IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 2, February 2024

Soil Classification and Crop Suggestion using Machine Learning Techniques

Dhiraj Ingole[1], Gaurav Pachbhai[2], Pranav Jambhrunkar[3], Aniket Bismore[4], Prof. R. N. Satthwane[5]
Students, Department of Computer Engineering[1,2,3,4]
Guide, Department of Computer Engineering[5]
Sinhgad Institute of Technology, Lonavala, India
dhirajingole.sit.comp@gmail.com [1], gauravpachbhai789.sit.comp@gmail.com[2]
pranavjambharunkar.sit.comp@gmail.com[3], aniketbismore.sit.comp@gmail.com[4]

Abstract: *In agriculture, the optimization of crop selection based on soil characteristics plays a pivotal role in maximizing yields and ensuring sustainable agricultural practices. Traditional methods of soil classification and crop suggestion rely heavily on manual labour and expertise, often resulting in time-consuming processes with limited accuracy. However, the integration of machine learning techniques presents a promising solution to this challenge*

Keywords: Agriculture

I. INTRODUCTION

In agriculture, the optimization of crop selection based on soil characteristics plays a pivotal role in maximizing yields and ensuring sustainable agricultural practices. Traditional methods of soil classification and crop suggestion rely heavily on manual labour and expertise, often resulting in time-consuming processes with limited accuracy. However, the integration of machine learning techniques presents a promising solution to this challenge.

This research paper aims to explore the application of machine learning algorithms in soil classification and crop suggestion. By leveraging large datasets of soil properties and historical crop performance, machine learning models can learn complex patterns and relationships, enabling more accurate predictions and recommendations.

The significance of this research lies in its potential to revolutionize agricultural practices by providing farmers and agricultural experts with timely and precise insights into soil characteristics and optimal crop choices. By harnessing the power of machine learning, farmers can make data-driven decisions that enhance productivity, optimize resource utilization, and promote sustainability.

Throughout this paper, we will delve into the methodologies and algorithms used for soil classification and crop suggestion, including supervised and unsupervised learning techniques.

II. PROPOSED WORK

This research proposes an integrated approach for soil classification and crop prediction leveraging machine learning techniques. The study utilizes image datasets for soil classification and CSV datasets for crop prediction. The proposed methodology involves preprocessing of the datasets, including data cleaning and feature extraction. Subsequently, two distinct algorithms are employed for classification: Convolutional Neural Network (CNN) for soil classification and Support Vector Machine (SVM) for crop prediction. The datasets are trained with the respective algorithms to generate models capable of accurate classification and prediction. The effectiveness of the models is evaluated through rigorous testing, providing valuable insights into soil type classification and crop prediction for agricultural applications.

This proposed work aims to contribute to the field of agricultural research by providing an integrated approach for soil classification and crop prediction using machine learning techniques. Through rigorous experimentation and evaluation, the study seeks to enhance understanding and decision-making capabilities in agricultural practices, ultimately leading to improved crop yields and sustainable soil management strategies.

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III. METHODOLOGY

Data Preprocessing:

- Cleaning the datasets to remove noise and inconsistencies.
- Feature extraction to identify relevant patterns and attributes.

Classification Algorithms:

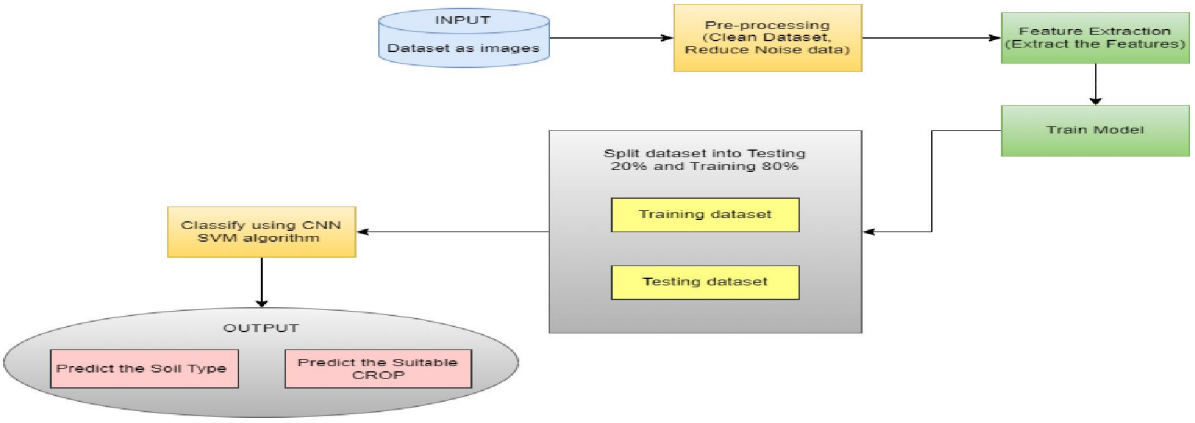
1) Utilization of Convolutional Neural Network (CNN) for soil classification.
2) Implementation of Support Vector Machine (SVM) for crop prediction.

Training and Model Generation:

1)Training the datasets with the respective algorithms to develop accurate models. 2)Parameters tuning and optimization for improved performance.

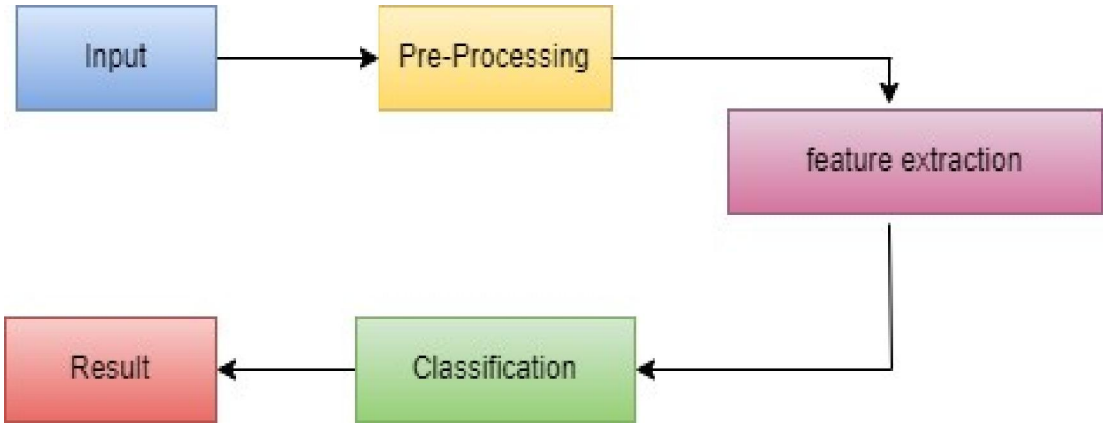
IV. ARCHITECTURE

ARCHITECTURE :



V. UML DIAGRAMS

FLOW DIAGRAM



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USE CASE DIAGRAM

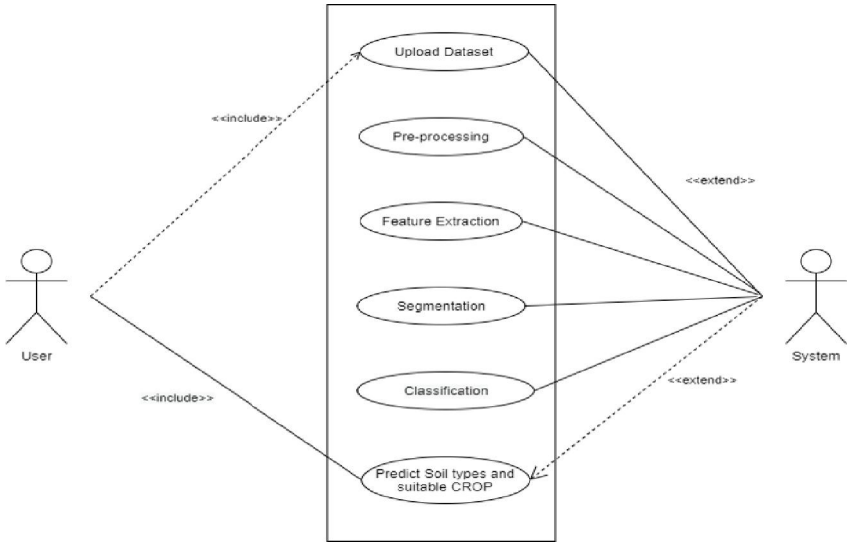

Figure: Use Case Diagram

IV. HARDWARE AND SOFTWARE REQUIREMENTS

HARDWARE REQUIREMENTS

- System Processors : Intel core2 Duo
- Speed : 2.4 GHz
- Hard Disk : 150 GB

SOFTWARE REQUIREMENTS

- Operating System: Windows 10 (64 Bit)
- IDE: Spyder
- Programming Language: Python version (3.7,3.8)
- Libraries: Tensorflow,Opencv ,Keras ,Numpy
- Database: DBSqlite3

V. APPLICATIONS

Precision Agriculture:

- The integrated approach can be applied in precision agriculture to accurately classify soil types and suggest crops based on soil characteristics.
- Farmers can utilize the developed models to make informed decisions regarding crop selection, irrigation, fertilization, and other agricultural practices tailored to specific soil conditions.

Sustainable Agriculture:

- Sustainable agricultural practices heavily rely on optimizing resource utilization and minimizing environmental impacts.
- The developed models can aid in promoting sustainable agriculture by facilitating the adoption of precision farming techniques and promoting soil conservation measures

Agricultural Research and Development:

- Researchers and scientists can use the proposed methodology as a framework for conducting further studies in agricultural science and technology.

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- By exploring alternative algorithms, datasets, and preprocessing techniques, the research can contribute to advancements in agricultural research and development.

Decision Support Systems:

Decision support systems (DSS) can integrate the developed models to provide real-time recommendations and guidance to farmers and agricultural stakeholders.

By incorporating soil classification and crop prediction capabilities, DSS can assist users in making timely and informed decisions, leading to improved agricultural productivity and sustainability.

These applications demonstrate the potential impact and relevance of the proposed research in various domains, ranging from agriculture and environmental management to decision support systems and sustainable development.

VI. FUTURE SCOPE

Future Scope: In reference to rainfall can depict whether extra water availability is needed or not. This research work can be enhanced to higher level by availing it to whole India. Crop diseases detection using Image Processing where users can upload picture of diseased crop and get pesticides recommendations. Implementation of Smart Irrigation System to monitor weather and soil conditions, plant water usage etc. to automatically alter watering schedule.

VII. CONCLUSION

- A model is proposed for predicting soil series and providing suitable crop suggestion for that specific soil.
- The model has been tested by applying different kinds of machine learning algorithm.
- CNN shows highest accuracy in soil classification with less time. It gives us more accuracy as compared to existing system and gives more benefit to farmers.
- As farmers get to know the suitable crop and fertilizers for specific soil. A lot of time and resources are preserved

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BIOGRAPHY

- Dhiraj Ingole - An Undergraduate Scholar pursuing Bachelors in Computer Engineering from Sinhgad Institute of Technology. He is working under the guidance of Prof. R. N. Satthwane
- Gaurav Pachbhai - An Undergraduate Scholar pursuing Bachelors in Computer Engineering from Sinhgad Institute of Technology. He is working under the guidance of Prof. R. N. Satthwane
- Pranav Jambhrunkar - An Undergraduate Scholar pursuing Bachelors in Computer Engineering from Sinhgad Institute of Technology. He is working under the guidance of Prof. R. N. Satthwane
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