops.html' , crop="ONION" ,
crop1=prediction1[0] , crop2=prediction2[0] , price=price["Price/hr"].iloc[1] ,
price1=price["Price/hr"].iloc[p1] , price2=price["Price/hr"].iloc[p2])
    elif(prediction == 3):
        return render_template('crops.html' , crop="ORANGE" , crop1=prediction1[0] , crop2=prediction2[0] , price=price["Price/hr"].iloc[2] , price1=price["Price/hr"].iloc[p1] , price2=price["Price/hr"].iloc[p2])
    elif(prediction == 4):
        return render_template('crops.html' , crop="PEAS" ,
crop1=prediction1[0] , crop2=prediction2[0] , price=price["Price/hr"].iloc[3] ,
price1=price["Price/hr"].iloc[p1] , price2=price["Price/hr"].iloc[p2])
    elif(prediction == 5):
        return render_template('crops.html' , crop="POTATO" , crop1=prediction1[0] , crop2=prediction2[0] , price=price["Price/hr"].iloc[4] , price1=price["Price/hr"].iloc[p1] , price2=price["Price/hr"].iloc[p2])
    elif(prediction == 6):
        return render_template('crops.html' , crop="RICE" , crop1=prediction1[0] , crop2=prediction2[0] , price=price["Price/hr"].iloc[5] , price1=price["Price/hr"].iloc[p1] , price2=price["Price/hr"].iloc[p2])
    elif(prediction == 8):
        return render_template('crops.html' , crop="SUGARCANE" , crop1=prediction1[0] , crop2=prediction2[0] , price=price["Price/hr"].iloc[7] , price1=price["Price/hr"].iloc[p1] , price2=price["Price/hr"].iloc[p2])
    else:
        return "no"
# render_template('index.html')
else:
    # return render_template('index.html')
    pass

if (__name__ == "__main__"):
    app.run()

```

Index.html

```
<!DOCTYPE html>
<script type="text/javascript">
var centerlat , centerlong;
var staticMapUrl = "https://maps.googleapis.com/maps/api/staticmap";
function myMap() {
var coordinateslt = [];
var coordinateslg = [];
var loclat , loclng ;
var coordinates = [];
var num = coordinates.length;
var map,location,mapCanvas,mapOptions;

if (navigator.geolocation) {
    navigator.geolocation.getCurrentPosition(function(position) {
        loclat = position.coords.latitude;
        loclng = position.coords.longitude;
        location = new google.maps.LatLng(loclat , loclng);
        mapCanvas = document.getElementById("map");
        mapOptions = {center: location, zoom: 16};
        map = new google.maps.Map(mapCanvas,mapOptions);
        map.setMapTypeId(google.maps.MapTypeId.SATELLITE);

        function setpoly(){

            for(var i=0;i<num;i++)
            {
                coordinates.push(new
                google.maps.LatLng(coordinateslt[i] ,
                coordinateslg
                [i]));
            }
        }
    });
}
```

```
coordinates.pop();  
map.setCenter(coordinates[num-1]);
```

```

flightPath = new google.maps.Polygon({
  path:coordinates,
  strokeColor: "#0000FF",
  strokeOpacity: 0.8,
  strokeWeight: 2,
  fillColor: "#0000FF",
  fillOpacity: 0.4
});
flightPath.setMap(map);
google.maps.event.clearListeners(map, "rightclick");
google.maps.event.clearListeners(map, "click");
}

```

```

google.maps.event.addListener(map, "rightclick", function(event) {
  var lat = event.latLng.lat();
  var lng = event.latLng.lng();
  coordinateslt.push(lat);
  coordinateslg.push(lng);
  num = num + 1;
  setpoly();
  centerlong = lng;
  centerlat = lat;
  staticMapUrl += "?center=" + centerlat + "," + centerlong;
  staticMapUrl += "&size=220x300";
  staticMapUrl += "&zoom=" + 18;
  staticMapUrl += "&maptype=" + google.maps.MapTypeId.SATELITE;

});

```

```

google.maps.event.addListener(map, "click", function(event) {
  var lat = event.latLng.lat();

```

```
var lng = event.latLng.lng();  
coordinatesIt.push(lat);
```

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;

```
    });  
  }  
}
```

</script>

<html>

<head>

<meta charset="UTF-8">

<meta name="viewport" content="width=device-width , initial-scale=1.0" >

<meta name="description" content="Fertilizer Prediction">

<meta name="author" content="Mayank Singh">

<script src="https://ajax.googleapis.com/ajax/libs/jquery/3.2.1/jquery.min.js">

</script>

<script type="text/javascript"

src="https://maxcdn.bootstrapcdn.com/font-

awesome/4.7.0/css/font-awesome.min.css"></script>

<script type="text/javascript" href="{{ url_for('static',filename='bootstrap.min.js') }}" rel="stylesheet" media="screen"> </script>

<script type="text/javascript" href="{{ url_for('static',filename='login2_js.js') }}" rel="stylesheet" media="screen"></script>

<script type="text/javascript"

src="https://maxcdn.bootstrapcdn.com/font-

awesome/4.7.0/css/font-awesome.min.css"></script>

<link href="{{ url_for('static',filename='styles/bootstrap.min.css') }}" rel="stylesheet" media="screen">

<link href="{{ url_for('static',filename='styles/login2_css.css') }}" rel="stylesheet" media="screen">

<link href="{{ url_for('static',filename='styles/index_css.css') }}" rel="stylesheet" media="screen">

<link href="{{ url_for('static',filename='styles/indexstyle.css') }}" rel="stylesheet"

et" media="screen">

```

</head>
<body>

<div class="container">
<nav class="navbar navbar-inverse navbar-fixed-top">
  <div class="navbar-header">
    <a class="navbar-brand" href="#">Precision Farming</a>
  </div>
  <ul class="nav navbar-nav">
    <li id="nav1"><a href="/users/index">Home</a></li>
    <!-- <li id="nav2"><a href="/users/logs">Logs</a></li> -->
    <!-- <li id="nav3"><a href="/users/graph">Graphs</a></li> -->
  </ul>

</nav>
</div>
<div id="map" style="width:100%;height:500px;margin-top:-40px"></div>

<script src="https://maps.googleapis.com/maps/api/js?key=AlzaSyAUbRHtu3
k_fg3jDGk_qAatE5jA4bC_ndE&callback=myMap"></script>
<div class="wrapper container-fluid">
  <div class="row well" style="min-height: 100px">
    <div class="row">
      <div class="col-sm-12 col-centered" style="padding-
bottom: 1em">
        <center><div class="btn-group center">
          <button id="manual_btn" type="button" class="btn btn-
primary active small">Manual</button>
          <button id="auto_btn" type="button" class="btn btn-
primary">Automatic</button>
        </div>
      </center>
    </div>
  </div>

```

</div>

```
<form action="/users/analyse" method="POST">
  <div class="row" style="padding-bottom: 0.5em , margin-left: -30px">
    <div class = "col-md-2">
      <div class="input-group">
        <span class="input-group-addon">Nitrogen</i></span>
        <input id="input_value3" type="text" class="form-
control" name="Nitrogen" placeholder="Enter Nitrogen Value">
      </div>
    </div>

    <div class = "col-md-3">
      <div class="input-group">
        <span class="input-group-addon">Phosphorous</i></span>
        <input id="input_value2" type="text" class="form-
control" name="Phosphorous" placeholder="Enter Phosphorous Value">
      </div>
    </div>

    <div class ="col-md-2">
      <div class="input-group">
        <span class="input-group-addon">Potassium</i></span>
        <input id="input_value1" type="text" class="form-
control" name="Potassium" placeholder="Enter Potassium Value">
      </div>
    </div>

    <div class = "col-md-2">
      <div class="input-group">
        <span class="input-group-addon">pH</i></span>
        <input id="input_value4" type="text" class="form-
control" name="pH" placeholder="Enter pH Value">
      </div>
    </div>
```

<div class = "col-md-3">

```

<div class="input-group">
    <span class="input-group-addon">Temperature</i></span>
    <input id="input_value5" type="text" class="form-
control" name="Temperature" placeholder="Enter Temperature Value">
    </div>
</div>
</div>
</div>
</div>

```

```

<div class="wrapper container-fluid" style="margin-bottom : 10px">
    <div class="row">
        <div class="col-md-12 text-right">
            <!-- <button type="button" class="btn btn-
primary nav_btn"><i class="fa fa-stop icn" aria-
hidden="true"></i>Stop</button> -->

```

```

        <button type="button" class="btn btn-primary nav_btn"><i class="fa fa-
pause icn" aria-hidden="true"></i>Contact</button>

```

```

        <button type="submit" href="/users/analyse" class="btn btn-
primary nav_btn" ><i class="fa fa-play icn" aria-
hidden="true"></i>Analyse</button>

```

```

    </form>

```

```

    </div>

```

```

</div>

```

```

</div>

```

```

<!-- <div class="container footer"><i class="fa fa-copyright pull-center" aria-
hidden="true" style="margin:3px"></i>NONE</div> -->

```

```

<td>

```



```

</td>

    <input type="button" id="btnExport" value="Export" onclick="Export()" />

</body>
</html>

<script type="text/javascript">
    $(function() {
        $("#manual_btn").click(function(){
            $('#input_value1').removeAttr("disabled");
            $('#input_value2').removeAttr("disabled");
            $('#input_value3').removeAttr("disabled");
            $('#input_value4').removeAttr("disabled");
            $('#input_value5').removeAttr("disabled");
            $('#auto_btn').removeClass("active");
            $('#manual_btn').addClass("active");
        });

        $("#auto_btn").click(function(){
            $('#input_value1').attr("disabled" , "true");
            $('#input_value2').attr("disabled" , "true");
            $('#input_value3').attr("disabled" , "true");
            $('#input_value4').attr("disabled" , "true");
            $('#input_value5').attr("disabled" , "true");
            $('#auto_btn').addClass("active");
            $('#manual_btn').removeClass("active");
        });
    });

</script>

<script type="text/javascript">
    function Export() {

```

//URL of Google Static Maps.

```

// var staticMapUrl = "https://maps.googleapis.com/maps/api/staticmap";

// //Set the Google Map Center.
// staticMapUrl += "?center=" + centerlat + "," + centerlat;

// //Set the Google Map Size.
// staticMapUrl += "&size=220x350";

// //Set the Google Map Zoom.
// staticMapUrl += "&zoom=" + 16;//mapOptions.zoom;

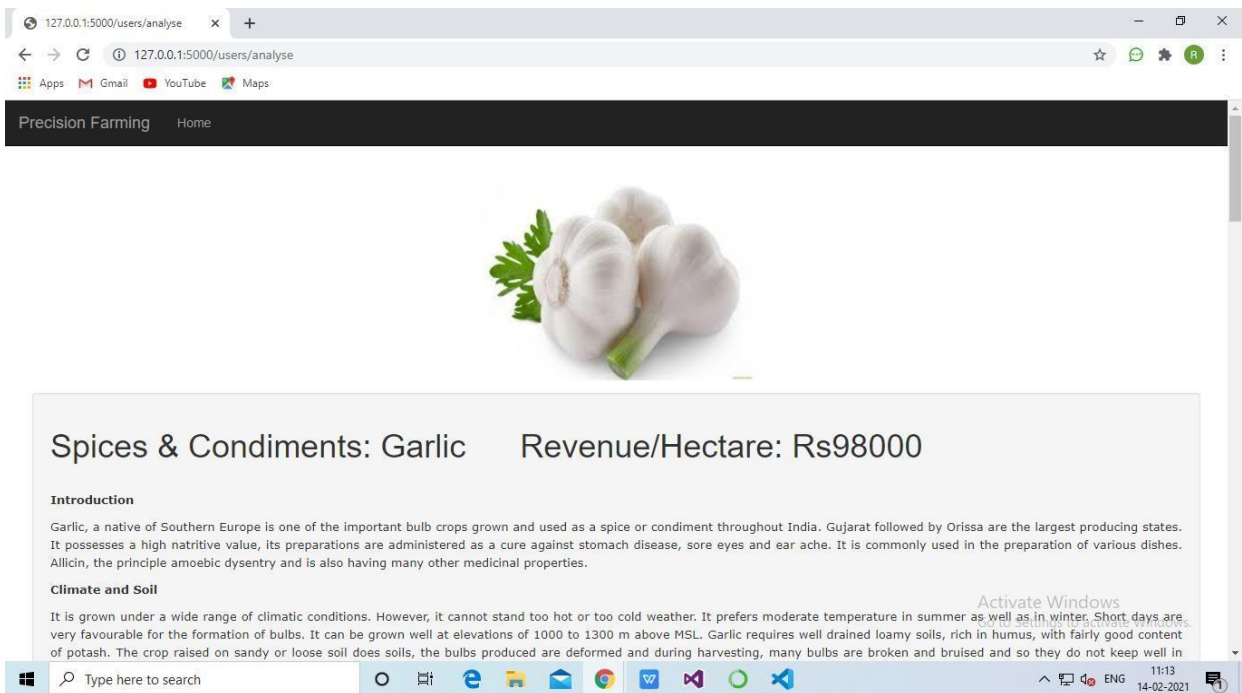
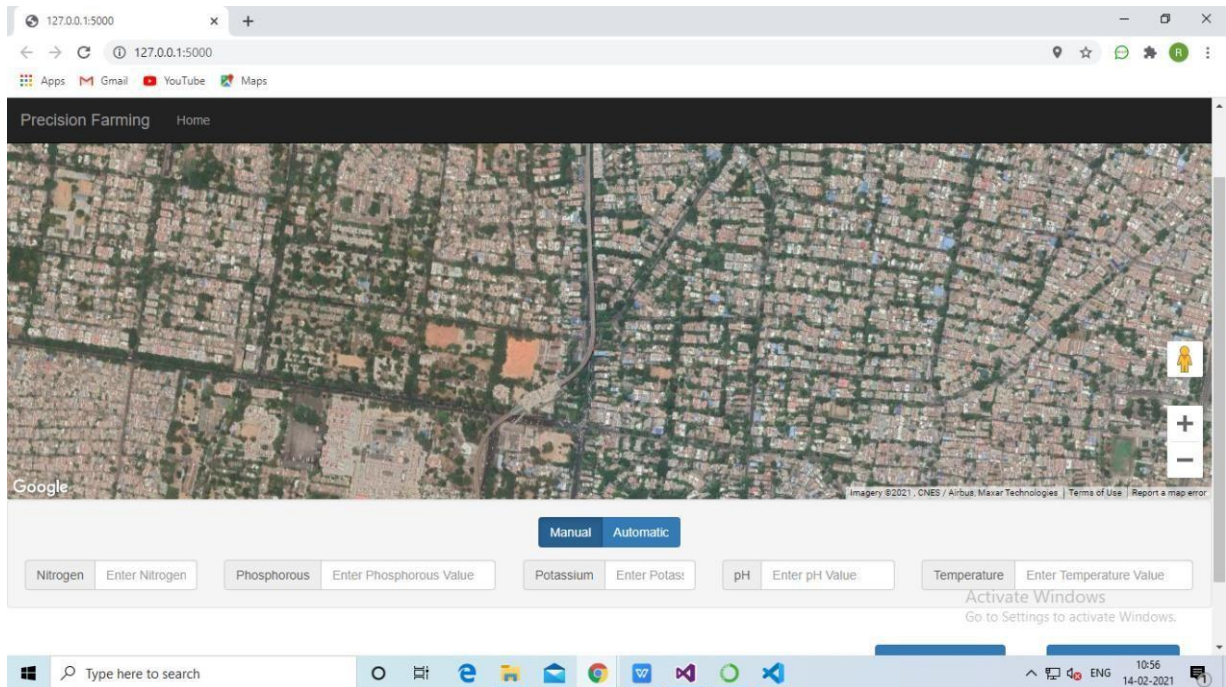
// //Set the Google Map Type.
// staticMapUrl += "&maptype=" + //mapOptions.mapTypeId;

// //Loop and add Markers.
// for (var i = 0; i < markers.length; i++) {
//     staticMapUrl += "&markers=color:red|" + markers[i].lat + "," +
marker s[i].lng;
// }

//Display the Image of Google Map.
console.log(staticMapUrl);
var imgMap = document.getElementById("imgMap");
imgMap.src = staticMapUrl;
imgMap.style.display = "block";
}
</script>

```

SCREENSHOTS:



127.0.0.1:5000/users/analyse

← → 127.0.0.1:5000/users/analyse

Apps Gmail YouTube Maps

Precision Farming Home



Onions

Revenue/Hectare: Rs440000

Onion are a cold-season crop, easy to grow because of their hardiness. We plant onions early in the spring and harvest in the fall after their tops begin to turn yellow and fall over.

Planting

- Plant onions as soon as the ground can be worked in the spring, usually late March or April. Make sure temperature doesn't go below 20 degrees F.
- Select a location with full Sun where your onions won't be shaded by other plants.
- Soil needs to be well-drained, loose, and rich in nitrogen; compact soil affects bulb development.
- Till in aged manure or fertilizer the fall before planting. Onion plants are heavy feeders and need constant nourishment to produce big bulbs.
- At planting time, you can mix in some nitrogen fertilizer, too, and side dress every few weeks until the bulbing process begins.
- Seeding? Onion seeds are short-lived. If planting seeds indoors, start with fresh seeds each year. Start seeds indoors about 6 weeks before transplanting.
- For sets or transplants, plant the smaller sets 1 inch deep, with 4 to 5 inches between each plant and in rows 12 to 18 inches apart.

Activate Windows
Go to Settings to activate Windows.

Type here to search



ENG 11:15

14-02-2021