CROPS YIELD PREDICTION AND EFFICIENT USE OF FERTILIZERS USING MACHINE LEARNING

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Abstract: India being an agriculture country, its economy predominantly depends on agriculture yield growth and agro industry products. Data Mining is an emerging research field in crop yield analysis. Yield prediction is a very important issue in agricultural. Any farmer is interested in knowing how much yield he is about to expect. Analyse the various related attributes like location, pH value from which alkalinity of the soil is determined. Along with it, percentage of nutrients like Nitrogen (N), Phosphorous (P), and Potassium (K) Location is used along with the use of third-party applications like APIs for weather and temperature, type of soil, nutrient value of the soil in that region, amount of rainfall in the region, soil composition can be determined. All these attributes of data will be analysed, train the data with various suitable machine learning algorithms for creating a model. The system comes with a model to be precise and accurate in predicting crop yield and deliver the end user with proper recommendations about required fertilizer ratio based on atmospheric and soil parameters of the land which enhance to increase the crop yield and increase farmer revenue.

I. Introduction

Is a highly populated country and randomly change in the climatic conditions need to secure the world food resources. Framers face serious problems in drought conditions. Type of soil plays a major role in the crop yield. Suggesting the use of fertilizers may help the farmers to make the best decision for their cropping situation [1]. The number of studies Information and Communication Technology (ICT) can be applied for prediction of crop yield [2]. By the use of Data Mining, we can also predict the crop yield. By fully analyse the previous data we can suggest the farmer for a better crop for the better yield The challenge in it is to build the efficient model to predict the most efficient model to predict the output of the crop so try with the different algorithms and compare all the algorithms and which one has the less error and loss chose that model and predict the yield of that particular crop. From this paper, u can see the comparison of the two algorithms and predicting the output from the best model.

II. Literature Review

Rice Crop Yield Forecasting of Tropical Wet and Dry Climatic Zone

Data mining is the process of identifying the hidden patterns from large and complex data. It may provide crucial role in decision making for complex agricultural problems. Data visualisation is also equally important to understand the general trends of the effect of various factors influencing the crop yield. The present study examines the application of data visualisation techniques to find correlations between the climatic factors and rice crop yield. The study also applies data mining techniques to extract the knowledge from the historical agriculture data set to predict rice crop yield for Kharif season of Tropical Wet and Dry climatic zone of India. The data set has been visualised in Microsoft Office Excel using scatter plots. The classification algorithms have been executed in the free and open source data mining tool WEKA. The experimental results provided include sensitivity, specificity, accuracy, F1 score, Mathew's correlation coefficient, mean absolute error, root mean squared error, relative absolute error and root relative squared error. General trends in the data visualisation show that decrease in precipitation in the selected climatic zone increases the rice crop yield and increase in minimum, average or maximum temperature for the season increases the rice crop yield. For the current data set experimental results show that J48 and LAD Tree achieved the highest accuracy, sensitivity and specificity. Classification performed by LWL classifier displayed the lowest accuracy, sensitivity and specificity results.

Crop Yield Prediction in Tamil Nadu Using Baysian Network

Crop prediction is an important agricultural problem. To address this problem, clustering and classification techniques are used for crop yield prediction. It is the one of the most commonly used intelligent technique based on data analytics concepts to predict the crop yield for maximizing the crop productivity. Machine learning techniques can be used to improve prediction of crop yield under different climatic scenarios. The Baysian network Classification is a supervised learning model which means temperature and rainfall analyses the crop data used for classification and probability values of Rice, Coconut,

Arecanut, Black pepper and Dry ginger crops. .The Baysian network Classification analysis technique is used for exploring the dataset. For the present study the mean absolute error (MAE), root mean squared error (RMSE), relative absolute error (RAE) and root relative squared error (RRSE) were calculated. The experimental results showed that the performance of other techniques on the same dataset was much better compared to SMO.

Use of Data Mining in Crop Yield Prediction

India is generally an agricultural country. Agriculture is the single most important provider to the Indian economy. Agriculture crop production depends on the season, organic, and monetary cause. The prognostication of agricultural yield is challenging and pleasing task for every nation. Nowadays, Farmers are hostile to produce the yield because of erratic climatic changes and scarcity of water resource. The main objective is collecting agricultural data which can be stored and analysed for useful crop yield forecasting. To predict the crop yield with the help of data mining technique, advanced methods can be introduced to predict crop yield and it also helps the farmer to choose the most suitable crop, thereby improving the value and gain of the farming area

Machine learning approaches for crop yield prediction and nitrogen status estimation in precision agriculture

Accurate yield estimation and optimised nitrogen management is essential in agriculture Remote sensing (RS) systems are being more widely used in building decision support tools for contemporary farming systems to improve yield production and nitrogen management while reducing operating costs and environmental impact. However, RS based approaches require processing of enormous amounts from different platforms and, therefore, greater attention is currently being devoted to machine learning (ML) methods. This is due to the capability of machine learning based systems to process a large number of inputs and handle non-linear tasks. This paper discusses research developments conducted within the last 15 years on machine learning based techniques for accurate crop yield prediction and nitrogen status estimation. The paper concludes that the rapid advances in sensing technologies and ML techniques will provide cost-effective and comprehensive solutions for better crop and environment state estimation and decision making. More targeted application of the sensor platforms and ML techniques, the fusion of different sensor modalities and expert knowledge, and the development of hybrid systems combining different ML and signal processing techniques are all likely to be part of precision agriculture (PA) in the near future

Rice Crop Yield Prediction using Data Mining Techniques

This paper shows the overview of rice crop yield prediction. Examines Different data mining techniques utilized for foreseeing rice crop yield. Rice crop creation assumes an imperative part in sustenance security of India, contributing over 40% to general yield generation. High harvest generation is reliant on appropriate climatic conditions. Inconvenient regular atmosphere conditions, for example, low precipitation or temperature extremes can drastically diminish edit yield. Growing better strategies to foresee edit efficiency in various climatic conditions can help rancher and different partners in vital basic leadership as far as agronomy and harvest decision. This paper reports utilization of various information mining methods will anticipate rice trim yield for Maharashtra state, India. To this review, 27 regions of Maharashtra were picked on the establishment of accessible information from openly available Indian Administration records with different atmosphere and harvest parameters. Precipitation, least temperature, normal temperature, most extreme temperature, reference trim evapotranspiration, range, generation and yield for the Kharif season (June to November) were the parameters chosen for the study for the years 1998 to 2002. WEKA tool was used for dataset processing

III. SYSTEM DESIGN

UML DIAGRAMS:

UML represents Unified Modelling Language. UML is an institutionalized universally useful showing dialect in the subject of article situated programming designing. The fashionable is overseen, and become made by way of, the Object Management Group.

The goal is for UML to become a regular dialect for making fashions of item arranged PC programming. In its gift frame UML is contained two noteworthy components: a Meta-show and documentation. Later on, a few type of method or system can also likewise be brought to; or related with, UML.

The Unified Modeling Language is a popular dialect for indicating, Visualization, Constructing and archiving the curios of programming framework, and for business demonstrating and different non-programming frameworks.

The UML speaks to an accumulation of first-rate building practices which have verified fruitful in the showing of full-size and complicated frameworks.

The UML is a essential piece of creating gadgets located programming and the product development method. The UML makes use of commonly graphical documentations to specific the plan of programming ventures.

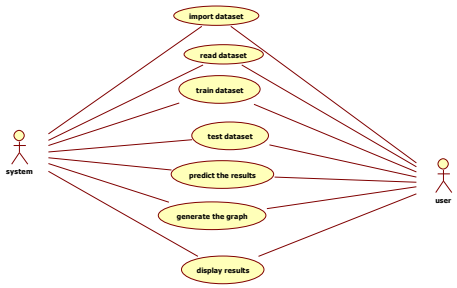
GOALS:

The Primary goals inside the plan of the UML are as in step with the subsequent:

1. Provide clients a prepared to utilize, expressive visual showing Language on the way to create and change massive models.
2. Provide extendibility and specialization units to make bigger the middle ideas.
3. be free of specific programming dialects and advancement manner.
4. Provide a proper cause for understanding the displaying dialect.
5. Encourage the improvement of OO gadgets exhibit.
6. Support large amount advancement thoughts, for example, joint efforts, systems, examples and components.
7. Integrate widespread procedures.

USE CASE DIAGRAM:

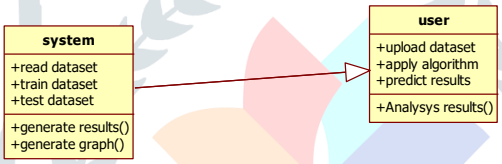
A use case diagram in the Unified Modeling Language (UML) is a type of behavioral diagram defined by and created from a Use-case analysis. Its purpose is to present a graphical overview of the functionality provided by a system in terms of actors, their goals (represented as use cases), and any dependencies 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.



use case diagram

CLASS DIAGRAM:

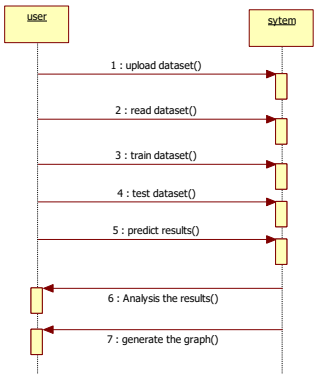
In software engineering, a class diagram in the Unified Modeling Language (UML) is a type of static structure diagram that describes the structure of a system by showing the system's classes, their attributes, operations (or methods), and the relationships among the classes. It explains which class contains information.



Class Diagram

SEQUENCE DIAGRAM:

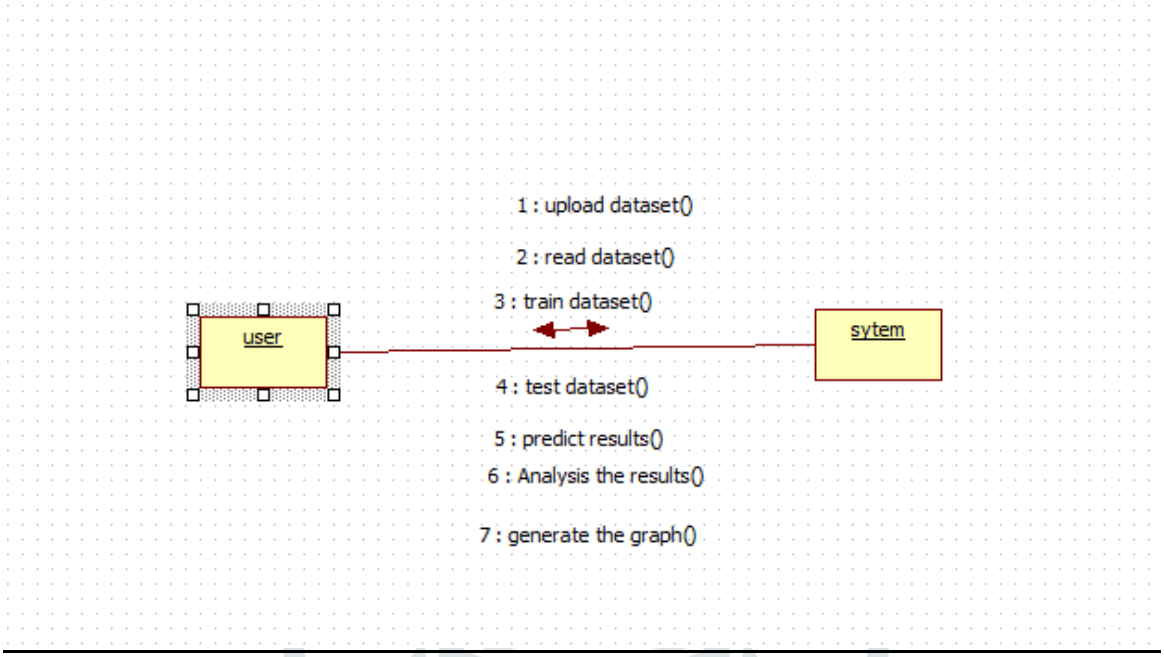
A sequence diagram in Unified Modeling Language (UML) is a kind of interaction diagram that shows how processes operate with one another and in what order. It is a construct of a Message Sequence Chart. Sequence diagrams are sometimes called event diagrams, event scenarios, and timing diagrams.



Sequence Diagram

COLLABORATION DIAGRAM:

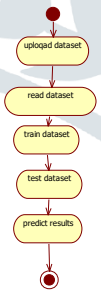
In collaboration diagram the method call sequence is indicated by some numbering technique as shown below. The number indicates how the methods are called one after another. We have taken the same order management system to describe the collaboration diagram. The method calls are similar to that of a sequence diagram. But the difference is that the sequence diagram does not describe the object organization where as the collaboration diagram shows the object organization.



Collaboration 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.



Activity Diagram

DEPLOYMENT DIAGRAM:

Deployment diagram represents the deployment view of a system. It is related to the component diagram. Because the components are deployed using the deployment diagrams. A deployment diagram consists of nodes. Nodes are nothing but physical hard ware's used to deploy the application.

Deployment Diagram

IV. Existing System

Where as in the case of existing system means that we can't able to predict what is the crop yield and the production of the crop which is also difficult to predict the fertility of the soil. Due to that farmers loss productivity and farmers also doesn't know that which crop is best to the three land and farmers does not no above the seed which seed to be used

Disadvantage: Less ferity, More cost, Less yield

Proposed System

Where as in the case of present system we can't find and predict the yield and ferity of the soil by using machine learning technique we can't find all these and the famers also get good benefit regarding the productively and rich of the soil

Advantages: Easy to predict, Good yield, Less cost.

SYSTEM REQUIREMENTS

H/W System Configuration:-

- Processor - I3/Intel Processor
- RAM - 4GB (min)
- Hard Disk - 160GB
- Key Board - Standard Windows Keyboard
- Mouse - Two or Three Button Mouse
- Monitor - SVGA

S/W System Configuration:

- Operating System : Windows 10
- Server side Script : Python

IDE : Google colab or Jupyter Notebook\

V. SYSTEM STUDY

1.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

- ECONOMICAL FEASIBILITY
- TECHNICAL FEASIBILITY
- SOCIAL FEASIBILITY

I. 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.

II. 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 on the available technical resources. This will lead to high demands being placed on the client. The developed system must have a modest requirement, as only minimal or null changes are required for implementing this system.

III. 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. The level of acceptance by the users solely depends on the methods that are employed to educate the user about the system and to make him familiar with it. His level of confidence must be raised so that he is also able to make some constructive criticism, which is welcomed, as he is the final user of the system.

SYSTEM TESTING

The purpose of testing is to discover errors. Testing is the process of trying to discover every conceivable fault or weakness in a work product. It provides a way to check the functionality of components, sub assemblies, assemblies and/or a finished product It is the process of exercising software with the intent of ensuring that the Software system meets its requirements and user expectations and does not fail in an unacceptable manner. There are various types of test. Each test type addresses a specific testing requirement.

TYPES OF TESTS

Unit testing

Unit testing involves the design of test cases that validate that the internal program logic is functioning properly, and that program inputs produce valid outputs. All decision branches and internal code flow should be validated. It is the testing of individual software units of the application .it is done after the completion of an individual unit before integration. This is a structural testing, that relies on knowledge of its construction and is invasive. Unit tests perform basic tests at component level and test a specific business process, application, and/or system configuration. Unit tests ensure that each unique path of a business process performs accurately to the documented specifications and contains clearly defined inputs and expected results.

Integration testing

Integration tests are designed to test integrated software components to determine if they actually run as one program. Testing is event driven and is more concerned with the basic outcome of screens or fields. Integration tests demonstrate that although the components were individually satisfaction, as shown by successfully unit testing, the combination of components is correct and consistent. Integration testing is specifically aimed at exposing the problems that arise from the combination of components.

Functional test

Functional tests provide systematic demonstrations that functions tested are available as specified by the business and technical requirements, system documentation, and user manuals.

Functional testing is centered on the following items:

- Valid Input : identified classes of valid input must be accepted.
- Invalid Input : identified classes of invalid input must be rejected.
- Functions : identified functions must be exercised.
- Output : identified classes of application outputs must be exercised.
- Systems/Procedures : interfacing systems or procedures must be invoked.

Organization and preparation of functional tests is focused on requirements, key functions, or special test cases. In addition, systematic coverage pertaining to identify Business process flows; data fields, predefined processes, and successive processes must be considered for testing. Before functional testing is complete, additional tests are identified and the effective value of current tests is determined.

System Test

System testing ensures that the entire integrated software system meets requirements. It tests a configuration to ensure known and predictable results. An example of system testing is the configuration oriented system integration test. System testing is based on process descriptions and flows, emphasizing pre-driven process links and integration points.

White Box Testing

White Box Testing is a testing in which in which the software tester has knowledge of the inner workings, structure and language of the software, or at least its purpose. It is purpose. It is used to test areas that cannot be reached from a black box level.

Black Box Testing

Black Box Testing is testing the software without any knowledge of the inner workings, structure or language of the module being tested. Black box tests, as most other kinds of tests, must be written from a definitive source document, such as specification or requirements document, such as specification or requirements document. It is a testing in which the software under test is treated, as a black box .you cannot “see” into it. The test provides inputs and responds to outputs without considering how the software works.

2. UNIT TESTING:

Unit testing is usually conducted as part of a combined code and unit test phase of the software lifecycle, although it is not uncommon for coding and unit testing to be conducted as two distinct phases.

Test strategy and approach

Field testing will be performed manually and functional tests will be written in detail.

Test objectives

- All field entries must work properly.
- Pages must be activated from the identified link.
- The entry screen, messages and responses must not be delayed.

Features to be tested

- Verify that the entries are of the correct format
- No duplicate entries should be allowed
- All links should take the user to the correct page.

3. INTEGRATION TESTING

Software integration testing is the incremental integration testing of two or more integrated software components on a single platform to produce failures caused by interface defects. The task of the integration test is to check that components or software applications, e.g. components in a software system or – one step up – software applications at the company level – interact without error.

Test Results: All the test cases mentioned above passed successfully. No defects encountered.

4. 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.

Test Results: All the test cases mentioned above passed successfully. No defects encountered.

VI.CONCLUSION

Work Crop yield prediction and efficient use of the fertilizer is successfully predicted and also found the efficient algorithm from both the algorithm and obtained the most efficient output of the yield. In future developing the web application based on this ideology and make the user use this easily and help the user to understand the yield of the crop, he is going to crop in that season

VII.REFERENCES

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