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DEEP LEARNING FOR SOIL FERTILITY AND PLANT NUTRIENT MANAGEMENT

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ABSTRACT

Deep learning methods are greatly admired in the research field of agriculture. The agriculture factors weather, rain, soil, pesticides, and fertilizers are the main responsible aspect to raise the production of yields.The fundamental basic key aspect of agriculture is Soil for crop growing. Examination of soil is a noteworthy part of soil asset management in horticulture. The soil investigation is exceptionally useful for cultivators to discover Which sort of harvests to be developed in a specific soil condition. The main target of this work is to investigate soil supplements utilizing deep learning classification techniques.

Keywords: Deep Learning , SVM (Support Vector Machine), CRA neutral networks.

1. INTRODUCTION

To analyse the soil nutrients former need to go Department of Agriculture or Cooperation and Farmers Welfare. This work takes some district of Tamil Nadu in India to analyze the soil nutrients. Distinctive sort's soil has a diverse variety of supplements. This system chooses Nitrogen, Phosphorus, Potassium, Calcium, Magnesium, Sulfur, Iron, Zinc, and so forth, nutrients for investigating the soil supplements utilizing CRA approach of Neural network. The performance of the classification is compared with the real time analysis based on the following two factors: accuracy and execution time.A support vector machine takes these data points and outputs the hyperplane (which in two dimensions it's simply a line) that best separates the tags. This line is the decision boundary: anything that falls to one side of it we will classify as blue, and anything that falls to the other as red. The goal of SVM is to identify an optimal separating hyperplane which maximizes the margin between different classes of the training dataSupport Vector Machine Algorithm. Support Vector Machine or SVM is one of the most popular Supervised Learning algorithms, which is used for Classification as well as Regression problems. However, primarily, it is used for Classification problems in Machine Learning. Classification Accuracy

of SVM and CNN In this study, it is shown that SVM overcomes CNN, where it gives best results in classification, the accuracy in PCA- band the SVM linear 97.44%, SVM-RBF 98.84% and the CNN 94.01%, But in the all bands just have accuracy for SVM-linear 96.35% due to the big data hyperspectral. SVM is a supervised machine learning algorithm which can be used for classification or regression problems. It uses a technique called the kernel trick to transform your data and then based on these transformations it finds an optimal boundary between the possible outputs.

Soil nutrient is an important aspect that contributes to the soil fertility and environmental effects. Traditional evaluation approaches of soil nutrient are quite hard to operate, making great difficulties. in practical applications. In this paper, we present a series of comprehensive evaluation models for soil nutrient by using support vector machine (SVM), multiple linear regression (MLR), and artificial neural networks (ANNs), respectively. We took the content of organic matter, total nitrogen, alkali-hydrolysable nitrogen, rapidly available phosphorus, and rapidly available potassium as independent variables, while the evaluation level of soil nutrient content was taken as dependent variable.

Results show that the average prediction accuracies of SVM models are 77.87% and 83.00%, respectively, while the general regression neural network (GRNN) model's average prediction accuracy is 92.86%, indicating that SVM and GRNN models can be used effectively to assess the levels of soil nutrient with suitable dependent variables. In practical applications, both SVM and GRNN models can be used for determining the levels of soil nutrient.

2. BACKGROUND

Soil nutrient is a crucial property that contributes to the soil fertility and other environment factors . Different components of the soil lead to diverse soil types because of the natural factors, causing various characteristics of the spatiotemporal distribution .According to previous study , this variety can make great influence othe regional distribution of vegetation, community biomass, and plant size, as well as the species composition. Therefore, an effective approach is necessary for evaluating the soil nutrient for the sake of scientific management and rational utilization of soil nutrient. Previous research shows that the soil nutrient can be well-estimated by using BP neural networks, principal component analysis, grey relational analysis, fuzzy comprehensive evaluation, and index method . However, these approaches are difficult to operate and the errors are not low enough. Although BP neural networks have a correct

result, there still exits a situation that may be not robust enough. Therefore, in this study, we aimed to use support vector machine (SVM), multiple linear regression (MLR), and artificial neural networks (ANNs) for the evaluation of the soil nutrient.

3. EVALUATION CRITERION OF SOIL NUTRIENT CONTENT

In this study, we took the content of organic matter, total nitrogen, alkali-hydrolysable nitrogen, rapidly available phosphorus, and rapidly available potassium as independent variables, while the rank of soil nutrient content was taken as dependent variable. The quantized rank of the soil nutrient criterion is the main object to be recognized by models.

4. PRINCIPLE OF SUPPORT VECTOR MACHINE

Support vector machine (SVM) is a learning algorithm mainly based on statistical learning theory. On the basis of the limited information of samples between the complexity and learning ability of models, this theory has an excellent capability of global optimization to improve generalization. In regard to linear separable binary classification, finding the optimal hyperplane, a plane that separates all samples with the maximum margin, is an essential principle of SVM. . Not only does the plane help improve the predictive ability of the model, but also it helps reduce the error which occurs occasionally in classifying.

Illustrates the optimal hyperplane, with "+" indicating the samples of type 1 and "–" representing the samples of type −1. Shows the main structure of SVM. The letter "K" stands for kernels . As we can see from the figure, it is a small subset extracted from the training data by relevant algorithm that consists of the support vector machine. For classification, choosing suitable kernels and appropriate parameters is of great importance to get a good prediction accuracy. However, a mature international standard currently for us to choose these parameters is nonexistence. In most circumstances, the comparison of experiment result, the experiences from copious calculating, and the use of cross validation that is available in software package are helping us to solve that problem to some extent

5. PRINCIPLE OF ARTIFICIAL NEURAL

An artificial neural network (ANN) model consists of several artificial neurons, which is an adaptive system, equipped to be adapting continuously to new data [13]. It is a powerful tool to deal with nonlinear problems in scientific researches and practical applications, especially in the field of pattern recognition. Structure of the ANN system can

be changed in accordance with internal or external information; at the same time, essential data can be extracted from various relevant relationships. Illustrates the general structure of an artificial neural network (ANN) model. ANN models usually consist of input layers, output layers, and hidden layers.

The input variables can be introduced to the network by the input layer . Meanwhile, response variables with predictions, which represent the output of the nodes in this certain layer, are offered by the neural networks. In terms of hidden layers, the type and the complexity of the process determine the optimal number of the neurons in these layers . Our study attempted to use a series of ANN models to classify the rank of soil nutrient quality, which mainly belonged to the application of ANN models in pattern recognition. Besides, we also used multiple linear regression (MLR) for the sake of making comparison, so that the overwhelming advantages of ANN models could be observed.

6. SYSTEM DESIGN

To understand the condition of the soil for the cultivation too earlier.This system shows how much the manures to be used in the soil to maintain the same soil wealth for the next generation.To understand the condition of the soil for the cultivation too earlier.This system show s how much the manures to be used in the soil to maintain the same soil wealth for the next generation.

CNN –This algorithm are used to find out the soil pixels from the given image

RNN – This algorithms are used to calculate the weight of the soil area in image and calculate the parameters.

ANN – This algorithms are used to find the properties of the soil and suggest the what the user want to do to maintain the required level.

Module 1 – From this module we are going to get the input image fro the user , and convert that image into to gray to find out the soil area in the image.

Module 2 – This module get the information from the user requirement based on that fin out the nutrient level.

Module 3 – This module is main part of the out project. Here only we are going to compare the current soil with trained database also analyze the parameters with user requirement nutrient level. It is also suggest the what are things we want to add in this soil like animal waste, etc with percentage. Finally display the compare with the proposed system with chemical forming.

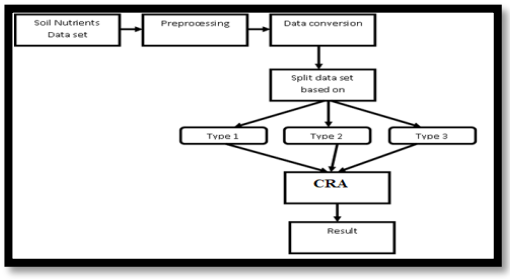

Fig 1 : System Model

7. IMPLEMENTATION

The transitional period for new organic operations can be the most demanding in terms of soil fertility management. This is as a result of the advantages of soil building and soil organic matter improvement haven't nevertheless been complete in an exceedingly transformation field, but the grower is limited to only a few soluble fertilizer materials. Growers gain experience during the transitional period, and as the soil organic matter builds, its benefits are reflected in improved soil fertility. Approved materials lists have been developed by the NOP and include a broad range of materials to supplement crop nutritional needs. Materials from organic or natural sources may contain waste vegetables, Crops, seeds, Green manure and Vermicomposting that may accumulate to toxic levels on a given field. These five classification problems are solved using the fast learning classification technique known as Extreme Learning Machine (ELM) with different activation functions like gaussian radial basis, sine-squared, hyperbolic tangent, triangular basis, and hard limit. After the performance analysis of ELMs with diverse activation functions for these soil parameter classifications, the gaussian radial basis function attains the maximum performance for four out of five problems, which goes above 80% in most of the accuracy rate calculations in every problem, followed by hyperbolic tangent, hard limit, triangular basis, and sine-squared. However, the performance of the final classification problem, i.e. the pH classification, gives moderate values with the gaussian radial basis and best performance (near 90%), with the hyperbolic tangent.

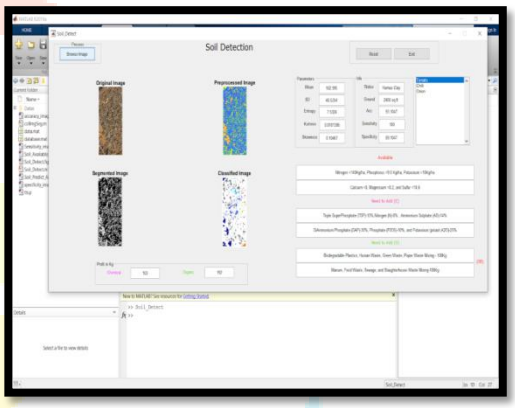

Fig 2: Output

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