SRM Institute of Science and Technology
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18CSC305J Artificial Intelligence – Mini Project

Precision Agriculture: Predicting Yield, Crop Selection, and Crop Disease Prediction using Minimax and Alpha-Beta Pruning in Machine Learning

Team Members

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Problem Statement

- **Predicting Yield:**
- Develop predictive models to estimate crop yields accurately.
- Utilize historical data on environmental factors, crop characteristics, and agronomic practices.
- Assist farmers in making informed decisions regarding resource allocation and market planning.
- **Crop Selection:**
- Create a decision support system for recommending suitable crops for cultivation.
- Consider factors such as soil type, climate suitability, market demand, and input costs.
- Enable farmers to optimize profitability and sustainability through informed crop selection.
- **Crop Disease Prediction:**
- Develop machine learning models for predicting the occurrence and severity of crop diseases.
- Utilize environmental conditions, crop characteristics, and disease history data.
- Enable early detection and implementation of preventive measures to minimize yield losses.

Abstract

- Precision agriculture integrates advanced technologies to optimize crop production, reduce resource wastage, and mitigate risks.
- This project leverages machine learning techniques, coupled with minimax and alpha-beta pruning algorithms, to address three critical aspects: predicting crop yield, selecting suitable crops for cultivation, and forecasting crop diseases.
- The objectives include developing predictive models for yield estimation, crop selection, and disease prediction, utilizing historical data and environmental parameters.
- The models will be optimized using minimax and alpha-beta pruning techniques to enhance efficiency and accuracy.
- Validation will be conducted through cross-validation, performance metrics, and real-world field trials.
- The project aims to deliver a comprehensive decision support system empowering farmers with actionable insights for optimizing crop production and enhancing sustainability.
- Adoption of such technology has the potential to improve agricultural productivity, resource efficiency, and economic viability for farmers worldwide.

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Introduction

- Precision agriculture is revolutionizing farming practices through technology.
- This project focuses on leveraging machine learning alongside minimax and alpha-beta pruning techniques.
- The aim is to address key challenges including predicting crop yield, aiding in crop selection, and forecasting crop diseases.
- By combining data-driven approaches with advanced algorithms, the project seeks to empower farmers with actionable insights.
- Ultimately, the goal is to enhance efficiency and sustainability in agriculture through innovative technological solutions.

Challenges / Motivation

1. **Data Variability**: Agricultural data's variability due to factors like climate, soil conditions, and crop types poses challenges for accurate prediction models.
2. **Adoption Barriers**: The resistance to adopting advanced technologies in agriculture, driven by factors such as cost, technical complexity, and lack of awareness among farmers, presents a significant challenge.
3. **Improved Efficiency**: Precision agriculture techniques, powered by machine learning and advanced algorithms, have the potential to significantly enhance the efficiency of agricultural operations, leading to higher yields and reduced resource usage.
4. **Economic Benefits:** Increasing productivity and reducing losses due to factors such as crop diseases can translate into heightened profitability for farmers, stimulating economic growth in rural areas.

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Literature Survey

Authors	Title	Dataset	Methods	Remarks
Liu, Rui, et al.	Crop Recommendation System Based on Deep Learning and IoT in Smart Agriculture	IoT sensor data, historical crop performance data	Convolutional Neural Networks, Long Short-Term Memory networks	Demonstrates system efficacy in enhancing crop selection.
Mohanty, Sharada, et al.	Using Deep Learning for Image-Based Plant Disease Detection	PlantVillage dataset	Convolutional Neural Networks	Addresses dataset imbalance and model generalization issues.

Existing System

- **Precision Agriculture Systems**: Existing precision agriculture systems leverage machine learning for predicting yield, crop selection, and disease prediction.

- **Yield Prediction Models**: They often analyze historical data on environmental factors, crop characteristics, and agronomic practices to assist farmers in making informed decisions regarding resource allocation and market planning.

- **Crop Selection Systems**: Current crop selection systems use machine learning to recommend suitable crops for cultivation based on factors like soil type, climate suitability, market demand, and input costs.

- **Crop Disease Prediction Model:** Existing crop disease prediction models employ machine learning techniques to forecast the occurrence and severity of crop diseases.

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Data Flow Diagram

Prototype

- **Phase 1**: Algorithm Used
- Utilizes Minimax and Alpha-Beta Pruning.
- **Phase 2**: Evaluation Metrics
- MAE, RMSE, Accuracy, Precision, Recall, F1 Score, TPR, FPR, AUC-ROC.
- **Phase 3**: Results
- Accurate yield prediction, optimized crop selection, proactive disease detection.
- **Phase 4**: Conclusion
- Demonstrates feasibility, suggests future refinements

References

- Zhang, Ying, et al. "Deep Learning for Remote Sensing Data: A Technical Tutorial on the State of the Art."
- Liu, Rui, et al. "Crop Recommendation System Based on Deep Learning and IoT in Smart Agriculture."
- Mohanty, Sharada, et al. "Using Deep Learning for Image-Based Plant Disease Detection."
- Saavedra-Nieves, Luis. "A Multi-Agent System for Decision Support in Precision Agriculture."
- Li, Zhihao, et al. "Real-Time Crop Disease Detection and Classification for Smart Agriculture."

THANK YOU