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Crop Management System Using Machine Learning

Sai Anand P, Sandeep S, V Pranav Srinivas
Computer Science and Engineering
SJB Institute of Technology
Bengaluru, India.

Rajeshwari G.L
Assistant Professor
Computer Science and Engineering
SJB Institute of Technology
Bengaluru, India.

Abstract:- **In India, Agriculture is very important and practised broadly across the country. This industry plays a major economic role in the country's development. So, three main criteria are needed to be considered while growing crops. Choosing fertilizers, selecting proper crops according to the region's climatic condition and Knowledge of crop price are the criteria that benefit the farmers and also helps the economic growth of the country. This paper proposes three different models for each of the above-mentioned criteria. The first model is the Fertilizer predictor, which predicts the suitable fertilizer that can be used for the given soil constituents. The second model is the crop predictor, which predicts the three most likely growable crops based on the given climatic conditions. The third model is the future crop price predictor, which predicts the crop price in future based on past trends and prices.**

Keywords:- *Crop Management, Machine Learning, Data Visualization, KNN, ARIMA, Random Forest, Logistic Regression.*

I. INTRODUCTION

The most important occupation practiced in our country is agriculture. The economy of India would have fallen if there was no agriculture. In the national GDP of India, around 15-20% is contributed by the agriculture sector [1]. Agriculture plays a very important role in overall development as well as in the economic sector of the country. Almost 60% of the land in our country is utilized for agriculture to satisfy the needs of the people in our country.

In the global economy, agriculture plays an important role. With the continued growth of the human population, pressure will increase on the agriculture system. Agriculture, now also called digital agriculture, has emerged from the new scientific fields which employ data intensive approaches to promote farm productivity while minimising environmental effects [2]. Information gathered in advanced crop cultivation are based on different types of sensors which allow a more precise and quick decisions to be taken, enhancing operating environment understanding (interaction between flexible crop, soil, and weather). Machine learning (ML) has emerged, in combination with large data technology and high-performance computer technology, to create new opportunities for discovering, quantifying and comprising data-intensive agricultural processes.

It is also important for our farmers to make profits using scientific approaches and technologies in agriculture. In India, wheat and paddy are the most important food crops. Every year farmers in India take difficult decisions that affect their incomes. Using new techniques and digital applications of machine learning farmers can predict the crop's price, can know the fertilizer for the soil, and plan the best crop for that season. Fertilizers not only enriches the soil health but also it increases holding capacity of water. So, knowing proper usage of fertilizer helps in getting more yield. Harvesting crops in places where climatic conditions are not suitable for the growth of crop leads to a decline in yield. Hence proper crop should be selected to grow according to the conditions**.** And also having an idea of trends and price of the crops in upcoming years will result in obtaining more profits for the farmers.

In the current situation, many farmers do not have enough knowledge about how to use technology to grow crops and also, they are not aware of the benefits they get from farming. Also, farming can be increased by understanding the crop's performance in the particular land and different environmental conditions. These are some of the challenges faced by the farmers every day. In developing Machine Learning Models, the following are the main challenges. Training data overfitting. Complexity of the data pipeline. The precision and interpretability of the model balance. Collection and storage of large quantities of farm datasets. This paper proposes three different models which are efficient for crop management. The first model predicts the fertilizer to be used based on soil nutrients and environmental conditions. The second models predict the crops which most probable to grow in the given climatic conditions. The third model predicts the future price of the crop from the past prices and trends. Also, proper Data Visualization techniques are used all the above proposed models.

This project aims to help the farmers to cultivate the best crop, predict the price of wheat, and also it will help to do the fertilizer analysis.

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II.CROP MANAGEMENT

Machine learning technique was used to predict the price of the crop. By recognising the patterns in our training dataset i.e., the input of the model, the price of the crop can be determined. The parameters used in the dataset are of previous years and their respective prices along with in-season profit, off-season loss and the respective rise and fall of the prices. Using this, the prices of the crops in the coming years can be predicted [3]. Productivity and operational efficiency can be improved by designing Crop Management. Storing accurate records, monitoring the team, keeping tabs on chemical applications or inventory, scheduling and managing production practice events can all be done effortlessly by Crop Management. Soil is one of the most important factors for getting good quality and good quantity of yield. The use of the correct fertilizer is vital for this purpose. Our model uses a dataset containing the various contents of the soil as parameters to determine the appropriate fertilizer to be used for that particular soil [4]. The knowledge of being aware of what crops to grow in which ecosystem makes all the difference between a good yield and bad yield. Our model helps the user to make this choice. The choice of the crop is determined by recognizing the patterns in our training dataset which is given as the input to the model. The parameters in the dataset are climatic conditions such as rainfall, temperature etc. This will give an overall prediction of which is best crop for that ecosystem [5]. Real time data is provided by Crop Management to help growers make right decisions at the right time [6]. Farmers can view costs of production and make decisions easily by using crop management system in order to increase profitability.

III. MODEL ARCHITECTURE

In the proposed systems we are designing the system for crop management analysis using Machine Learning approach. These Machine Learning approaches help in data visualization as well as developing prediction models.

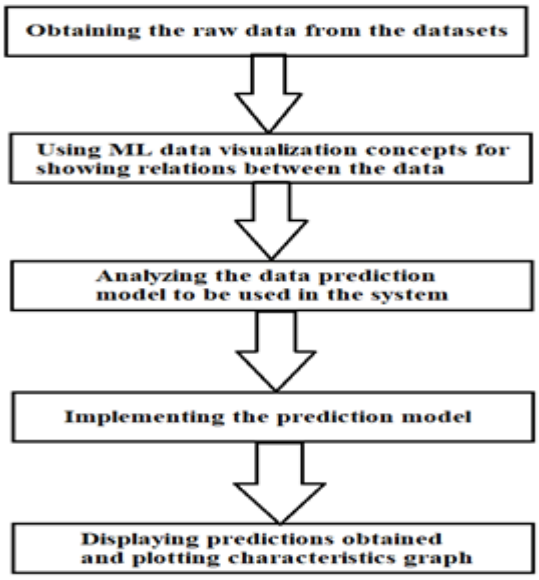

Fig 1 Architecture for the Proposed Model

IV. METHODOLOGY

The first step in each of the proposed model to collect suitable datasets. Open-source datasets have been collected from the website kaggles.com. The next step is to apply suitable data visualization techniques for the obtained datasets. Data Visualization focuses not only on qualitative descriptions of data but also on the estimation of data. For qualitative understanding, Data visualization provides an important suite of tools. Techniques that are used in this model are Hist plot, Correlation Data, Heatmap, Pair plot, Bar plot etc. After Visualization, the Data Pre-processing step is followed. Here Data is transformed for the sake of convenience of the Machine Learning model to obtain high accuracy.

The next step is the major step, where to extract features, machine learning algorithms are used. Machine learning algorithms do not involve any human interaction, instead, these algorithms learn from the previous experiences which are given as input to these algorithms. Generally, the learning tasks are functions where it maps input to the output functions.

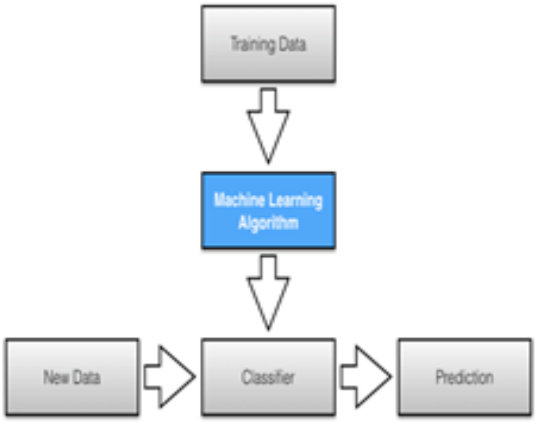

Fig 2 Methodology used for prediction

The Machine Learning Algorithm used in our Models are:

KNN-Model: KNN is an algorithm based on instance-based learning. It is often called lazy learning. Till the function is evaluated, all computation is delayed and the function is just approximated locally. KNN model is used in the first proposed model that is for fertilizer predictor.

Random Forest: To solve both regression and classification tasks Random Forest algorithm can be used. Random Forest solved the given tasks using Bootstrap and Aggregation. Bootstrap means using multiple decision trees and Aggregation is commonly known as bagging. Random Forest algorithm is used in both fertilizer predictor and crop predictor models.

Logistic Regression: For binary classification-related problems, Logistic regression is largely used. This algorithm is used in crop predictor model.

ARIMA Model: "Auto-Regressive Integrated Moving Average" is shortly called as ARIMA model. This model is mainly used for forecasting problems. ARIMA model is used in Future crop price predictor model.

V. CONCLUSION

While there have been similar projects in the past, this project aims to bring a more refined and accurate outcome. The goals have been satisfied with the code developed.

The proposed system in data visualization and data predictions using various prediction models such as the KNN model, Random Forests, Arima model helps in analysing the large datasets and predicting with high accuracy. These systems give a better way of approaching analytics as well as predictions. These systems save a large amount of time and have better accuracy.

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