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Soil Classification and Suitable Crop Prediction

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Abstract: *This paper investigates the development of digital image analysis approach for estimation of physical properties of soil in lieu of conventional laboratory approach. The traditional laboratory approach attracts some drawbacks such as lot of manual involvement, time consuming, chances of creeping of human errors, uncertain prediction and always invasive in nature . The signal processing methods involve enhancing original image using filters and calculating the features of the transformed images. In this paper Low mask, Gabor Filter and color quantization are applied to the original images to extract the texture features of soil images for retrieval. Results on a database of 100 soil images belonging to 10 different types of Soils with different orientations, scales and translations shows that proposed method performs retrieval efficiency effectively. The features are constructed on preprocessed methods applied on the Soil texture image by considering different types of windows. These features offer a better classification rate.*

Keywords: *Soil Texture, Types of soil, Soil texture, Law mask features, Color Quantization*

I. Introduction

The content-based image retrieval (CBIR) system is used in many fields to browse and search huge image databases. Agriculture or Ground Water identification purpose people are usually brought to use large collections of soil images. They need an automatic soil identification system to assist them in their work. This paper presents a soil retrieval system which takes input image as a Soil images taken from region and pictured by Coolpix Camera. It gives the most similar images from the database. The problem involves identification of the matching soil, as well as retrieval of related varieties in a database. The scope of this research paper is to extend the approaches used in image processing to describe the texture of an image region are statistical, geometrical, structural, and model-based and signal processing features. Additionally, increasing work price, deficiency of gifted specialists and enhance creation forms have all add weight upon makers. Computerized arrangements are the response for the issues that are being confronted today by the horticulture world. In structural designing it is an essential to know the dirt classes up to a few profundities preceding any development. The immediate strategy to recognize the dirt classes by boring boreholes and testing soil tests is exceptionally costly.

Soils are recognized by its characteristics, such as physical appearance (e.g., color, texture, landscape position), and assist in vegetation [1]. A vernacular distinction is used in classifying texture as heavy or light. Light Soils have better structure and easy for cultivation [1]. Soil texture is an important soil characteristic that drives crop production and field management. The textural class of a Soil is determined by the percentage of Sand, Silt and Clay [1]. Soils can be classified as one of four major textural classes: Sands, Silts, Loams and Clays. A clay soil is referred to as a fine-textured soil whereas a sandy soil is a coarse textured soil [2]. Soil texture determines the rate at which water drains through a saturated soil. Water moves more freely through sandy soils than it does through clayey soils.

Fig.1 red soil, clay soil, river soil, sea soil, alluvial soil, black soil, silt soil, silt-black, alluvial-sea, alluvial-river, alluvial-red, alluvial-clay, clay-alluvial, river-red, clay-sea, alluvial river red, alluvial-red-river, alluvial-silt-clay soil.

II. Problem Definition

The existing approach for soil classification and crop prediction has some drawbacks such as lot of manual involvement, time consuming, chances of creeping of human errors, uncertain prediction and always invasive in nature. This method proposes investigation of, the development of digital image analysis approach for estimation of physical properties of soil that overcomes the problems of existing method.

III. Methodology

The soil type is classified using color, texture, boundary features. These three are the primary values necessary for identification of the crop to grow well and produce an efficient yield.

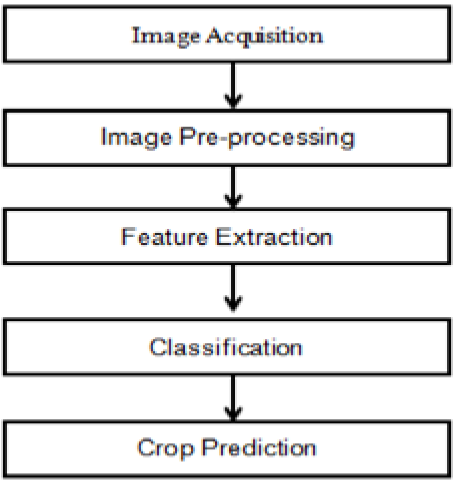

Fig 2- Block Diagram for Classification of soil

This Proposed Block Fig 2 is used to classify the soil. The works includes processing of images for dissimilar types of soil sample, extracting features of soil samples and then develops acceptable model which recognize the dissimilar types of soil images. The classification makes use of saturation, density, color, area, equi-diameter and texture features extracted from images of bulk soil. RGB components are extracted from sample images.

Image Acquisition

The images are captured with camera (DXC-3000A, Sony Corporation, Japan) connected to a PC. Camera was settled over the light vestibule on a duplicate stick, which gave simple vertical development to finely tune the position of camera concerning soil parts. Images were captured using the software Matrox Intellicam for Windows and saved in bmp format. Illumination source was a fluorescent light tube, which provided even illumination over the field of view.

Image Pre-Processing

The nature of the image is definitive for the outcomes of examination, influencing the capacity to recognize quality under examination and accuracy of consequent estimations. Therefore, the accompanying techniques are connected to obtain error free picture.

1. Shade Correction

Few images, basically taken by advanced cameras, display uneven brightening, termed shade. Part of image is intense and some other parts are not illuminated than mean value. This marvel is result of mistake in framework as a matter of first importance and non-homogeneous light source. Exact modulating the amazing cameras will make smaller this impact. The primary issue brought about by the nearness of shade, it can broadly influence the consequences of binarization, particularly of phase with gray level near the background of image. Along these lines, exertion is consumed with a specific end goal to right this mutilation.

2. Removing Artifacts

Certain images frequently consist of few artifacts convinced at the time of pattern arrangement, as claw mark, blur, put-outs, alleviation, lapping tracks or comet tails. These components evacuation is typically exceptionally troublesome, other than incomprehensible. At the same time, image rectification will influence the components dissected this results to chance falling discipline over the entire examination methods. Along these lines, to result high quality initial images.

Features Extraction

The pattern is basic description of an article or a quantitative or an element of enthusiasm for an image. And one or more descriptors of an object or a substance of image from the pattern or pattern is an arrangement of descriptors. Features in pattern acknowledgment writing are called descriptors. The feature is fundamental for separating a class of objects from another class. A strategy is utilized to depicting the objects and the objects features are highlighted. Extraction of features from the article/element of an image produces description of image.

A. Color Features

In this, RGB segments are separated. The partition of RGB component from input color image sample is called extraction of RGB features.

B. Boundary Description Features

In the microstructure of a material soil has the most trademark highlight. They can have shape and character, diverse sizes, beginning from soils in a clean, solid solution and completing with extremely difficult soils which are somewhat in homogeneous bundles of other, correspondingly situated elements.

The features of Query image and the training images are extracted using the color quantization,Gabor filter and Law mask S5S5. Then, the Query image of the soil is matched with the training images in database. Based on the matching of Query image and training image the soil with highest matching ratio is given as output. Matlab R2008A is used for Simulation purpose. The block diagram of the process is shown in fig 3. The dataset which consists of more than hundred soil images such as alluvial soil, Clay soil, Black soil, red soil, river soil, sea soil

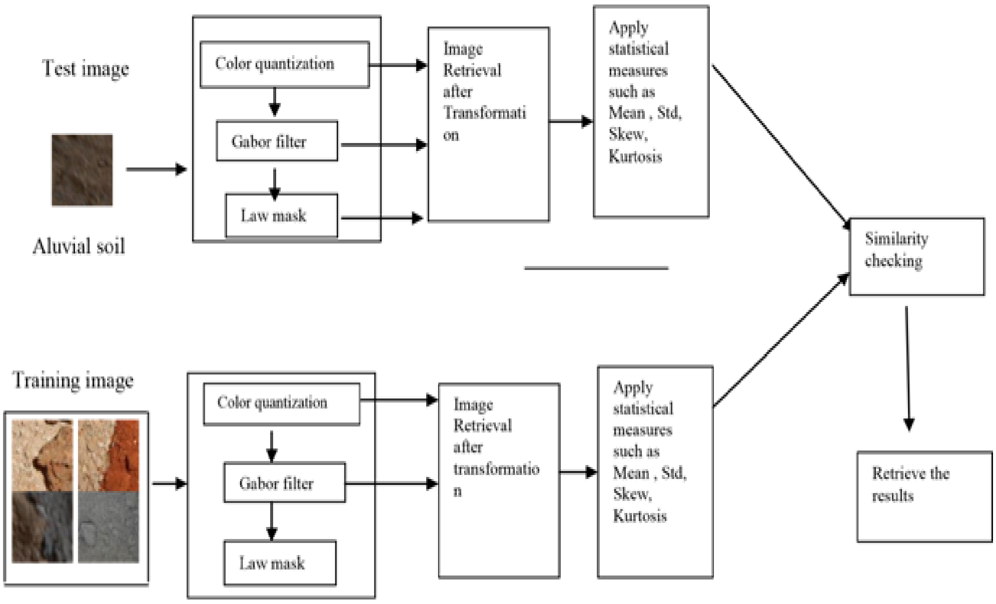

Fig 3 Block Diagram

Algorithm

1. Read the texture (M×N)
2. Apply the required preprocessing method on the given texture Method
3. wcount = (size of the texture)/(size of the window)
4. IF Method = sequence
    i. .i=1;j= 1 ;count = 1;
    ii. Read the window of P×Q from the pixel (i,j) size
    iii. From this window, calculate various Law's mask features
        If count>wcount
        Apply "classification "
        Else
      i=i×P, j=j×Q, count=count+1
     goto 2
     Else "method = random"
        i. Set the values of a, b and M, count=1
        ii. y(n+1)=((a*y(n))+b)%M
        iii. From the preprocessed image, read the window of size PxQ from the pixel y(n+1)
5. Read the window of P×Q from the pixel (i,j) size
6. From this window, calculate various Law's mask features
7. If count> wcount Apply "classification"Else Count = count +1
   Goto 2

IV. Experimental Results

The fig 4 shows the filtered image of clay and alluvial soil. The first row images are clay soil, color quantized clay soil, Law mask filtered image and Gabor filtered image. Second row shows the same of alluvial soil.

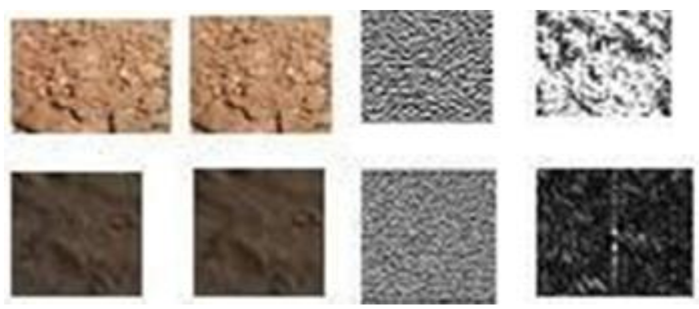

Fig 4 a) Original image of clay soil b) color quantized c) S5S5 law mask filter d) Gabor filter
e) Original image law masks of alluvial soil f) color quantized alluvial soil g) S5S5 h) Gabor filter alluvial soil

Fig 5 describes the query image to find a match. Fig 6 describes retrieved images from the database and fig 7 shows the closed matches of query image. From the above analysis, the proposed method using Gabor filter is an efficient method to retrieve more number of similar images. It is an efficient method to retrieve more number of similar images.

Fig 5 Query Image

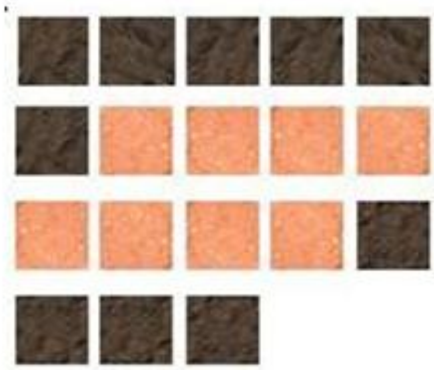

Fig 6 Retrieved Image

Fig 7 Closed Match Image

V. Conclusion

A texture and color based soil retrieval system has been proposed to identify the needed soil from the database. The proposed algorithm uses the efficient feature extraction methods like color quantization for color based feature extraction and Texture based feature extraction is done by applying Gabor filter and Law mask (S5S5). Then the matching is achieved by applying statistical measurements like Mean, standard deviation, skew, and kurtosis. The performance of the proposed method using Gabor filter is proved to be more efficient. Combining different color and texture features extracted from the images enhance the accuracy of the system. For the soil recognition the segmented soil image is taken as an input for simulation using Matlab.

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