

Smart Farming Crop Yield Prediction using Machine Learning

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Abstract - India's agriculture sector is under crisis for nearly two decades now. The suicidal cases are growing in numbers over the years. This roots to the lack of proper knowledge and the mundane methods adopted by farmers in their farming. Various seasonal, economic and biological patterns influence the crop production. Catastrophic changes in these patterns may lead to a great loss to the farmers. These risks can be avoided by adopting smart farming methodologies i.e. incorporating technology in the day-to-day farming. The project mainly focuses on deriving useful insights on crop-yield prediction, weather forecasting, crop type plantation, and crop cost forecasting. The statistical agricultural dataset is undertaken for experimental analysis. The data is pre-processed and classified into training and testing data. Then suitable classification methods like Support Vector Machine (SVM) and Random forest are used for better classification outcome.

Key Words: Weather forecasting, crop yield prediction, crop cost forecasting, SVM, random forest

1. INTRODUCTION

Agriculture is taken into account the foremost vital occupations in our country. It is the backbone of our economy and it helps in the overall development of the country. Nearly 60% of the land within the country is employed for agriculture so as to satisfy the needs of a billion individuals. Thus, the modernization of agriculture is very important and can lead the farmers of our country towards profit.

Currently, India is generating negative returns. Thanks to the shortage of information and the strategies adopted by farmers in their farming. Indian farmers do not embrace technology and they work on a random basis. Numerous factors have an effect on their crops production that they're not aware of. Any changes within the weather, the economy can cause severe injury to their crops. This has resulted in a situation where farmers have low financial gain and high debts and they end up committing suicide.

This paper presents the concept of smart farming where agriculture is done by precisely managing data related to soil type, temperature, atmospheric pressure, humidity, and crop type field parameters in order to achieve optimized outputs

at minimum disturbances to the environment. It is well known that climate is one of the foremost imperative field parameters that determine plant growth and its output. This is because each plant is susceptible to certain growing conditions such as air temperature, relative humidity, soil temperature, wind, and light, etc. Therefore, it is vital for farmers to understand these climatic conditions of their farms. Many problems related to managing farms and to maximize productions while achieving environmental goals can be solved with proper predictions.

2. RELATED WORKS

In this era, we have witnessed various technological advancements that are an answer to many problems in terms of time, quality, money or effort. Engineers are now collaborating with farmers to create a technological solution to factors affecting agriculture.

The Precision Agriculture model is a personalized solution for farmers to analyze and manage variability within fields for profitability. [1] Wolfert et al and [2] Blradar et al have presented a survey on smart farm.

Venkatesan and Tamilvanan [3] proposed a concept that we can monitor the agricultural field through Raspberry pi camera, allowing automatic irrigation based on the weather condition, humidity, and soil moisture.

Bauer and Aschenbruck [4] proposed an approach to find the leaf area index (LAI), an important crop-parameter for smart farming,

An IoT application, named 'AGRO-TECH', was proposed by Pandithurai et al. [5] which helps farmers to keep track of soil, crop, and water. Another one is a precision a farming method using IoT for high groundnut yield also suggesting irrigation timings, optimum usage of fertilizers and identifying soil features proposed by Rekha et al.

3. METHODS

The project aims to show practical and experimental results to improve the crop yield production thus resulting in profitability to the farmers.

3.1. DATA SOURCES

For the experimental purpose, the statistical information is collected from Kaggle.com. We have taken a dataset consisting of historical data for millets.

The various attributes are regarded as following:

- Moisture
- Rainfall
- Average Humidity
- Temperature (average, max, min)

3.2. PRE-PROCESSING

After collecting the data, we want to exact valuable information. With certain business criteria, we classify data into 2 groups - training data and testing data.

3.3. FEATURE EXTRACTION

It is the process of reducing the raw data into manageable groups (features) for processing it. Beginning with an initial set of raw data it builds up derived values (features) which results in an informative and non-redundant data. As the statistical agriculture data is redundant and too large to be processed, it is first transformed into a reduced or minimal set of features.

3.4. ALGORITHMS

Support Vector Machine

Support vector machine is a classification technique [5] It is a model that best split the different features. Its main objective is to figure out the perfect hyperplane which distinctly classifies the data points. The distance between the data points (support vector) and the hyperplane are as far as possible. One challenge with Support vector machine algorithm is that if the features or dimensions increase it is hard to visualize.

Random Forest

Random Forest is a binary tree-based machine-learning methodology. We use this algorithm to predict yields of varied crops. RF develops many decision trees based on a random selection of data and variables. More trees result in a more robust prediction. Random forest handles the missing values and handles the accuracy for it. It handles the dataset with higher dimensionality.

4. CHALLENGES AND FUTURE SCOPE OF ADVANCEMENT

There will be numerous difficulties in executing technological arrangements in agriculture as it is an enormous division. Farmers having the capacity to adjust

and implement technology in a nation like India can genuinely be challenging. Right off the bat, there is an absence of mindfulness in innovation based cultivating and their appropriateness. This, additionally, originates from the absence of information. The technology much be in neighborhood dialects and have interfaces that are straightforward for laymen. Arrangements offered to the Indian market must be adaptable thinking about the variable size of farmers in India. Also, it is imperative to offer arrangements that are adaptable.

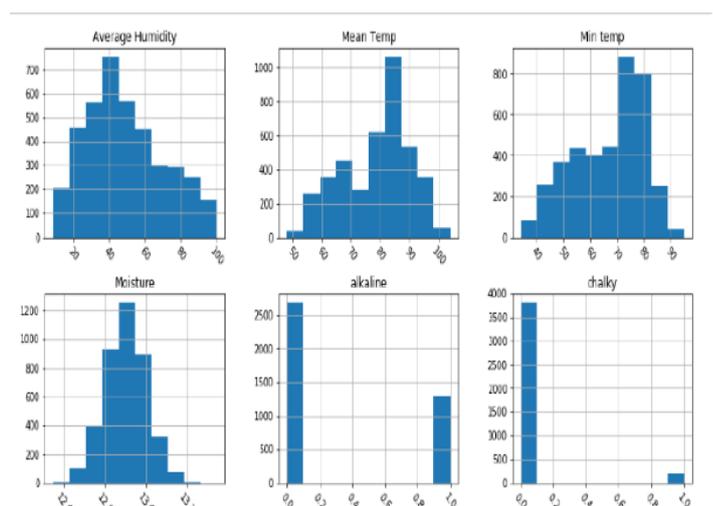
5. RESULT

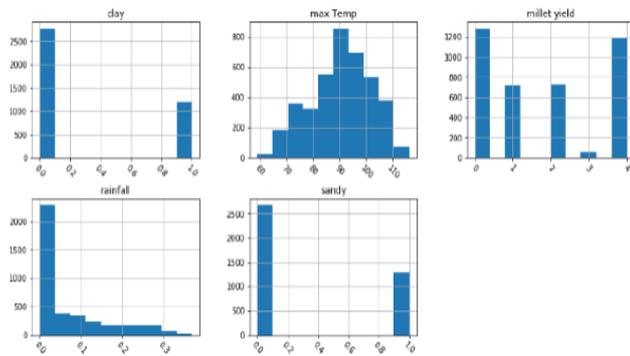
The final result of the project is to predict the crop yield. We classify the crop yield as excellent bio condition, good bio condition, poor bio condition. The smart farming crop yield prediction is an overall approach to predict the crop yield

Out[34]:

	excellent_bio_cond	good_bio_cond	poor_bio_cond
0	0	0	1
1	1	0	0
2	0	1	0
3	1	0	0
4	0	0	1
5	1	0	0

and use the predictions in developing better quantitative and qualitative crops.





6. CONCLUSION

Agriculture has always been the most important sector for survival. There are a lot of difficulties faced by our farmers these days due to various unpredictable reasons. Hence, as engineers, we need to collaborate with farmers and provide them a solution to improve the quality and quantity of crops. Our project is the first step towards it. Prediction can help us make strategic decisions in crop production. With machine learning, we get insights about the crop life which can be very beneficial.

7. FUTURE WORK

As the smart farming methodologies increase, there would be a vast requirement for newer technologies to be implemented. The project which is now a web-based the application can be made into an app where farmers can be educated and informed about their crop yield. Once a prediction is done we can improve on the automation process where the farmers can remotely control the field using a mobile app.

REFERENCES

- [1] Sundmaeker, H.; Verdouw, C.; Wolfert, S.; PrezFreire, L. 'Internet of Food and Farm 2020'. In Digitising the Industry—Internet of
- [2] Wolfert, S.; Ge, L.; Verdouw, C.; Bogaardt, M.-J. Big data in smart farming a review. *Agric. Syst.* 2017, 153, 69–80.
- [3] Venkatesan, R.; Tamilvanan, A. 'A sustainable agricultural system using IoT. In Proceedings of the 2017 International Conference on Communication and Signal Processing (ICCSP) 2017; PP. 763-767
- [4] Bauer, J.; Aschenbruck, N. 'Design and implementation of an agricultural monitoring system for smart farming'
- [5] Pandithurai, O.; Aishwarya, S.; Aparna, B.; Kavitha, K. 'Agro-tech: A digital model for monitoring soil and crops using internet of things (IoT).