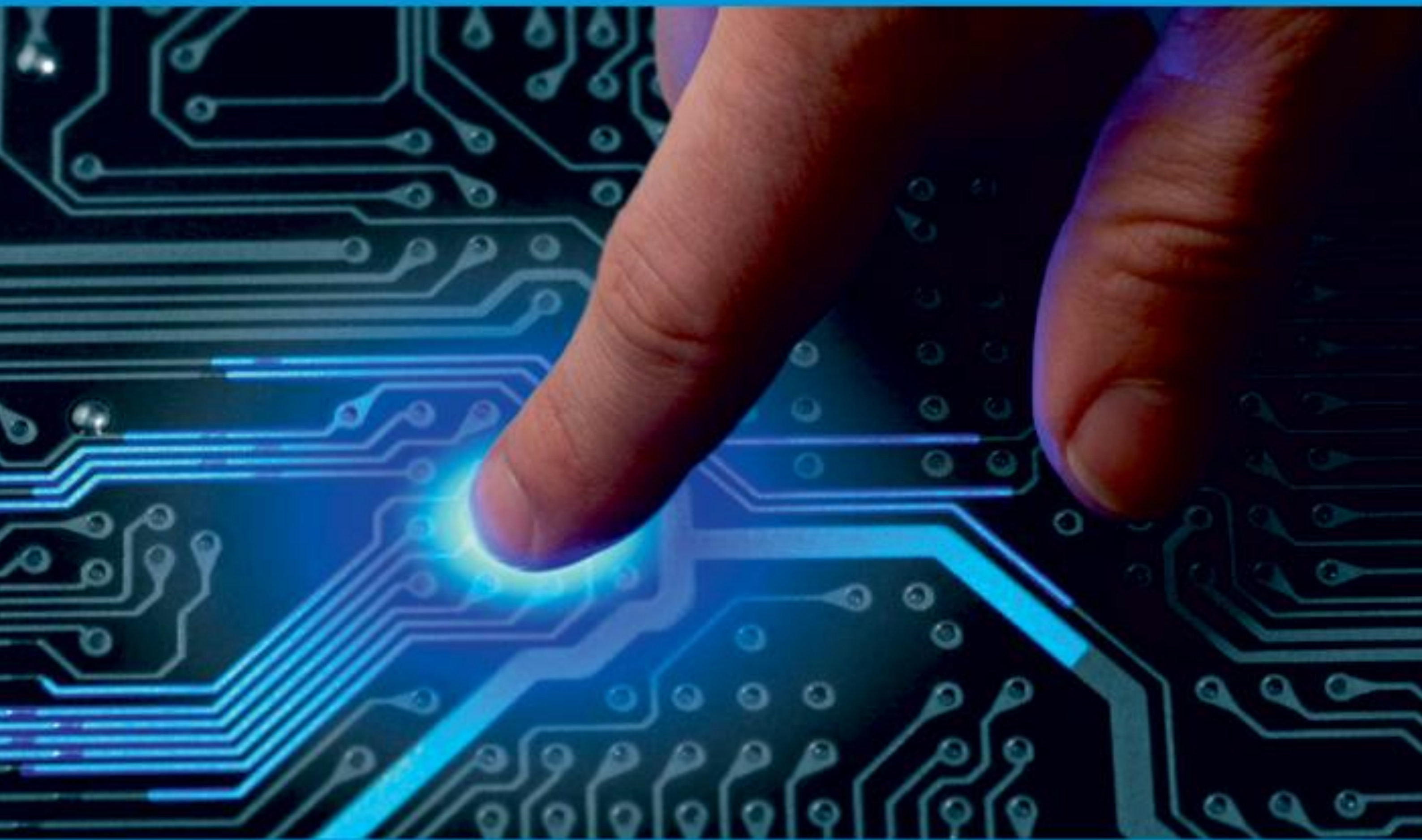
IJIRCCE

e-ISSN: 2320-9801 | p-ISSN: 2320-9798



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN COMPUTER & COMMUNICATION ENGINEERING

Volume 11, Issue 5, May 2023

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 8.379

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 |

|| Volume 11, Issue 5, May 2023 ||

| DOI: 10.15680/IJIRCCE.2023.1105244 |

Soil Classification and Crop Suggestion by Image Processing using Machine Learning

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ABSTRACT: The agricultural quarter in India performs a vital position within the country's financial system, contributing extensively to the gross domestic product and making sure food protection. However, the agricultural productivity and crop predictions are being adversely affected by unpredictable weather modifications. This state of affairs ends in reduced crop yields and challenges farmers in forecasting future plants correctly. To address this difficulty, this research venture makes a speciality of supplying steering to amateur farmers with the aid of leveraging gadget gaining knowledge of techniques, particularly the Naive Bayes set of rules, for crop prediction. The mission collects seed information for various plants, along with applicable parameters consisting of temperature, humidity, and moisture content material, which are critical for a hit crop growth. Using picture processing strategies, the project objectives to classify soil sorts based on input photos of soil samples. By reading the traits of the soil, the gadget determines which plants are suitable for the unique soil kind. To make the technology handy and consumer-pleasant, a cellular application for Android is being evolved as part of the assignment. The software allows users, specifically farmers, to enter parameters together with temperature, even as robotically shooting their region. This information is then utilized in the prediction method to propose appropriate plants for cultivation. By combining photo processing, system getting to know, and mobile technology, this venture targets to assist farmers in making informed choices concerning crop choice based on their soil kind. Ultimately, the task seeks to improve agricultural productiveness, allow better crop predictions, and contribute to the overall welfare of farmers in India.

KEYWORDS: Keywords: agriculture, crop suggestions, soil classification, image processing, machine learning, crop prediction, farmers.

I. INTRODUCTION

introduction: Land classification and crop data are important aspects of agricultural practices. Accurate soil classification helps in understanding soil properties and characteristics, while crop recommendations help farmers make informed decisions about crops suitable for particular soil conditions Recent advances in convolutional neural networks (CNNs).), a deep learning model for image analysis has shown promising potential in soil classification and crop recommendation In this case, CNN converts geographic information into image-like images, enabling the model to analyze spatial patterns and extract meaningful features for classification Using the power of deep learning a, CNNs can learn the complex relationship between soil properties and crop suitability This approach has the potential to revolutionize traditional approaches to soil classification, which often rely on manual surveys and expert knowledge. The operationalization of the process through CNNs makes it possible to efficiently handle large amounts of information, real-time results and crop recommendations tailored to unique soil characteristics In this work, we investigate the use of CNNs for land classification and crop recommendation. We have proposed an approach that includes data collection, preprocessing . model architecture design, training, and analysis for land classification accuracy and crop recommendation Using the power of CNN we aim to provide a solution reliable and scalable for agricultural stakeholders, to provide better crop choice and improve overall agricultural productivity f value -and to empower insight. Through this study, we hope to demonstrate the potential of CNNs in soil classification and crop recommendation, and to establish their potential for automating and improving decision-making processes in agriculture. The results of this study can contribute to the development of precision agriculture, enabling farmers to make informed decisions based on data-driven insights, resulting in sustainable and efficient agricultural practices

II. OBJECTIVE

Develop an image processing program that can analyze maps and extract relevant features for soil classification. Develop a comprehensive soil classification model that accurately classifies soil types based on selected features. Use soil types and their crop preferences namely establishes a list of alignment. Design crop Recommendation a system that uses soil classification results for crops suitable for a soil type Provide recommendations. Ensure the accuracy and reliability of the crop recommendation system by on rigorous testing and evaluation. Develop a simple and user-friendly interface for farmers to input and retrieve map crop proposals Analysis of new features in the tun

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recommendation system Add, such as weather conditions and market demand. Extend the scope of work available, to cover different regions and geographies, starting from all over India. With agricultural experts, researchers and organizations cooperate to make the industry and its the actual presence has met. world agricultural practices and leverage domain knowledge .Develop scalable and scalable planning systems that can handle large maps and constantly update the crop recommendation database. Document the project process, findings and recommendations to support knowledge of soil classification and crop selection To facilitate informed decision making and sustainable agricultural practices. Explore the potential for future enhancements, such as integrating remote sensing data or leveraging machine learning algorithms for continuous improvement of the crop recommendation system.

III. METHODOLOGY

User Registration and Login: To grant access to the application, create a user registration and login system. Before using the crop recommendation tool, users must create an account and log in. Acquisition of Input: Enable users to upload an image of the soil via the application's user interface. Give consumers the choice of choosing an image from the gallery or taking a photo with their device's camera. Preprocessing : Enhance the input image's quality and get it ready for more analysis via preprocessing processes. To make an image more suitable for processing, use methods like noise reduction, image scaling, and normalisation. Edge Enhancement: In the preprocessed image, use edge enhancement methods to draw attention to the limits and edges of soil characteristics. Enhancing the borders can make it easier to distinguish between various geographical areas and soil textures. RGB Conversion: - Change the previously processed image's original colour space to RGB (Red, Green, and Blue). The separation of colour information, which can be employed as a feature for soil categorization, is made possible via RGB conversion. Binary Conversion: Use a good thresholding technique to convert the RGB image into a binary image. Thresholding makes further analysis easier by segmenting the image into discrete parts depending on intensity or colour values. Edge Detection: Identify the edges and contours of the soil characteristics by using edge detection methods, such as Canny edge detection or Sobel operator. Edge detection aids in the extraction of distinctive features and soil region borders. Segmentation: Use segmentation to separate the soil regions from the background and other non-soil features in the binary image. Depending on the image parameters, many segmentation approaches can be used, such as region growth, watershed segmentation, or clustering. Extraction of Geometry-Based Soil Features: - Extraction of geometric features, such as area, perimeter, compactness, elongation, and texture features, from the segmented soil regions. - These features capture the shape, size, and spatial arrangement of soil regions, which can aid in the classification process. Convolutional Neural Network (CNN) Classification Use a labelled dataset of soil image and the suggested crop to train a CNN model. Give the trained CNN model the extracted soil features as input for classification. Accurate categorization is made possible by the CNN model, which learns the patterns and correlations between soil parameters and crop compatibility. Crop Recommendation: Use the CNN classification's output to choose the best crop to plant in the given soil. Connect the categorised soil type to a database of suggested crops and preferred crops for each soil type. Based on the classification outcome, show the user the recommended crops. outcomes Presentation: - Through the application interface, provide the user the outcomes of the crop recommendation. Showcase the suggested crops along with relevant details like the ideal planting season, necessary conditions for growth, and estimated output.

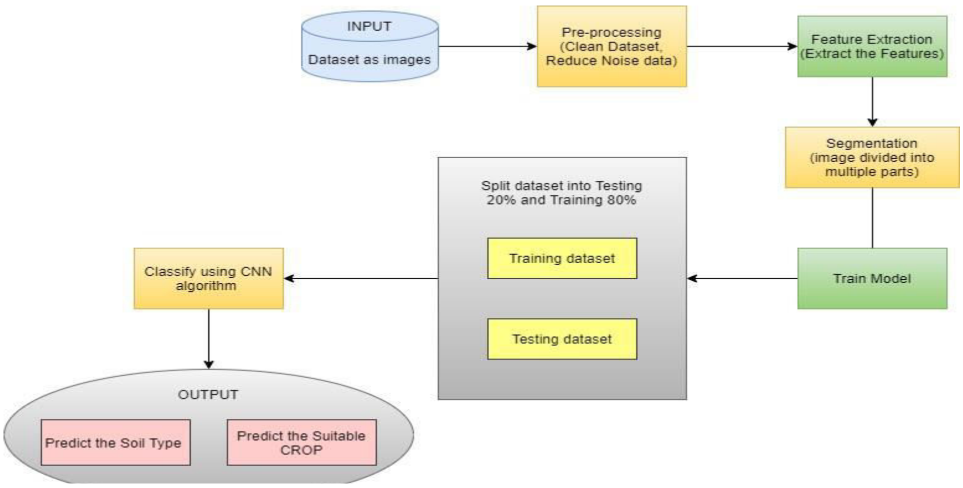

Fig. 1.1: System Architecture

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Input: The system requires a dataset of photographs of soil as input. These pictures show several soil samples that were collected from various places.

Preprocessing: The input dataset is cleaned up and the noise is reduced through preprocessing. Techniques including noise reduction, normalisation, and image enhancement may be used in this step.

Features Extraction: Following preprocessing, pertinent features are collected from the soil photos. These parameters reflect significant aspects of the soil that reveal its potential for various crops. Techniques like form analysis, colour analysis, or texture analysis are examples of feature extraction approaches.

Segmentation: To concentrate on particular areas that contain soil information necessary for crop classification, the preprocessed pictures may be split into various segments or regions of interest. To distinguish the soil patches from the surrounding area or other undesirable features, segmentation techniques like thresholding or clustering may be used.

Train the model: The dataset is divided into training and testing sets, with training set receiving 80% of the data. A machine learning model, more precisely a Convolutional Neural Network (CNN), is trained using the training set. On the labelled soil photos, where the soil type and related suitable crops are known, the CNN is trained.

Testing: The trained model is tested using the final 20% of the dataset. These photos are sent into the trained CNN to check how well it performs and gauges how well it can identify the various soil types and recommend suitable crops.

Classification utilising the CNN algorithm: The retrieved characteristics are utilised to categorise the soil photos into various soil kinds. On fresh, previously unseen soil photos, CNN uses its knowledge of relationships and learning patterns to generate predictions. The estimated soil type for each image is included in the step's output.

Output: There are two primary outputs offered by the system:

i) Predict the Soil kind: For each input soil image, the system predicts the kind of soil by categorising it into several groups, such as clay, loam, sand, etc.

ii) Predict the Appropriate Crop: In accordance with the projected soil type, the system recommends the appropriate crops that are understood to do well in that specific soil type. The suggested crops are based on existing information and advice from experts.

To give precise soil classification and crop predictions, the system architecture combines image processing techniques, feature extraction, and CNN-based classification. The method seeks to help farmers decide which crops are suitable for their particular soil conditions by analysing the input soil photos, thereby optimising agricultural productivity and promoting sustainable farming practises.

IV. DATA FLOW DIAGRAM

The input of a soil image triggers the creation of the data flow diagram for the crop suggestions by soil categorization project. The system's main source of data is this picture.

The system starts a series of preprocessing and segmentation procedures after receiving the soil image. Preprocessing entails clearing the image of noise and other information to preserve only the key characteristics of the soil. By dividing the image into discrete sections of interest, segmentation enables a more specialised analysis. The system then continues on to feature extraction after the preprocessing and segmentation phase. In this case, pertinent features are derived from the segmented and preprocessed soil image. These criteria capture significant soil qualities that are critical in determining the appropriateness of the soil for various crops.After that, a trained model, namely a crop classification algorithm, is fed the collected features as input. The best appropriate crop for the existing soil conditions is predicted by this algorithm using the retrieved attributes as well as previously acquired knowledge on crop-soil relationships. The system then generates an output in the form of the anticipated crop. Based on its distinct qualities, the advised crop is the best option for production in the evaluated soil.

In conclusion, the data flow diagram shows how data is processed, segmented, extracted features, and predicted crops sequentially starting with the input soil image. It demonstrates how a trained model and image processing techniques are used to analyse the soil image and offer helpful crop suggestions based on the soil's properties.

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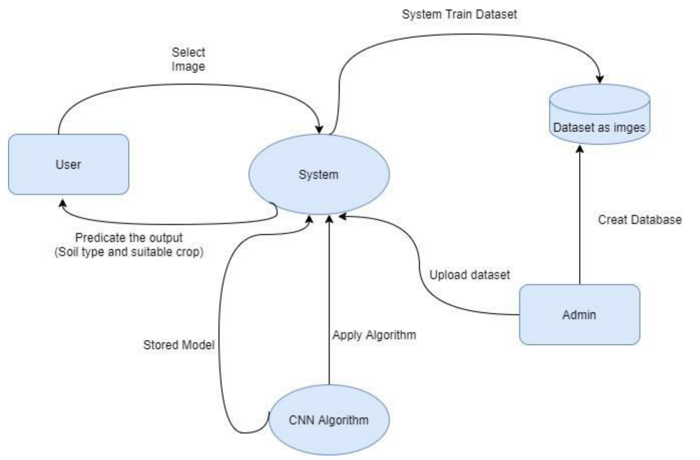

Fig. 1.2: DataFlow diagram

V. ACTIVITY DIAGRAM

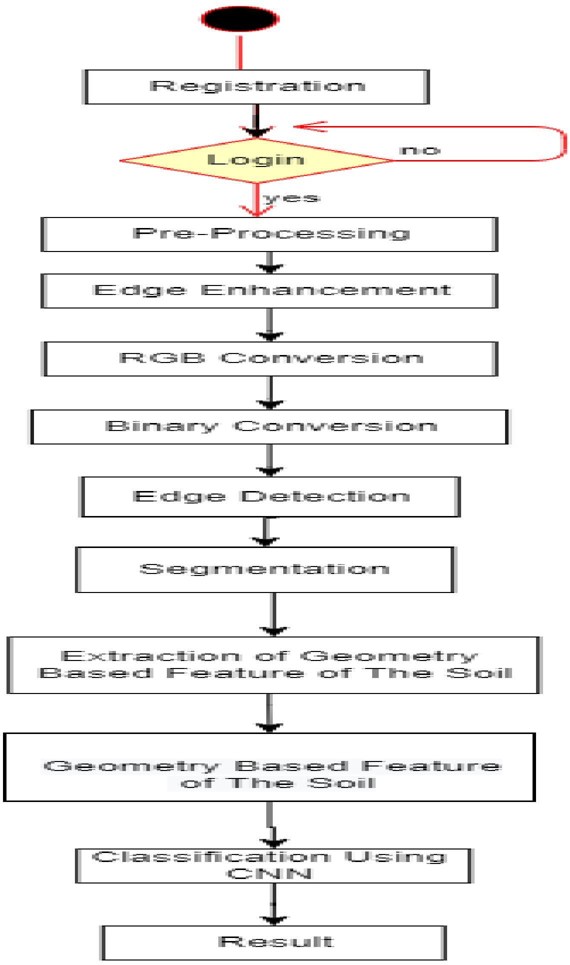

Fig. 1.3: Activity Diagram

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Activity diagrams are visual depictions of workflows with choice, iteration, and concurrency supported by activities and actions. Activity diagrams can be used to depict the operational and business workflows of system components in the Unified Modelling Language. An activity diagram demonstrates the total control flow. Users may register for an account by supplying the required information. After confirming the user's information, the system generates an account. Users who have registered may log in using their credentials. The user's login details are validated by the system. Users can upload a picture of the soil after logging in to submit soil information. The image is brought into the system and stored there for processing. Applying Feature Extraction: The system applies image processing methods to the soil picture in order to extract pertinent characteristics. Algorithms for feature extraction examine the image and pinpoint its essential elements . Support Vector Machine (SVM) method: The retrieved features are subjected to the SVM method . Based on the retrieved features, SVM categorises the soil and establishes its properties . Predict Soil Specifics: Using the features retrieved, the SVM algorithm predicts the type of soil. The system gives anticipated soil information, including the type, content, and characteristics of the soil . Users can check the anticipated soil specifics to confirm the soil result . To verify the accuracy of the prediction, they can speak with specialists or compare the results with what they already know.

VI. CONCLUSION

Our nation's economy benefits from the field of agriculture. However, this lags behind in utilizing emerging machine learning technology. In order to close the technological and agricultural gap, our project on crop suggestions by soil categorization using image processing and machine learning approaches. Our nation's economy depends heavily on agriculture, thus it is crucial to adopt cutting-edge technology, like machine learning, to maximise crop yield .We can give farmers helpful information about which crops are good for particular soil types by utilising image processing and machine learning methods. By using these methods, we may maximise crop productivity while addressing a number of agricultural difficulties. Farmers must remain knowledgeable about the .The use of machine learning in agriculture has many advantages, including improved crop yield prediction accuracy and the capacity to contrast the performance of various crops. We can aim for maximum yield rates and address the issues facing the agricultural industry by implementing these strategies into agricultural practices .In conclusion, the goal of our research is to equip farmers with the information they need to improve crop output, address agricultural issues, and anticipate yields more accurately. We can enhance the agricultural sector and contribute to the expansion of our nation's economy by adopting machine learning and other innovations.

VII. ACKNOWLEDGEMENT

We’re really indebted to D.Y Patil College of Engineering , Ambi, Pune. for providing us an opportunity to undertake this project work as partial fullfilment of the BACHELOR’s Degree in BACHELOR OF ENGINEERING curriculum. We would like to express our heartiest gratitude to Prof. Dipali Khairnar and all the faculties of the BE Computer Department for their encouraging support and guidance in carrying out this project. We express our sincere thanks to D.Y Patil College of Engineering Technology, Ambi, Pune. for permitting us to take this project work and for them instance of the good programming technique, which helped us to design and develop a successful **Soil Classification and Crop Suggestion by Image Processing using Machine Learning**. Finally, sincere thanks to our project members, mentors and all well-wishers for their esteemed guidance, support, valuable suggestions and constructive criticism.

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