

# Agro tech: crop , fertilizer recommendation system and disease prediction system

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**Abstract** — Agriculture in India is already very grown up and due to this the farmers have enough opportunities, but at the same time challenges also. Due to the poor weather ,climate conditions ,lack of proper care there are huge losses to the farmers in terms of their productivity .Because of not much knowledge, education in the rural area farmers tend to commit mistakes by not giving their crop proper treatment like good fertilizers to grow the crop, taking care of the disease which has been caught up by the crop. So in this paper we have tried to solve such problems by proposing 3 model system which will take care of Crop production in an efficient manner. A user friendly UI which helps ruler farmers .After considering the accuracy factor because if the model is not accurate ,ultimately the farmers and customers will not get benefitted ,we arrived at using Random Forest Algorithm which is 95 % accurate most of the times in our model. So basically we are expecting that after taking valuable inputs from user like soil nutrients, images of the crop we will predict the desired output with highest efficiency.

**Keywords**— Crop Prediction,Machine Level Algorithm,Random Forest,Logistic Regression,SVM,NB Classifier,XG Boost.

## I. INTRODUCTION

- Agriculture helps to the Nation and its economy. The major chunk of Nation's people rely on on crops for daily business.
- The maximum of the daily wage farmers have an belief that they depend on superstition and then decide which crop to grow in a specific month. So they find easiness in following the old age grandparent's crop patterns. And are unaware that farm's circumstance is unhealthy, due to current reports of the meteorological department.
- When we talk about farming it is not allowed to take into consideration all the unbalanced upcoming that help in farm's growth although we must be aware of what type of crop one should grow . Various methodologies are available these days out of which Deep Learning can help us fix this issue.
- In this project , we have implemented an intelligent system called Crop and fertilizer Recommendation , which intends to assist the farmers in making an informed decision about which crop to grow and which fertilizer used depending on the sowing season , his farm's geographical location, soil characteristics as well as environmental factors such as temperature and rainfall.
- We also implemented an image processing system called Disease Prediction , which help to farmers whether crop are infected or not and if it is infected then system shows name and prevention of that disease.
- Crop Production is usually the maximum of the major commodities which will impact the Nation's healthy equipment measures.
- Where we all presently live, the maximum chunk the people is highly variable on crop for daily means . Plethora of great methodologies, which include Computer Learning and Data Learning, which can be taken into account so that it becomes easy to people to raise the output of their farms.
- In this project, I present a website in which the following applications are implemented; Crop recommendation, Fertilizer recommendation and Plant disease prediction, respectively.

In the crop recommendation application, the user can provide the soil data from their side and the application will predict which crop should the user grow.

For the fertilizer recommendation application, the user can input the soil data and the type of crop they are growing, and the application will predict what the soil lacks or has excess of and will recommend improvements.

For the last application, that is the plant disease prediction application, the user can input an image of a diseased plant leaf, and the application will predict what disease it is and will also give a little background about the disease and suggestions to cure it.

## II. RELATED WORK

The modern way dealing of farms has impacted numerous areas of departments in machine learning systems for the benefit of making impact of the rapidly increase of data coming from from various means. A category of artificial network is called machine learning, which has a high capability to tackle various obstacles for in caretgorizing of information-based farming systems. The current theory aims at dedicating light on data learning in farms by analyzing the recent theory based upon combining of information learning also with farm producing crops, soil cultivation, thread production.

Deep learning and Machine learning are becoming important in crop yield analysis. Crop prediction is now-adays critical issue in agriculture. Any person who is interested in getting aware of how much crop yield he will be expecting. In the future, crop prediction will be performed by tsking into consideration user's experience in particular crop yield and crop.

The crop prediction is a maximum problem that remains to be solved based on detailed data. Different learning techniques are the better choice for this purpose. Different learning techniques have been considered and checked in crop farm estimating the tomorrow's year's agriculture production.

Although it can be implemented by applying different learning algorithms like Random Forest on critically evaluated data and then after recommending crop suitable for particular fertilizer. It represents a small analysis of agriculture yield analysis using learning techniques.

We have Created Web Application having three feature Crop , Fertilizer Recommendation System which takes into consideration all the appropriate parameters, including temperature, rainfall, location , NPK (Potassium, Phosphorus, Nitrogen) and soil condition to predict crop suitability Using Supervised Machine Learning Algorithms and Disease Prediction System using Crop Image.

The below defined model help the users to pick the right crop by giving inside view of casual user's never keep right task of thereby getting low the chance of agriculture loss and thus increases output. Also causes them from getting lossed , and can be improper in harsh temperate zones.

While looking at the results, degree of temperature is almost defined by only SARIMA model. But in case of rainfall , that is another prime concern for the analyzation of agriculture yield is hard to calculate accurately. We design a model to predict crop production by collection the previous data. This model usually is defined by a structured dataset and not an unstructured dataset. We have taken the Data from kaggle.

Basically taken into account the problems and deputations caused due by the farmers ,we are providing various machine level algorithms to solve such complicate problems such as random forest, Xg boost ,etc. Although the problems are not that efficient but our solutions are. As we also see that by implementing the algorithms our accuracy has increased to a very different level which indeed helps the farmers to accurately predict the things and grow particular type of crop ,etc. Different technologies such as Weather API is used for capturing the weather data from API ,classifier ,etc are being used efficiently. And the machine learning algorithms such as linear regression which helps in to model the class or event is used ,apart from this SVM-which means that supervised techniques have also been used for learning models. Using the Classifier with the help of Baye's theorem effective results are being produced.

Sometimes farmers may suffer loss due to inaccurate prediction of the results by the models which we have designed,so to overcome that it is very crucial that we must check the accuracy of our system which we are providing and then provide the solutions.As we know that Random Forest provides the most accurate results and its reasons are also listed below so by taking that into account we have used Random Forest as our primary algorithm in the model to provide accurate results thereby causing and saving their invested money in the crops ,fertilizers which they have purchased.Various other machine learning algorithm were also tried and tested but they were not much accurate.

## III. MODELS AND METHODOLOGY

In this paper we have proposed three model:-

### **Crop recommendation :**

it helping farmers to suggest best crop by consideration of soil ingredient

### **Working:-**

It takes user input of soil data and weather data like NPK values, ph level, rainfall, state and city. weather data it fetching from API further using machine learning algorithm that is

using machine learning algorithm that is

- 1) Random forest help to takes the average of database for predictive accuracy.
- 2) Logistic regression model used to model a certain class or event
- 3) SVM:-also known as support vector machine which determines the position of the vectors.
- 4) NB classifier:-it is a classifier which is used in determining the result .
- 5) XG boost used to developing high performance tree model.It is a library further it undergoes dataset training and then it recommend best crop to user.

Any time any part of the model can be accessed by the customers whichever they are in needful situation by giving certain inputs according to website.And also the inputs are cost effective that is they only need to upload images of their crop and on or database we will provide them with suitable outputs.

Also it is not necessary to for the user/customer to simultaneously use all the three models ,they can as per their requirements use any of the models .And also to motivate them we have displayed success stories of other farmers at last.

**Fertilizer recommendation:**

It recommends proper fertilizer for respective crop by considering soil nutrient.

**Working:-**

For fertilizer recommendation soil plays vital role firstly user have to find what amount of nutrient present in soil with the help of laboratory. then user have to fill details on website that is NPK value and the crop for which user want fertilizer .recommendation take place based on excessiveness and deficiency of current fertilizer based on dataset user get best fertilizer for that respective crop.

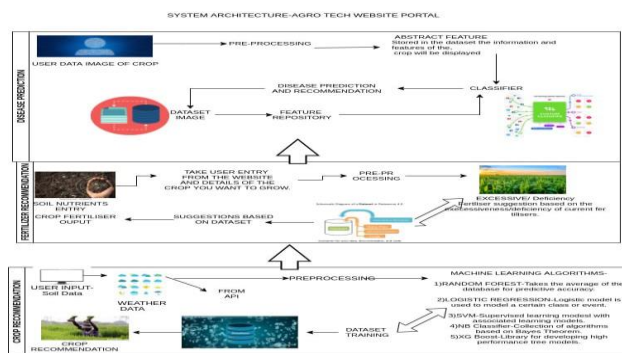
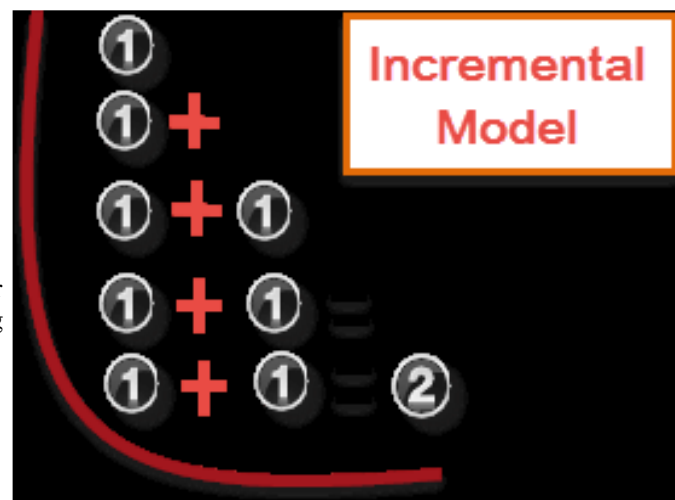
Incremental Model defines a procedure of information development with measures that are divided into various different modules of the information development process. In this system, every module requires the requirement,manupulation and design phases. Each consequent release of the system adds quality to the before release. The defined method continues till the complete module is achieved.

**Disease prediction:**

It predicting disease for crop by image processing algorithm.

**Working:-**

Disease prediction is done using image processing algorithm .User have to upload image of crop which is infected .It gets processing through dataset and then it displaying the disease of crop.



**1. Requirement analysis:** In the prime module of the given incremental phase, the output analyzer experts determines the requirement. Also the module function gatherings are implied by the requirement analyzer team. To implement the soft computing under the incremental model, this phase helps in a very good role.

System Architecture is displayed above which tells us the overall idea of our three models which we have implemented and also displays general condition on how the customer/farmers/people must use our website portal in an efficient way/manner.Its a very straight forward website which gives insights about all the three implementations of our model regarding fertilizer,crop,disease prediction models.

**2. Design & Development:** In this second module of the Incremental phase of SDLC, the overall design of the module inconsistency and the designed procedures are departed with success. When information is developing latest solution, the incremental model produced various decline phase.

**3. Testing:** In the current model, the testing procedure is checking the requirement of every function so as to add new features..

- Guardian Naive Bayes 80%
- Decision Tree' 69.09%
- SVM 85.22%
- Random Forest 99.09%
- XG Boost 96.31

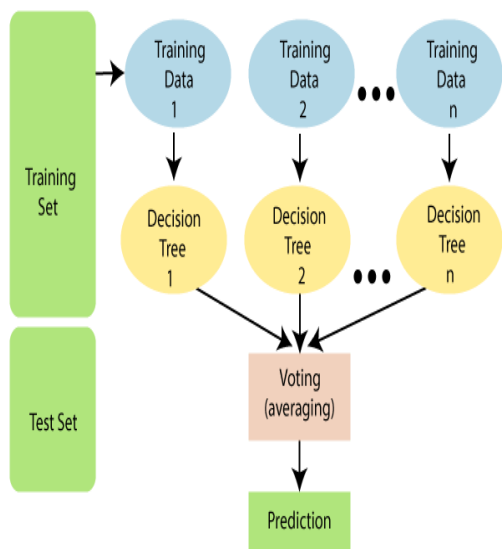


TABLE I : Accuracy vs Algorithm

Algorithm	Accuracy (%)
Logistic Regression(LR)	86
Support Vector Machine (SVM)	75
NB Classifier (NB)	60
Random Forest (RF)	95
XG Boost (XB)	90

**Why we are using only Random Forest?**

**Because it takes very minimal training time when compare it to other different algorithms. And also it knows output with very precise accuracy, even if the big on dataset it can runs precisely. We have to maintain precise results when a very big amount of information is missed.**

**NB Classifier-**

Naive Bayes used as classifier is a commodity of series of classifier algorithms which are based on **some theorem**. It can not be said as single entity but a collection of methods in which all of them have a single outcome, i.e. each pair of features are made totally independent of each other.

**Logistic Regression-**

Logistic Regression sometimes act as a Machine Learning module which can be used for the classification areas, in which prediction analysis is based on the concept of probability. In the probability i.e either 0 or 1 will be the outcome and based on that user can predict what class the action belongs to. It also has function which executes the outcome of the obtained result, because probability is very crucial in knowing the precise solution that we provide.

**SVM-(Support Vector Machine)-**

We need to bifercate the two methods of data sets, when there are too many possible planes that must be chosen. Our therefore prime aim is to locate a plane which will have the most of the margin, i.e the most of the distance carries data's of both classes. Outsourcing the distance will give some method so that other data sets will happen to be classed upon huge latency.

**RESULTS AND DISCUSSIONS**

We have Created Web Application having three feature **Crop , Fertilizer Recommendation System** -which takes into consideration all the appropriate parameters, including temperature, rainfall, location , NPK (Potassium, Phosphorus, Nitrogen) and soil condition to predict crop suitability Using Supervised Machine Learning Algorithms and **Disease Prediction System-** using Crop Image.

### Fertilizer Recommendation Result

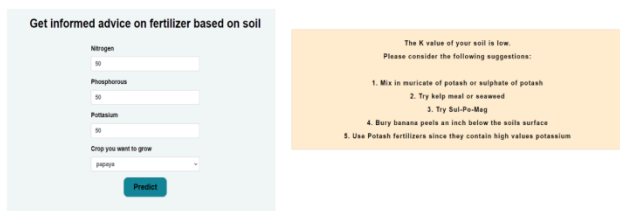


Fig. 7: The Fertilizer Recommender system

### Crop Recommendation Result

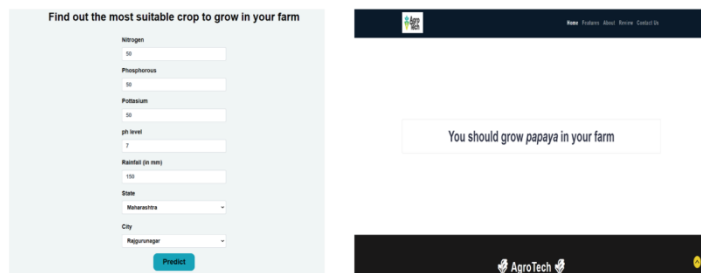
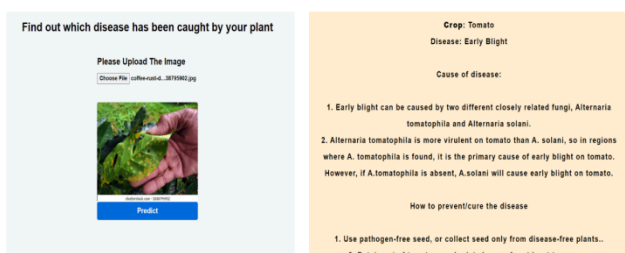


Fig. 8: Crop Recommendation Result

### Disease Prediction Result



#### How to use??

Crop Recommendation system ==> enter the corresponding nutrient values of your soil, state and city. Note that, the N-P-K (Nitrogen-Phosphorous-Potassium) values to be entered should be the ratio between them. Note: When you enter the city name, make sure to enter mostly common city names. Remote cities/towns may not be available in the Weather API from where humidity, temperature data is fetched.

Fertilizer suggestion system ==> Enter the nutrient contents of your soil and the crop you want to grow. The algorithm will tell which nutrient the soil has excess of or lacks. Accordingly, it will give suggestions for buying fertilizers.

Disease Detection System ==> Upload an image of leaf of your plant. The algorithm will tell the crop type and whether it is diseased or healthy. If it is diseased, it will tell you the cause of the disease and suggest you how to prevent/cure the disease accordingly. Note that, for now it only supports following crops.

#### Proposed Approach-

We have Created Web Application having three feature **Crop , Fertilizer Recommendation System** -which takes into consideration all the appropriate parameters, including temperature, rainfall, location , NPK (Potassium, Phosphorus, Nitrogen) and soil condition to predict crop suitability Using Supervised Machine Learning Algorithms and **Disease Prediction System**- using Crop Image.

### IV. CONCLUSION

As we know agriculture is a major concern in India ,so according to that looking at the climate conditions we have created a model which will help the people/citizen of India.

It will be very helpful to farmer to grow appropriate crop and used proper fertilizer .

It is very helpful to increase production of crops.

Hence we conclude that our website portal is capable enough of predicting any disease and crop prediction capability with utmost perfection.

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