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SOIL CLASSIFICATION AND CROP SUGGESTION USING DEEP LEARNING

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ABSTRACT:

In the last few decades researchers are interested in land mapping and its classification due to various reasons. The reasons for an increase in the focus of the research community are, the increasing demand for agricultural land and soil health analysis, as the health of the soil, is essential for the healthy production of crops. Image classification is one such approach for soil and land health analysis. It is a complex process having the effects of various factors. This paper has proposed the study of current researches, the problems it addressed, and its prospects. The emphasis is focused on the analytical study of various advanced and efficient classification mechanisms and techniques.

INTRODUCTION:

Soil possess different senses for different people like it is the products of past surface processes for a geologist. Similarly, for a penologist, it is a chemical and physical process currently occurring. In India, Soil is particularly the basic and most essential entity for the agricultural Domain. The product quantity losses can be reduced and the quality of the crop can be improved if the characteristics of the soil can be recognized. It is very important for countries that have several agricultural commodities to be export.

Production of crops depends on four main factors like climate, soil fertility, availability of water, and disease or pests. And four biological factors as organic matter content, Activation carbon content, Nitrogen content, and root health.

The health of soil can be tested in the range of 1 to 100[1]. A soil health test report provides an integrative assessment and also identifies specific soil constraints. In this paper main focus survey for soil health and different methodology used in the classification process. This process will help in building a model for classifying various kinds of soil series data along with a suitable suggestion for improving the fertility of the soil by detecting the health of the soil.

PROBLEM STATEMENT:

It is widely recognised that environmental problems such as soil degradation (erosion and desertification) affects many agricultural lands globally. These problems have caused soil quality decline, crop yield reduction, economic crisis, poverty, unemployment, and rural urban migration. Poor soil quality can result from inadequate fertilisation, infrequent crop rotation or over farming of the same land. A reduction in soil quality can also result from both water shortages and excessive rain**.**

LITERATURE SURVEY

As discussed above, the number of researchers are working in this area. In paper [2], the authors observed that the number of classification algorithms is available in remote sensing methods like minimum distance, maximum likelihood, support vector machine, K-NN, and multilevel classification. All the classifiers work for the same – classification and accuracy. Edaphic factors are the external factors include the soil moisture, soil air, soil mineral, soil temperature, soil organic matter, soil organism, and soil reactions [3]. The growth of the plant is completely depending on these factors. In our focus, organic matters are important because it provides the entire major, minor, and micronutrient to the plant. The role of the organic component is improving the texture of the soil, helping to increase The water holding capacity of the soil. It is the food for most micro-organisms. It is observed that the growth of crops depends on two factors as shown in figure- external factors and internal factors.

Paper [4], works on the development of the vision system for the soil where technology was based on image processing with feature extraction. In this approach, images are considered as input for classification. Paper also pointed out that the level of nutrients will be helpful for farmers to come up with fertilizer recommendations [5].

Another algorithm in vision séance is developed in [6] by A Iriars and others. This group of researchers developed an algorithm for 'weed detection in the crop by computational vision'. The purpose of this design was the management of weeds in crops. A binary classification method was used in this approach.

SYSTEM ANALYSIS

The Systems Development Life Cycle (SDLC), or Software Development Life Cycle in systems engineering, information systems and software engineering, is the process of creating or altering systems, and the models and methodologies that people use to develop these systems. In software engineering the SDLC concept underpins many kinds of software development methodologies.

EXISTING SYSTEM:

The authors observed that the number of classification algorithms is available in remote sensing methods like minimum distance, maximum likelihood, support vector machine, K-NN, and multilevel classification. Another algorithm in vision séance is developed in by A Iriars and others. This group of researchers developed an algorithm for 'weed detection in the crop by computational vision. A binary classification method was used in this approach.

PROPOSED SYSTEM:

A classification of the soil and identifying the quality level to which a soil belongs and what contents of the soil need to be improved can define the type of the soil. Knowing such a class or type of soil can be very useful for cultivation. For analyzing the type of soil in a specific geographical area can be done by collecting soil samples of that area and using different machine learning algorithms classifying them into various classes. With the emergence of machine learning and its implementation in image processing, the soil sample can be classified efficiently into class to which it belongs.

METHODOLOGY

DEEP LEARNING ARCHITECTURE

The deep learning architecture learns various important nonlinear features from the given samples. Then, this learned architecture is used to predict previously unseen samples. To train our deep learning architecture, we collected images from different sources. The architecture of the learning technique highly depends on CNN. All the aspects of deep learning architecture are described below

DATASET COLLECTION:

Data from two different sources are collected for training and testing the model. We collected a total of 4 types of soil classes images with each images of 30 images. For training purposes, 80% images of each class are used and the rest of the images are utilized for testing purposes.

ARCHITECTURE DEVELOPMENT:

The learning model is based on CNN which is very useful for pattern recognition from images. The network comprises an input layer, several hidden layers and an output layer. The hidden layers consist of multiple convolution layers that learn suitable filters for important feature extraction from the given samples. The features extracted by CNN are used by multiple dense neural networks for classification purposes.

SOFTWARE ENVIRONMENT

SOFTWARE DEVELOPMENT LIFE CYCLE:

There is various software development approaches defined and designed which are used/employed during development process of software, these approaches are also referred as "Software Development Process Models". Each process model follows a particular life cycle in order to ensure success in process of software development.

DESIGN:

The software system design is produced from the results of the requirements phase. Architects have the ball in their court during this phase and this is the phase in which their focus lies. This is where the details on how the system will work

is produced. Architecture, including hardware and software, communication, software design (UML is produced here) are all part of the deliverables of a design phase.

IMPLEMENTATION:

Code is produced from the deliverables of the design phase during implementation, and this is the longest phase of the software development life cycle. For a developer, this is the main focus of the life cycle because this is where the code is produced. Implementation my overlap with both the design and testing phases.

Many tools exists (CASE tools) to actually automate the production of code using information gathered and produced during the design phase.

TESTING:

During testing, the implementation is tested against the requirements to make sure that the product is actually solving the needs addressed and gathered during the requirements phase. Unit tests and system/acceptance tests are done during this phase. Unit tests act on a specific component of the system, while system tests act on the system as a whole. So in a nutshell, that is a very basic overview of the general software development life cycle model. Now let's delve into some of the traditional and widely used variations.

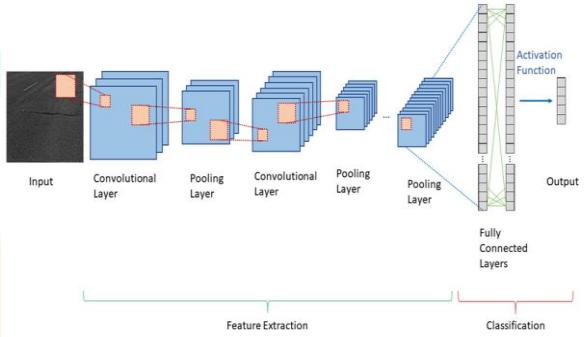
CONVOLUTION NEURAL NETWORK:

CNN stands for Convolutional Neural Network, which is a type of artificial neural network that is commonly used for image recognition, object detection, and classification tasks.

CNNs are particularly effective at identifying patterns in images, making them useful for tasks such as image recognition, self-driving cars, and medical image analysis.

The key feature of a CNN is its ability to use convolutional layers to automatically learn features from raw image data.

Convolutional layers apply filters to an input image to extract features such as edges, corners, and blobs. These features are then passed through other layers, such as pooling and fully connected layers, to classify the input image.



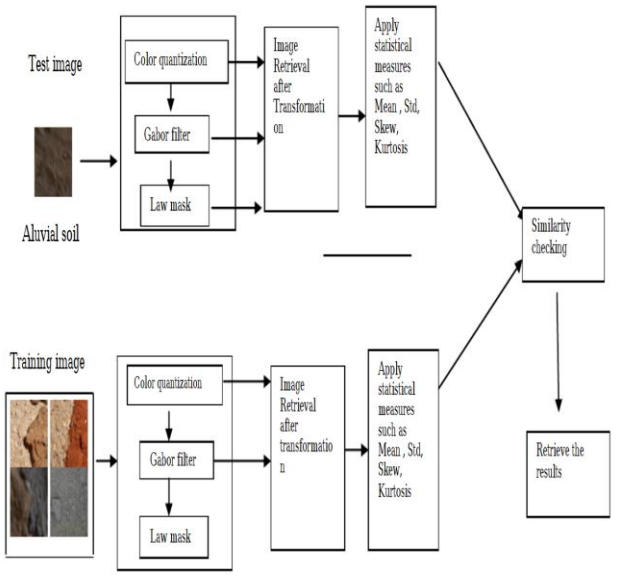
Here is a simplified step-by-step process of how a basic CNN (Convolutional Neural Network) works:

1. Input Layer: The input layer receives the input image, which is a matrix of pixel values.
2. Convolution Layer: The convolution layer applies a set of filters or kernels to the input image. Each filter slides across the input image, performing a convolution operation to extract relevant features from the image. The output of this layer is a set of feature maps.
3. Pooling Layer: The pooling layer reduces the dimensionality of the feature maps generated by the convolution layer by performing operations such as max pooling or average pooling. This helps to make the image features more efficient and reduces the risk of overfitting.
4. Fully Connected Layer: The fully connected layer takes the output of the pooling layer and applies a set of weights to produce the

final output. This layer is similar to the hidden layers in a traditional neural network.

5. Output Layer: The output layer produces the final output of the input image. The class with the highest probability is the predicted class for the input image.

SYSTEMARCHITECTURE DESIGN:



CONCLUSION:

This project surveys the different algorithms and methodologies associated with the land classification and in this paper, it has been attempted to identify a method for detecting the nutrient level in the soil. Organic matters play a vital role in soil health. Uses of organic matters are good in séance of increasing water-holding capability and to provide major, minor, and micronutrient to the plant. The good classifier should handle diversity in the land. It should be hierarchical for deep classification with maximum accuracy. The level of nutrients will be helpful for farmers for the further recommendation of fertilizers. Fuzzy Logic with a rule-based system is highly modified and can perform more accurate results of classification. On the other hand, binary classification is a basic and fast approach, however, its accuracy is low as compared to the fuzzy logic system

FUTURE ENHANCEMENTS:

The government of India started a scheme 'Soil Health Card' promoted by the Department of Agriculture & Cooperation under the Ministry of Agriculture. It will be implemented through the Department of Agriculture of all the State and Union Territory Governments. An SHC is meant to give each farmer soil nutrient status of his holding and advice him on the dosage of fertilizers and also the needed soil amendments, that he should apply to maintain soil health in the long run. A huge group of scientists is associated with land classification, crop classification, and soil classification. There is a need for classification of soil for its nutrient and its health. Few works are available associated with it. The proposed research work can be introduced for classifying soil for its health detection. All the methods that are involving with the training and testing phase have a limitation of the size of the database. It can be worked on this factor to reduce the space complexity as well as time complexity.

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