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Agriculture Crop Price Prediction Using Machine Learning

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ABSTRACT

The project introduces in machine learning model for predicting accurate crop price, which uses historical, weather and economic data to increase the forecast accuracy, benefiting agricultural decisions. Agriculture plays a vital role in the economic stability of many countries, and predicting crop prices is crucial for both farmers and policymakers. Accurate crop price prediction can help optimize resource allocation, improve market efficiency, and reduce economic volatility. This paper explores the use of machine learning techniques to predict agriculture crop prices by analyzing historical data, weather patterns, market trends, and other relevant factors. Several machines learning algorithms, including Linear Regression, Decision Trees, Random Forest, and Support Vector Machines, are evaluated for their performance in predicting crop prices. The proposed models are trained on diverse datasets and compared using metrics such as Mean Absolute Error (MAE), Root Mean Squared Error (RMSE), and R-squared. Our results show that machine learning models, particularly Random Forest and Support Vector Machines, can effectively predict crop prices with significant accuracy. The paper also discusses the challenges and limitations of using machine learning in agricultural price forecasting and suggests potential improvements, including the integration of real-time data sources and advanced deep learning techniques. The findings contribute to the growing field of predictive analytics in agriculture, offering valuable insights for farmers, traders, and policy-makers alike.

Keyword: ***Price prediction, decision tree, crop price, regression, forecasting, machine learning.***

1. INTRODUCTION

Agriculture is a cornerstone of the global economy, providing food, raw materials, and livelihoods to billions of people worldwide. However, one of the major challenges faced by the agricultural sector is the volatility of crop prices. Price fluctuations can significantly impact both producers and consumers, leading to financial instability, poor resource planning, and inefficient market conditions. As a result, accurately forecasting agricultural crop prices is essential for optimizing farm production, improving supply chain management, and enabling better decision-making by policymakers and stakeholders in the agricultural sector.

Machine learning techniques, such as regression analysis, decision trees, random forests, and support vector machines, have shown great promise in various prediction tasks, including crop price forecasting. These methods enable the development of models that can learn from historical data and adapt to changing market conditions. By leveraging advanced computational techniques, machine learning provides an opportunity to improve the accuracy and reliability of crop price predictions, offering significant benefits to farmers, traders, agricultural economists, and policy-makers.

This research paper explores the potential of machine learning algorithms in predicting agricultural crop prices. It focuses on analyzing key factors influencing crop prices and compares the performance of various machine learning models. By examining the effectiveness of these models, this study aims to contribute to the development of more accurate, data-driven approaches for predicting agricultural prices and addressing the challenges posed by price volatility in the agricultural industry.

2. RELATED WORK

Numerous studies have examined the use of ML techniques for predicting agricultural prices. For example, [1] used Support Vector Machines (SVM) to predict prices for rice in India, giving moderate accuracy. [2] implemented Random Forest for forecasting wheat prices in the United States and remarked about the importance of feature selection for improving the performance of the model. [3] applied LSTM networks to predict soybean price, proving that deep learning models perform the best at capturing temporal dependencies. There is no comprehensive study comparing the performance of several ML models across different crops and regions. This research aims to fill this

void by investigating the effectiveness of Linear Regression, Random Forest, and LSTM in predicting crop prices using a diverse dataset.

3. PROBLEM STATEMENT

The project will predict a wide range of crop prices by making use of rainfall and WPI data. One of the approaches will be to use Decision Tree Regression to analyze previous data. Subsequently, any further price will be predicted using the latest data and further extrapolated for forecasting for the upcoming twelve months.
Because of the myriad variables that affect crop prices, prediction continues to be a monumental challenge. The implications of these price oscillations represent uncertainty to farmers, distributors, and policymakers in determining production levels, when to store, and when to enter the market. The lack of effective forecasting tools results in farm income losses and inadequacies in the supply chain. This leads to the simple problem of how to leverage machine learning to provide more accurate agricultural crop price forecast models based on historical data as well as other anticipatory external variables which could impact the crop market.

4. RESEARCH METHODOLOGY

4.1 Data Collection and Preprocessing

The dataset used in this study is comprised of historical crop price data, weather records, and economic indicators covering the period between 2010 and 2022. The crop price data contains daily prices for wheat, rice, and maize obtained from government pages of agriculture. Meteorological values like temperature, rainfall, and humidity were obtained from weather stations. Economic indicators were obtained from central bank reports dealing with inflation rates and exchange rates. Data preprocessing involved missing value handling, normalizing of features, and splitting of the dataset into training and testing. The dataset was split in an 80:20 proportion, where 80% was used for training and 20% for testing.

4.2 Feature selection

Feature selection was done using correlation analysis and domain knowledge. Important features are taken into account, including historical crop prices, weather conditions, and economic indicators. The selected features were positioned or arranged as the input variables on the respective machine learning models.

4.3 Model Selection

The two models explored for ML were:
1. Linear Regression: Introduced as the model for baseline, rests on a linear relationship among input features and crop prices.
2. Random Forest: Ensemble learning technique that strengthens the accuracy of the prediction model through the joint prediction of numerous decision trees.

5. SYSTEM ARCHITECTURE

The project focuses on investigating the prediction of Crop price estimation. The proposed methodology will use the decision tree algorithm to predict the results efficiently. The data collected is analyzed and cleaned to predict the price of the crops. The architecture of the proposed crop prediction system is depicted below.
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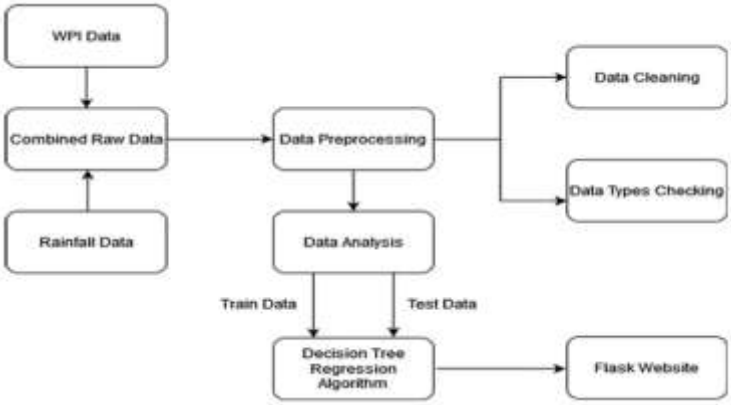

Fig.1 : System Architecture

5. CONCLUSIONS

In this paper, is relatively presents a comprehensive decision support framework aimed at optimizing national crop production planning. It addresses key gaps in agricultural policymaking by incorporating the roles of various stakeholders and utilizing historical crop production data across different land sectors. The framework aims to balance national crop requirements, export demand, and profit optimization, overcoming the common issue where crops are produced based on farmers' preferences or past prices, rather than meeting national demand. This often leads to overproduction of certain crops and shortages of others. A decision-aiding tool is proposed to guide farmers in making crop production decisions that align with national needs and maximize earnings.

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