



# INTERNATIONAL JOURNAL OF PURE AND APPLIED RESEARCH IN ENGINEERING AND TECHNOLOGY

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## SOIL NUTRIENT DETECTION THROUGH IMAGE PROCESSING IN CHROMATOGRAM IMAGE

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Accepted Date: 15/02/2014 ; Published Date: 01/04/2014

**Abstract:** India is an agriculture country; where in about 70% of the population depends on agriculture. also Indian agriculture occupies an eminent position in global cultivation of rice, wheat, sugarcane, pulses and vegetables. Soil testing provides the basic information for the farmer to decide, the suitable crop, content of minerals in the soil, extent of fertilizer to be used, etc. The current processes for soil analysis are chemical which are expensive, time consuming and laborious process. This is provide an alternate technique for soil analysis by utilizing image processing for chromatograms. The shape, size, color and textural patterns of the chromatogram image are hypothesized to contain important information of the mineral content in the soil. A circular paper chromatogram is obtained from an alkaline solution of silver nitrate and soil. Farmers have wide range of diversity to select suitable Fruit and vegetable crop. It presents a method to automatically analyze the chromatogram image

**Keywords:** Overall Technique, Filled Image , Feature Extraction.



PAPER-QR CODE

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Access Online On:

[www.ijpret.com](http://www.ijpret.com)

How to Cite This Article:

Sagar More, IJPRET, 2014; Volume 2 (8): 360-364

## INTRODUCTION

Agriculture productivity is strongly dependent on the choice of the crop that is best suited for the given soil. While traditionally the best crops in different regions have involved over a period of time, there has also been the influence of new crops being imported from other regions. In addition, the effects of globalization has resulted in certain crops like wheat and rice gaining in prominence due to global popularity, and many crops like cotton are grown because of their increased global demand. Consequently soil testing has become an important step in agriculture cycle. Not only does this allow the farmer to choose a suitable crop, it also allows him to choose an appropriate fertilizer for growing a specific crop. Soil testing is usually done in commercial laboratories using sophisticated equipment. The tests are normally carried out to determine the quantities of major nutrients (NPK) like nitrogen (N), phosphorus (P) and potassium (K), along with other like calcium, magnesium, sulfate, sodium, boron, copper, iron, zinc, organic-carbon and humus etc. The process of laboratory analysis is typically time consuming and expensive. It is generally advised that many samples should be taken from different locations at each site. In addition the results do not have high accuracy.

Recently an entirely different approach to determine soil properties has emerged. This is based on interpretation of a chromatographic image made from a soil solution and photosensitive chemical like silver nitrate. A sample Chromatogram is shown in fig 1. Soil scientist's claim that the patterns and the colors in the image contain information about the soil properties [1] & [2].

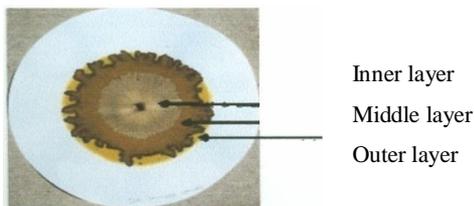


Fig 1:-Sample Chromatogram

The circular image has three distinct regions, known as the inner, middle and the outer region. The inner region is said to contain information about the minerals such as nitrogen, sodium, potassium, and phosphorus; the middle region reveals the presence of organic carbon and organic matter; and the outer region tells us about humus. This makes it the best candidate for image processing as patterns and colors in the chromatogram can be utilized for detection of nutrients.

In this paper we are trying to implement the alternate soil analysis technique from image processing of chromatogram. It is implemented for qualification of nitrogen content in soil. This approach would be cheaper and much faster than the laboratory analysis process.

## OVERALL TECHNIQUE

### A. Color Texture Segmentation.

#### ALGORITHM

Step1:- Read the polar image.

Step2:- Calculate the energy image to black and white image.

Step3:- Convert the entropy image to black and white image.

Step4:- Filled the black and white image.

Step5:- Convert the polar image from  $8*9*b$  color space to CIE  $L^*a^*b^*$  colorspace.

Step6:- Segment the inner layer using filled image  $a^*$  and  $b^*$  layer of CIE  $L^*a^*b^*$  color space as input to K-means classifier.

Step7:- Extracted the feature as area and color.

### B. ENTROPY CALCULATION.

Entropy is a statistical measure of randomness that can be used to characterize the texture of the input image. Entropy is defined as

$$E = -\sum (p_i \cdot \log_2(p_i))$$

Where  $p$  is probability of pixel. In this paper we decided to use  $9*9$  neighborhoods around the corresponding pixel in the input image for Entropy Image.

### BLACK AND WHITE IMAGE

Entropy Image is converted to black and white image at a thresholds. This black and white image contains edge evidences. Edges in the image contains details to separate different regions in chromatogram image.

## FILLED IMAGE

As we are only interested in qualification of nitrogen whose information contain in inner layer. The black and white image is filled up to first edge from the top of image. This provides rough inner layer segmentation. The algorithm which is used to fill the image is as:

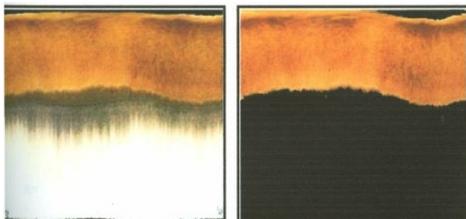
### ALGORITHM

Step 1:- Go column wise and store the row co-ordinate at which first edge occurs.

Step 2:-Filled the image according to stored row co-ordinate.

### **r\*g\*h\* to CIE L\*a\*h\***

The L \*a\*b\* color space is derived from the CIE XYZ tristimulus values. The L\*a\*b\* space consists of a luminosity layer 'L \*', chromaticity-layer 'a\*' indicating color falls along the red-green axis, and chromaticity-layer 'b\*' indicating the color falls along the blue-yellow axis. All of the color information is in the A\* and B\* layers. For colorspace conversion we used MatLab inbuilt function make form. The whole process is carried out iteratively until the Centroid values become constant, i.e. do no change iteratively. For segmentation we used inbuilt MatLab function 'k- means'. The segmented inner layer is as shown in fig .



## MEAS URE OF SIMILARITY

The shape, size, color of the inner region in chromatogram image contains the important information of nitrogen in soil [1].so we extracted the features such as area, and color of inner segmented region. These features are compared with standard values of chromatogram image

## FEATURE EXTRACTION

Most of the chromatograms contain three regions inner, middle and outer. The size, color, shape and textural patterns of these regions are hypothesized to contain

important information of the mineral content of soil. We hence extract the features such as area, and color of inner segmented region

Area = Number of pixels in that region/100;

Color = Mean of multi-band intensity of the pixels in that region.

## CONCLUSION

After We have presented a method to automatically analyze the chromatogram image for the detection of nitrogen in soil. Chromatogram image processing involves combination of different modified approaches, detecting the center of the chromatogram, normalization and then segmentation into different circular regions followed by extraction of features. As a future scope of work, a knowledge base using concepts of case-based reasoning can be built from the features and information extracted out of the chromatogram image for the determination of remaining minerals.

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