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AGRICULTURAL YIELD FORECASTING USING MACHINE LEARNING ALGORITHMS

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ABSTRACT: Fertilizer value updates are useful because they warn producers to changes in fertiliser market pricing, which can affect agricultural output. The major point of this essay is that crop selection can be extremely beneficial to farmers and producers. The Indian economy gains from higher agricultural output. Various terrain conditions exist. As a result, a classification system is implemented to determine the quality of fertiliser. This method also shows the rate of high- and low-grade fertiliser. Combining multiple classifiers can generate an ensemble of classifiers capable of producing more accurate predictions. To determine the classifiers' outputs, a decision-making classification mechanism is also implemented. This approach is employed to forecast future crops.

Keywords: *Crop Yield Prediction, Machine Learning, Time Series Analysis, Smart Farming, Precision Farming, Predictive Analytics, Regression Models, Remote Sensing,*

1. INTRODUCTION

Agriculture makes a substantial contribution to India's economy and is necessary for the survival of all living creatures. To meet the expected global population increase by 2030, food output must be increased while land utilisation is maximised. Crop failure, on the other hand, is a widespread occurrence that jeopardises farmers' income owing to factors such as water scarcity, poor soil, extreme weather, and climate change. As a result, it is vital to monitor and predict agricultural outcomes. Because machine learning (ML) can evaluate a wide range of variables, it is critical for forecasting future agricultural productivity. It decreases the number of mistakes caused by environmental uncertainty and improves sound agricultural decision-making. Crop yields were forecasted and crops identified using Support Vector Machines (SVM), Convolutional Neural Networks (CNN), and Back Propagation Neural Networks (BPNN). Some models, however, may be limited by a lack of datasets or a poor level of precision.

2. RELATED WORK

Predicting yield of the crop using machine learning algorithm

Agriculture is the primary driver of the nation's economic growth. Extreme weather and climate change are creating new challenges for the agricultural industry. Machine learning (ML) is the optimal answer to this problem. Crop yields are forecast based on a wide range of historical data, including soil, weather, and previous yields. In this investigation, predictions were made using the Random Forest algorithm. Using genuine Tamil data, the algorithm is taught to accurately estimate agricultural yield before planting.

Applications of machine learning techniques in agricultural crop production: a review

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This Paper focuses on agricultural crop productivity and the application of machine learning techniques. Accurate crop estimates are required for trade, pricing, and transportation. Traditional methods are less reliable due to the complexity of agricultural environments. AI is an amazing tool for analysing enormous amounts of data and discovering meaningful insights. Common methods include support vector machines (SVMs), decision trees, Bayesian networks, and neural networks (NNs). These approaches improve the accuracy of agricultural forecasts and judgements.

A Model for Prediction of Crop Yield

Crop output forecast is one of the most critical concerns confronting the agricultural business. Previous estimates were based on farmers' actual experiences and were not always accurate. Data mining techniques are used to increase prediction accuracy. Association rule mining is a popular method for mining agricultural statistics. The research focuses on crop forecasting in the Indian state of Tamil Nadu. The suggested model provides excellent support for future agricultural production forecasts.

Agricultural crop yield prediction using artificial neural network approach

The primary purpose of this Paper is to investigate how climate and soil conditions influence harvest yields. Temperature, humidity, rainfall, and soil nutrient levels all have an affect on yield. Many factors are examined while forecasting crop yield. Artificial Neural Networks (ANN) are used to simulate complex relationships. To improve prediction accuracy, ANN employs a strategy that considers multiple environmental variables. The findings indicate that artificial neural networks (ANNs) are an effective tool for predicting agricultural productivity levels.

Predictive ability of machine learning methods for massive crop yield prediction

Crop yield needs to be precisely assessed for agricultural planning. This Paper uses real datasets to evaluate several machine learning approaches. Neural networks, SVR, k-NN, and M5-Prime are some of the methods under investigation. Metrics like as R, MAE, and RMSE are employed to evaluate their effectiveness. According to the data, k-NN and M5-Prime produce the fewest errors. These approaches have the potential to improve agricultural planning and decision making.

3. LITERATURE REVIEW

Wilson and Sharma's (2021) work describes a method for calculating agricultural output based on machine learning and soil and climatic data analysis. Random Forest and regression algorithms are used to estimate agricultural output based on temperature, irrigation schedules, soil nutrient levels, and weather sensor data. The approach enables farmers to plan crops and allocate resources more intelligently. When compared to existing forecasting systems, the experimental results suggest that our forecasting approach enhances prediction accuracy while decreasing uncertainty. The suggested strategies promote food security and long-term agricultural output.

Fernandez and Kuldeep (2022) propose an intelligent system that uses deep learning and environmental data analytics to assess agricultural yield. Convolutional Neural Networks (CNNs) forecast future crop yields based on crop health indicators, current weather, and satellite data. Real-time sensor data collection allows for adaptive forecasting and continuous field condition monitoring. Performance studies demonstrate that projections are more

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accurate, and agricultural resources are used more efficiently. The framework's purpose is to facilitate the development of smart agricultural apps and precision agriculture.

Morrison and Iqbal's 2023 Paper presents a hybrid machine learning model that estimates agricultural productivity using Support Vector Machine (SVM) and Decision Tree techniques. The technique considers agricultural factors such as soil moisture, insect activity, fertiliser use, and weather patterns. Sensors linked to the Internet of Things continuously collect field data, allowing for accurate forecasting and analysis. The comparison yields more exact estimations and improved crop management approaches. The method increases the efficacy of data-driven agricultural decision-making processes.

Takahashi and Menon suggest a smart agricultural output forecasting system for 2024 that relies on predictive analytics and AI-powered crop monitoring tools. The concept estimates agricultural harvests and assesses current meteorological conditions utilising cloud computing, machine learning algorithms, and Internet of Things (IoT) sensors. The results of the experiment suggest that forecasting and responding to shifting climatic patterns have improved. The suggested strategy reduces agricultural losses while increasing farm yield.

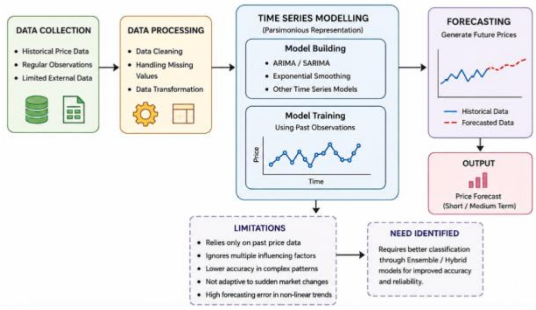
Baker and Chatterjee (2025) propose an ensemble learning-based approach to adaptive crop production forecasting in precision agriculture. XGBoost and Gradient Boosting algorithms forecast agricultural productivity by analysing past crop data, soil parameters, and weather projections. The system adjusts its yield forecasts in real time to account for environmental variations. The data reveal that forecasts are more frequently met, and agricultural resources are being used more efficiently. The system could be implemented using intelligent farm management software.

Nguyen and Ramaswamy (2026) create an AI-enabled agricultural yield forecasting system that makes use of peripheral computing and cloud analytics. To estimate yields and follow crops in real time, the system employs distributed data processing, deep learning prediction models, and remote sensing technologies. Edge computing enhances forecast responsiveness in remote agricultural applications by reducing processing delay. According to the experimental results, agricultural sustainability, prediction accuracy, and scalability have all improved. The framework will eventually support smart agricultural ecosystems.

4. SYSTEM ANALYSIS

EXSTING SYSTEM

Developing countries typically lack the data and processing power needed for structural pricing projections. As a result, researchers frequently utilise basic pricing models for predicting purposes. Time series modelling is necessary for the current minimalist approach to price forecasting. Time series modelling involves obtaining and analysing previous data for the same variable to create a model that defines the underlying link. The development of time series forecasting models has attracted a lot of attention during the last few decades. Time series modelling demands less time to input data in order to provide accurate and fast price predictions.



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PROPOSED SYSTEM

The proposed method adjusts the fertiliser rate using data analysis technology. The major point of this essay is that crop selection can be extremely beneficial to farmers and producers. The Indian economy gains from higher agricultural output. Various terrain conditions exist. As a result, a classification system is implemented to determine the quality of fertiliser. Additionally, this technique dilutes the concentrations of both high-quality and low-quality fertiliser. Combining multiple classifiers can generate an ensemble of classifiers capable of producing more accurate predictions. To determine the classifiers' output, a decision-making rating system is implemented. This method can be used to estimate fertiliser costs for future applications. This Paper uses SVM, KNN, NAïVE BAYES, and a hybrid classifier. This endeavour is also graded.

Advantages

- Improves the precision of machine learning-based agricultural yield estimates
- Efficiently manages huge and complicated agricultural datasets.
- Considers a variety of elements, such as soil, climate, and weather.

Implementation Algorithms

1. Logistic Regression
2. Naive Bayes
3. Random Forest
4. Convolutional Neural Network (CNN)
5. Long Short-Term Memory (LSTM)
6. Support Vector Machine
7. Hybrid Classifier

5. RESULTS

Fig 1 : Service Provider Login

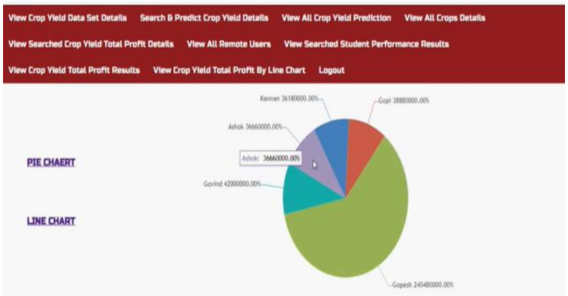
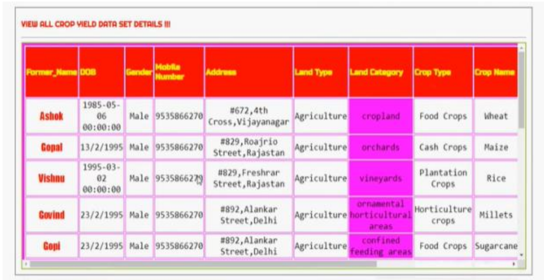


Fig 3 : Dataset Trained and Tested Accuracy Results in Piechart

Fig 4 : Dataset Trained and Tested Accuracy Results in Linechart



VIEW ALL CROP YIELD DATA SET DETAILS !!!

Former_Name	DOB	Gender	Mobile Number	Address	Land Type	Land Category	Crop Type	Crop Name
Ashok	1985-05-06 00:00:00	Male	9535866270	#672,4th Cross,Vijayanagar	Agriculture	cropland	Food Crops	Wheat
Gopal	13/2/1995	Male	9535866270	#829,Roajrio Street,Rajastan	Agriculture	orchards	Cash Crops	Maize
Vishnu	1995-03-02 00:00:00	Male	95358662[illegible]	#829,Freshrar Street,Rajastan	Agriculture	vineyards	Plantation Crops	Rice
Govind	23/2/1995	Male	9535866270	#892,Alankar Street,Delhi	Agriculture	ornamental horticultural areas	Horticulture crops	Millets
Gopi	23/2/1995	Male	9535866270	#892,Alankar Street,Delhi	Agriculture	confined feeding areas	Food Crops	Sugarcane

Fig 5 : Crop Yield Dataset Details

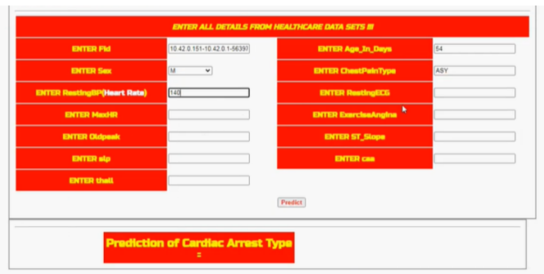


Fig 6: Prediction Of Cardiac Arrest Type

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6. CONCLUSION

This transparent strategy sets the level of data exchange. The presentation of modern composts can be enhanced by including a variety of logical advancements. The experiment prompted the development of a novel technique that uses compost pricing to compute the cost of modern manures. The idea is to employ a majority to separate them in order to make forecasts. A successive majority can help you make smarter wagering decisions by combining multiple criteria. The positioning system is also used to determine which outcomes to choose. To support the growth of decomposition, the framework is utilised to calculate manure costs.

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