Crop Suggestion System: A Machine Learning Approach for Enhanced Agricultural Productivity

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Abstract

The Crop Suggestion System (CSS) is an innovative tool designed to assist farmers in selecting suitable crops based on soil characteristics. Utilizing machine learning algorithms, the system analyzes soil data, including nitrogen (N), phosphorus (P), potassium (K), and pH values, to provide personalized crop recommendations. This paper discusses the development, implementation, and evaluation of the CSS, highlighting its potential to enhance agricultural productivity and sustainability. The findings indicate that the CSS can significantly improve decision-making processes for farmers, leading to optimized crop yields and resource utilization.

Introduction

In the realm of modern agriculture, the selection of appropriate crops is a critical factor that significantly influences yield and resource efficiency. Farmers often face challenges in making informed decisions regarding crop selection due to the variability in soil quality and environmental conditions. The Crop Suggestion System (CSS) addresses these challenges by leveraging advanced machine learning techniques to provide tailored recommendations based on specific soil attributes.

Literature Review

A comprehensive literature review reveals that the application of machine learning in agriculture has gained significant traction in recent years. Various studies have demonstrated the effectiveness of machine learning algorithms in crop recommendation systems...

Methodology

The design of the CSS involves several key components, starting with data collection and preprocessing. The system collects soil and environmental data, ensuring that the information is clean, consistent, and well-labeled...

User Interface and Usability

The user interface of the CSS is designed to be intuitive and accessible, allowing farmers to easily input their soil and environmental parameters...

Results and Discussion

The evaluation of the CSS revealed that Random Forest and Naive Bayes models yielded the highest accuracy, demonstrating the system's capability to provide personalized crop recommendations based on specific soil conditions...

Conclusion

In conclusion, the Crop Suggestion System represents a significant advancement in agricultural technology, providing farmers with a reliable tool for making informed crop selections. By leveraging machine learning algorithms, the CSS enhances crop productivity and promotes sustainable farming practices...

Illustrations

Model Performance and Accuracy

	N	P	K	temperature	humidity	ph	rainfall	label
0	90	42	43	20.879744	82.002744	6.502985	202.935536	rice
1	85	58	41	21.770462	80.319644	7.038096	226.655537	rice
2	60	55	44	23.004459	82.320763	7.840207	263.964248	rice
3	74	35	40	26.491096	80.158363	6.980401	242.864034	rice
4	78	42	42	20.130175	81.604873	7.628473	262.717340	rice

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DecisionTrees's Accuracy is: 90.0

	precision	recall	f1-score	support
apple	1.00	1.00	1.00	13
banana	1.00	1.00	1.00	17
blackgram	0.59	1.00	0.74	16
chickpea	1.00	1.00	1.00	21
coconut	0.91	1.00	0.95	21
coffee	1.00	1.00	1.00	22
cotton	1.00	1.00	1.00	20
grapes	1.00	1.00	1.00	18
jute	0.74	0.93	0.83	28
kidneybeans	0.00	0.00	0.00	14
lentil	0.68	1.00	0.81	23
maize	1.00	1.00	1.00	21
mango	1.00	1.00	1.00	26
mothbeans	0.00	0.00	0.00	19
mungbean	1.00	1.00	1.00	24
muskmelon	1.00	1.00	1.00	23
orange	1.00	1.00	1.00	29
papaya	1.00	0.84	0.91	

Decision Tree's Accuracy: 90.0% Naive Bayes' Accuracy: 99.09%

Support Vector Machine (SVM) Accuracy: 10.68% Logistic Regression Accuracy: 95.23%
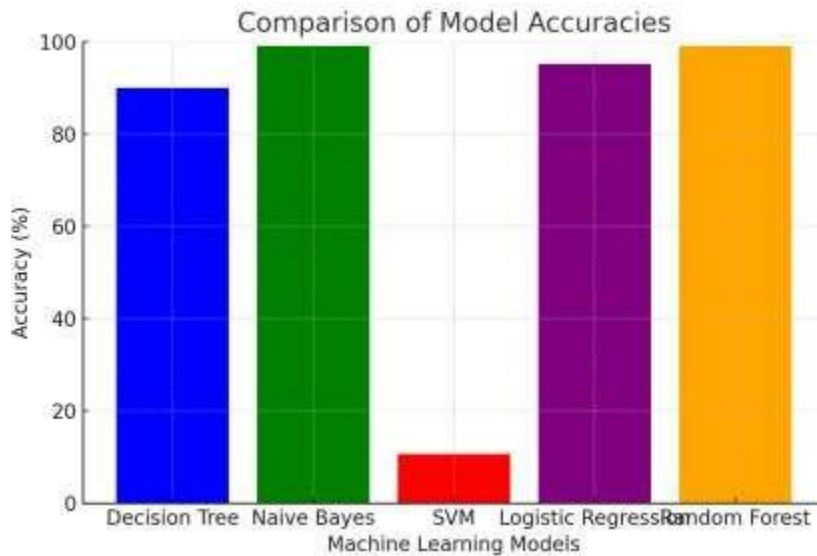
Random Forest Accuracy: 99.09%

Figure: Model Accuracy Comparison

Correlation Analysis of Soil Parameters

The correlation matrix shown below represents the relationship between different soil parameters, including nitrogen (N), phosphorus (P), potassium (K), temperature, humidity, pH, and rainfall. This analysis helps in understanding how different soil characteristics influence each other, which is essential for making accurate crop predictions.
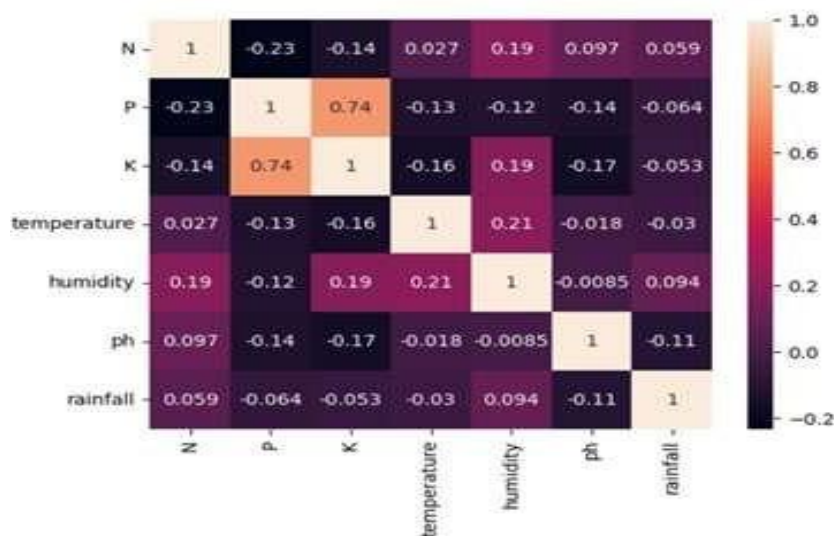

Figure: Correlation Heatmap of Soil Parameters