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Soil Health Classifiers system Using Image Processing

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ABSTRACT: Farmers addicted to the use of hybrid seeds, machine, fertilizers and pesticides for the more and more production during the farming. Though these practices solved the food shortage problem, they created some problems too within the soil health, In terms of excessive use of fertilizers and pesticides, depletion of ground-water, soil degradation etc. These problems were exacerbated by lack of training to use modern technology and awareness about the correct usage of chemicals etc.

This research paper is about to detection of the health of soil for fertility of the crops. The ultimate goal is improved classification rate of soil health detection and suggest a relevant crops with respective properties of soil.

KEYWORDS: Classification, Detection, Soil Heath, Crop Fertility, Image processing.

I. INTRODUCTION

Core soil gain and absorb the different minerals and essential metals from the nature. There are 16 main factors on which the productivity of crop and fertility of soil is depends. These factors get roughly classified into three classes' 1-Primary factors, 2-secondary factors and micro metal factors. Primary factor are concern with potassium content, sulphate contains, Hydrogen, Oxygen and nitrogen, carbon, contains.

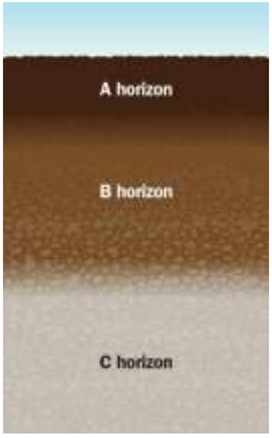

Figure 1: General Soil Profile

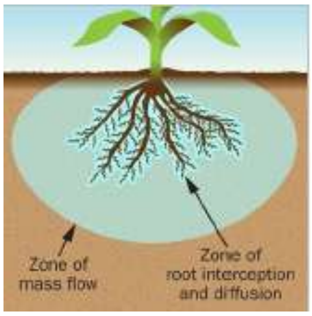

Figure 2 Nutrients in soil

Secondary factors are related to minerals like calcium, magnesium or phosphorus. And other are iron, manganese, copper, zinc, molybdenum, boron and chlorine. If the soil losing her nutrient health it shows the symptoms on crop growth. And hence if crop get affected without external interference then we can assume that soil has nutrient deficiency.

For nutrients to be absorbed into the plant, they must be in the soil solution and in close proximity to the root surface. Nutrients in soil solution move to the roots by three processes: root interception, mass flow and diffusion (see Figure 2)

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II. LITERATURE SURVEY

Government of India started a scheme 'Soil Health Card' promoted by the Department of Agriculture & Co-operation under the Ministry of Agriculture. It will be implemented through the Department of Agriculture of all the State and Union Territory Governments. A 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.

Most of the classification systems associated with the physical test of soil in laboratory and collaborated with the government scheme, However, Distance between the farmer and laboratory make the inconvenience. Most Laboratories takes minimum one week to prepare the report and hence it is time consuming.

Back Propagation Networks(BPN) – approach, is used to analysis of main soil properties such as organic matter, essential plant nutrients, micronutrient that affects the growth of crops and find out the suitable relationship percentage among those properties using Supervised Learning, Back Propagation Neural Network. Although these parameters can be measured directly, their measurement is difficult and expensive[1] .

The data obtained from various tests is highly subjective, which further complicates the existing variability in soil conditions over space and time[2].

Agricultural monitoring systems must be able to recognize agricultural areas, discriminate among different crop types, and finally evaluate crop health status. The identification of crop stress factors stands as a critical point in order to correct crop growth simulation models and properly estimate the expected crop yield [3].

Disadvantages of existing system these systems, either are based on soil testing only from the laboratory and readily expensive which may be not feasible for all the farmers. Issues arise when growth of crops being minimized and problem of soil health get ignored due to testing of it within time. Generally content of soil are not noticed by farmers because they are not visible. Though the color of soil and texture can be identified easily, but they are not sufficient to show the health of soil. Many classification systems are working on soil features and health rather than crop yielding in it.

Problem identified from the literature survey [1,2,3] , motivated us to focus attention on 'Agricultural monitoring systems'.System must be able to recognize agricultural areas, discriminate among different soil types, and finally evaluate crop health status. These various aspect regarding the agriculture motivate us for research and focus on relation between soil health and crop growths, because incorrect soil and crop management practice during the cultivation may arise heavy loss in soil quality. Our approach toward the easy soil health monitoring system with accuracy and within time.

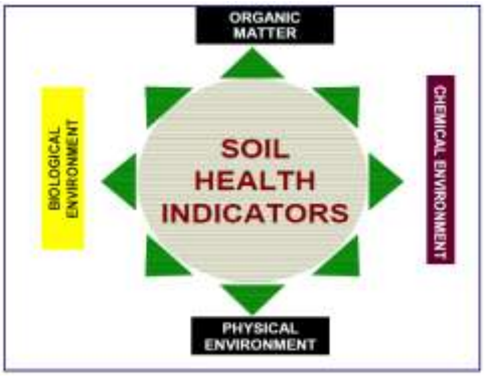

Figure 3: Soil Health Measures

A huge group of scientist is associated with the land classification, crop classification and soil classification. There is need of classification of soil for its nutrient and its health. Few work is available associated with it. We can contribute our research in this direction by classifying soil for it health detection.

All the methods those are involving with training and testing phase have limitation of size of database. We can work on this factor to reduce the space complexity as well as time complexity.

III. PROPOSED SYSTEM

Crop selection is a process which will lead us to specify a particular crop or a group of crops that is the most suitable based on specific pieces of land, on a specific geographical area, on a particular time of the year. All the factors considered by us are directly involved in the yield of the crops that we are predicting. There can be different factors affecting the production of a crop such as soil condition, pH, nitrogen, phosphate, potassium, organic carbon, calcium, manganese, copper, iron, depth, rainfall, temperature, humidity, price etc. As mentioned before, we have implemented various machine learning algorithms on this research for crop prediction. Machine learning is a field of image processing uses feature extraction techniques to give computer systems the ability to "detect" from dataset.

Popular classifiers are available for soil classification ,and some of them are based on Linear Discriminate Classifiers (LDCs) and k-

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Nearest Neighbour (KNN) classifiers. However, nowadays they are being surpassed by Support Vector Machines (SVM) classifiers, which outmatch the two above. their general optimistic performance has lead them to be nowadays conceived as SVM classifier.

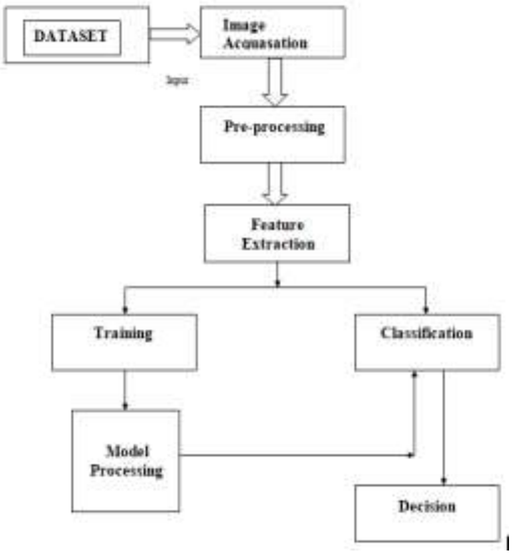

Figure 4: Proceeding flow Chart

The image contains errors like noise or artifacts like scratches, lapping tracks, comet tails, etc which needs to be eliminated before the further processes. Image preprocessing also includes the detection and restoration of bad lines, geometric rectification or image registration, radiometric calibration, data conversion among different sources, atmospheric correction (topographic conversion) and quality evolution of data.

All the features that are required for us to classify the soil type are done in this phase. A number of features like the texture, color, intensity, saturation, hue, etc are extracted for detection of soil type. a filter known as Gabor Filter is implemented for feature extraction. Gabor Filter is a linear filter used for edge detection.Feature extraction included selection of suitable variables which is a critical step for successful implementation of soil image classification task. In this step we select on the variable which are most useful for a particular approach. By the end of this step, a good representative dataset for each class is obtained. It is observed that divergence related algorithms are used to evaluate class seperability and refining training samples for each class. Also other features like entropy, standard deviance, mean, etc.; can be extracted using Gabor filter. The main and important feature of soil that is color is needed to be extracted. Hence a measure called color moments are used to differentiate images based on their features of color. These provide a color similarity between images which can be compared to the values of images indexed in the data base for tasks like image retrieval.

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1. It is necessary to find all possible feature subsets that can be formed from the initial set of data
2. Every feature is meaningful for at least some of discriminations, and
3. Variations within intra-class and between inter-class is not too much high.

The selected set of features should be a small set whose values efficiently discriminate among patterns of different classes, but are similar for patterns within the same class. Features can be classified into two categories:

1. Local features, which are usually geometric
2. Global features, which are usually topological or statistical.

IV. MATHEMATICAL FOUNDATION

Classifier is used to classify cancerous image from other diseases. For simplicity Support Vector machine classifier is used here. SVM takes set of images and predicts for each input image belongs to which of the two categories of cancerous and non-cancerous classes. The purpose of SVM is creating hyper plane that separates two classes with maximum gap between them [2]. In our proposed model processed output given as input to SVM classifier which takes training data, testing data and grouping information which classifies whether given input image is cancerous or non-cancerous. All the algorithms were easily fitted as the programming of this part was comparatively easy. Simple method callings were all that were required. The algorithms, upon being

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implemented, processed all the data using all the internal calculations. Data frames were created and could be viewed in the variable explorer. Because of the fact that the data had been split into training and testing datasets, the algorithm could start the core process: learning. The machine learned from the train set. This learning was to be used later on while predicting from the test set. Fitting is similar to training. Determining the mean and variance of the normal distribution that best explains our observed data is called fitting: we are determining the parameters' mean μ and variance σ.

```
Algorithm: Nearest neighborhood
------------------------------
for
  count = 1: nColors
  distance(:,:,count) = ( (a -   color
markers(count,1)).^2 + ..         (b -
color markers(count,2)).^2 ).^0.5;
end

[~, label] = min(distance,[],3);
label = color labels(label);
clear distance;
```

Figure 5: KNN algorithm

Mean: usually mean is used in applications such as noise removal or low pass filtering (smoothing) while variance can be used in identifying sharp details such as edges. 'mean' value gives the contribution of individual pixel intensity for the entire image & variance is normally used to find how each pixel varies from the neighboring pixel (or centre pixel) and is used in classify into different regions.
mean (mean(I)) is simple function to compute mean iof image in matlab
wavelet: In color images each pixel is represented by several color components. Typically there are three of them per pixel. In the RGB color space, e.g., there is one component for red, green, and blue, respectively. Other choices are the YUV color space (luminance and chrominance) and the CMYK color space (cyan, magenta, yellow, black). Note, that we will treat each color component of color images as separate grey scale image.

$$s = \frac{\max - \min}{\max}$$

$$H = \begin{cases} 60 * \dfrac{(G-B)}{\max - \min} & R = \max \\ 120 + 60 * \dfrac{B-R}{\max - \min} & G = \max \\ 240 + 60 * \dfrac{R-G}{\max - \min} & B = \max \\ V = \max & \end{cases}$$

The computation of the coefficients c0,0, c0,1 and d0,N−1 at the first level of a wavelet transform using the wavelet depends on pixels from outside. In general, for a symmetric wavelet with corresponding analysis filters-h and -g the computation of the coefficients

$$l = \frac{|h|+1}{2}$$

$$l = \frac{|g|+1}{2}$$

classifier with RBF kernel was performed to evaluate the proposed approaches and current methods in the rear-vehicle detection system. The optimal parameters were selected via 5-fold cross-validation.
The SVM score for classifying observation x is the signed distance from x to the decision boundary ranging from -∞ to +∞. A positive score for a class indicates that x is predicted to be in that class, a negative score indicates otherwise.
The score is also the numerical, predicted response for x, f(x), computed by the trained SVM classification function

$$f(x) = \sum_{j=1}^{n} a_j y_j G(X_j, x) + b$$

,where (α1,...,αn,b) are the estimated SVM parameters, G(xj,x) is the dot product in the predictor space between x and the support vectors, and the sum includes the training set observations.

V. RESULT AND CONCLUSION

Results with its specific grade (% N-P2O5-K2O by weight), chemical analysis, and handling and use characteristics. All fertilizer materials need to be handled in a safe and effective manner. Material Safety Data Sheets (MSDS) describe the characteristics of each material and are available at every point of sale for customers and employees to obtain.

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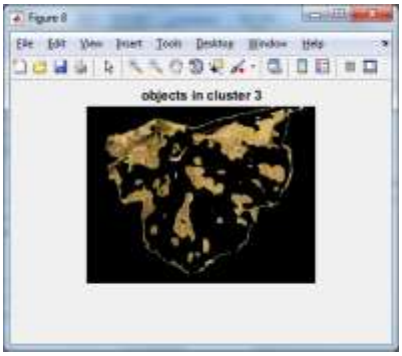

Figure 6: clustering 3 testing

Granular fertilizers generally have a higher analysis (nutrient content) than liquid fertilizers and are relatively less expensive. Their storage, handling and transport requirements differ from those of liquid or gaseous fertilizers. Granular materials can be blended to meet a wide range of crop requirements.In general, liquid fertilizers are more expensive per unit of nutrient than granular fertilizers because of the extra weight and volume that must be transported, and, in some cases, the extra processing. This is balanced by the convenience of being able to pump it and the ease and accuracy of metering and placement.

Figure 7: Implementation of system

In 2016, ammonium polyphosphate (10-34-0), a liquid, cost 84% more than the same amount of nutrient purchased as (granular) mono-ammonium phosphate. The difference is even greater for complete N-P-K fertilizers, where liquids may cost double the equivalent in granular fertilizer.

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