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## Precision Agriculture using ML for Soil and Crop Prediction

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Abstract: Agriculture plays a vital role in India's economy, yet many farmers lack access to the right technological tools to select crops based on soil and environmental conditions. Traditional crop selection methods are manual, time-consuming, and prone to human error, often resulting in poor yield and financial loss. To address this, we propose a desktop-based application that uses machine learning and image processing to classify soil types and suggest suitable crops accordingly. The application allows users to input soil images and environmental parameters such as temperature, humidity, rainfall, and pH levels. Using Convolutional Neural Networks (CNN), the software classifies the soil type from the image. Crop prediction is then carried out using algorithms like Support Vector Machine (SVM) and Random Forest, which consider both soil type and climatic conditions to suggest the best crop options. Additionally, the application integrates a weather forecasting module to help farmers plan their sowing and harvesting cycles more effectively. The interface is built using Python and GUI tools like Tkinter, making it user-friendly, fast, and reliable for offline use. The system was tested on various datasets and achieved high accuracy in both soil classification and crop prediction. This desktop application aims to reduce the dependency on traditional methods, improve decision-making, and support sustainable agriculture by guiding farmers with data-driven insights..

**Keywords:** Soil Classification, Crop Prediction, Machine Learning, Convolutional Neural Network (CNN), Support Vector Machine (SVM), Weather Forecasting, Desktop Application, Agricultural Decision Support System, Image Processing, Random Forest Algorithm

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