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Classification of Soil Image using Feature Extraction

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Abstract: ***There are various methods for soil classification using different algorithms. In the image processing to describe the texture of image using statistical and geometric feature. Signal processing techniques are used to filters images and calculate features of transformed images. The purpose of proposed algorithm is to perform classification ofby making use of SVM (Support Vector Machine).We can replace SVM with ANN technique for classification. Goal is to classify pictures of soil sample with high accuracy as well as cost effective. In this paper, color moment, Hsv , wavelet transform and gabor filter feature extraction methods applying to original images and extracting texture features of soil images it for classification. Results on a database of soil images belonging different types of Soils to show that proposed method performs soil classification effectively.***
Keywords: Color moment, Hsv, wavelet transform, gabor filter, SVM

I. INTRODUCTION

In some engineering issues like petroleum engineering geotechnics engineering and many others; fashionable soil classification techniques might be inadequate. Requirement of expert in preceding classification techniques it observes importance and trends of the indicators further to any previous information that is probably available.

From segmentation algorithm salient features of segments are retrieved by making use of boundary energy technique . Assign classes to the segments by using boundary energy method. They preferred use of ANNs, support vector machines (SVM) as well as Decision Trees. In the first extract the features of soil images, image processing features extraction methods. Then sample images consider as database will be prepared and then soil classification has been done by using SVM(Support Vector Machine) algorithm.There are different standard classification algorithms such as sub-soil layers using cone penetration testing [3] in petroleum engineering, palaeoecology etc.

For soil classification Cone Penetration Testing (CPT) is less expensive alternative. In which, into the soil metallic cone push and soil strength is obtained.

Two phase solve the problem: In first, Utilize the segmentation algorithm for the cluster contiguous blocks of instances and after by using domain experts segments are classified. To automatic classification of soil layers present in measured information is vital.

Its basic need in civil is to know the classes of soil. Mostly using soil investigation technique is CPT [3]. But it requires soil sample data manually. Classification is difficult. As per expert knowledge different results are occurred. To overcome this problems or to remove these disadvantages, formed the algorithm that work efficiently. that are based on processing of image[2].

This paper is structured as follows, First introduction, in section 2 block diagram, section 3 feature extraction methods. The results are given in section 4

II. BLOCK DIAGRAM

A. Training Part

In which first different type of soil sample picture are collected. Then on soil image enhancement process is to be applied. After that for retriving the soil features, implemented an algorithm by making use of features extraction techniques such as, Gabor features, Colour auto correlogram, Hsv ,Color moments-mean sd,. After that focused on develop database and at the last for deciding class develop an SVM algorithm.

B Testing part

In which choose one soil sample image. Which will performe all processes such as preprocessing, feature extraction, feature preparation. Find class of soil by using SVM algorithm. Implement an algorithm by using MATLAB.

1) *Soil Image:* Many types of image of soil samples are available. For example Peat, Sandy soil, clay etc.
2) *Preprocessing:* Here improvements such as processes are performed. This will help for feature extraction process.

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3) *Feature Extraction:* Features extraction methods use to extract features of soil.
4) *Feature Data Preparation:* In previous section feature extraction carried out but different features separation carried out in this section.
5) *Feature Database:* Database Formation is done here.
6) *Support Vector Machine***:** SVM is used for actual classification

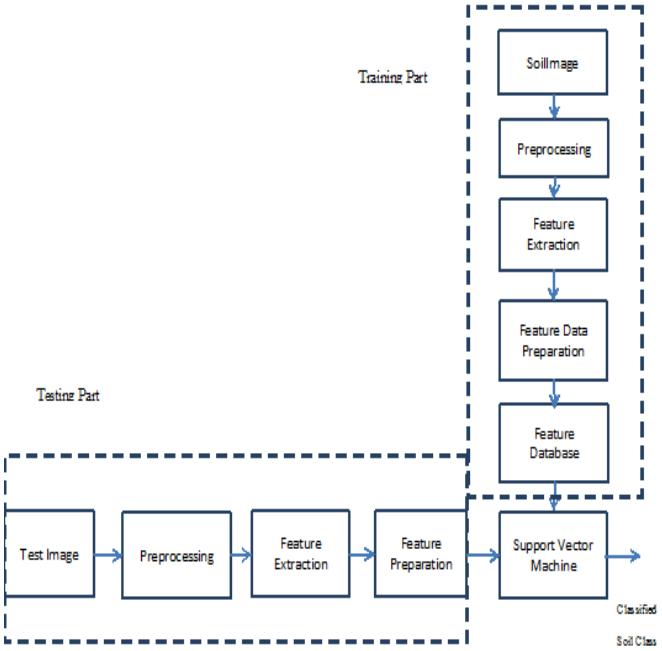


Fig 1 Block diagram

III. ENHANCEMENT USING CONTRAST STRETCHING

This process is adjusting digital images because of this suitable for display result. Image analysis is called Image Enhancement. Spatial domain method and frequency domain method is two category of method enhancement. Image is processed by using Enhancement so results for a specific application are very suitable. Its feature like edges, boundaries, or contrast are generate graphic display that are very helpful for analysis and display. It also improve the chosen features dynamic range. Image enhancement also improve the portion visibility. Digital data is modified in order to improve the image qualities with the help of computer.

In preprocessing enhancement technique used. Here contrast stretching enhancement technique used. It helps in maximizing clarity, sharpness and details of features. It helps towards in format on extraction and further analysis.

Fig2. Shows contrast Enhanced Image of given soil image.

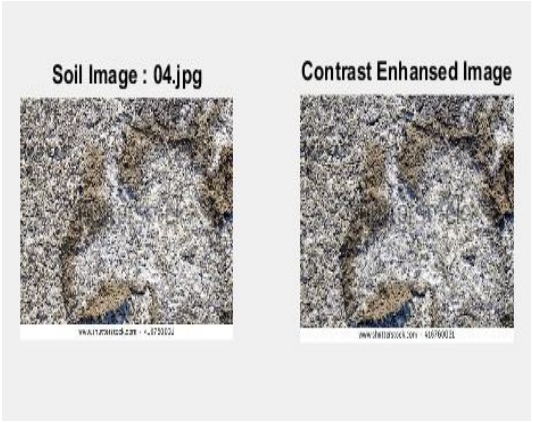


Fig 2: Soil Image and contrast Enhanced Image

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Improve the contrast of image using enhancement technique by `stretching' the range of intensity values is called as Contrast stretching. This technique is different and more sophisticated than histogram equalization it is apply using linear scaling function for the image pixel values. Specify upper and lower pixel value limits before stretching its necessary .

IV. FEATURE EXTRACTION USING HSV METHOD

Representation of distribution of colors in an image is referred as a color histogram. Any type of color built and its used for three dimensional spaces like RGB or HSV. A hexagon are 3D (Three-Dimensional) representation of HSV and the intensity are represented using central vertical axis. The definition if Hue are angle range (0.2 π) relative to red axis with angle 0, blue 4π/3, green 2π/3 and red 2π. Purity and depth of color is called saturation. Purity are measured a radical distance from central axis and values between 0 at centre and 1 at outer. The determination of this transition is by the saturation threshold and is again dependent on the Intensity.

The formula are used for to transfers RGB to HSV:

$$S=1-\frac{3}{R+G+B}(\min(R,G,B))$$

$$V=\frac{1}{3}(R+G+B)$$

$$H=\text{Cos}^{-1}\{[1/2(R-B)+(R-G)]/\ [(R-G)^2+(R-B)(G-B)\ ]^{1/2}\}$$

Here R, G, B indicates Red, Green and Blue components respectively and values in between 0-255. To obtain value of H from 0^0 to 360^0 the value S and V from 0 to 1.

Using the formula H ,S and V are obtained .Fig 3 shows H ,S and V for given image

H= ((H/255*360) mod 360

V= V/255

S= S/255

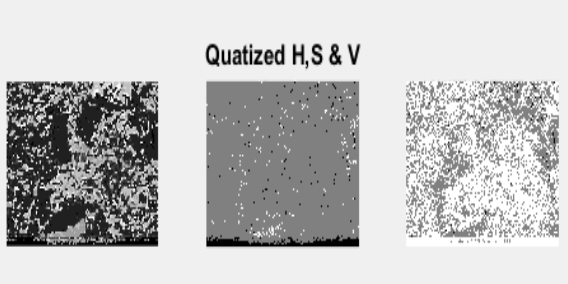


Fig 3 Quantized H , S and V

V. TEXTURE EXTRACTION USING GABOR FILTERS

A group of wavelets capturing energy at a specific frequency and a specific direction are called as GABOR Filters A 2D Gabor function g(x,y) and its Fourier transform G(u,v)

are defined as follows;

$G(x,y)=(1/2\pi\sigma_x\ \sigma_y)\exp[-1/2(x^2/\sigma_x^2+y^2/\sigma_y^2)+2\pi jw_x]$

$G(u,v)=\exp\{-1/2[(u-w)^2/\sigma_u^2+v^2/\sigma_v^2]$

where $\sigma_u=1/2\ \pi\sigma_x$ and $\sigma_v=1/2\ \pi\sigma_y$

By using Rotation and Dilation of the Gabor Function g(x,y) is set of self similar functions it generated

$G_{mn}(x,y)=a^{-m}G(x,y)$ Where a>1

X'=a-m(x cos è + y sin è) and y'=a-m(-x sin è + y cos è);

È =nð/N;

m and n represent Scale and Orientation of wavelet

m=0,1,….M-1 and n=0,1,…N-1

M are number of Scales

N are number of Orientations.

Given input image I(x,y),

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Discrete GABOR wavelet transforms:

Wmn=ΣΣ I(x1,y1) gmn*(xx1,y-y1).....4

where * indicates complex conjugate.

The features obtained are combined as per proposed algorithm and final results are acquired after the implementation.

Fig 4 shows Gabor for given soil image

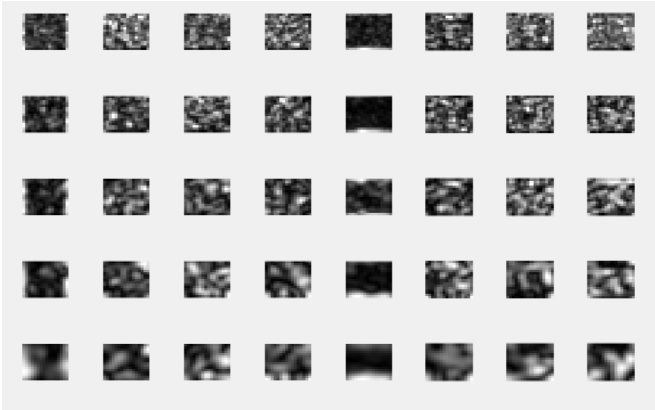


Fig 4 Gabor filter

VI. CLASSIFICATION OF IMAGE USING SVM

The SVM (Support Vector Machine) are the tool in high-dimensional spaces it is applicable for sentiment analysis and document classification. The dimensionalities are extremely large which range (≥106≥106) is. A subset of the training points are utilized in the actual decision process of assigning new members, only these points need to be stored in memory (and calculated upon) when making decisions. Class separation is often highly non-linear. The new kernels are used for substantial flexibility for decision boundaries and which is leading to greater classification performance.

We are using SVM for detection of soil type.

Fig 5 shows detected soil type is saline.

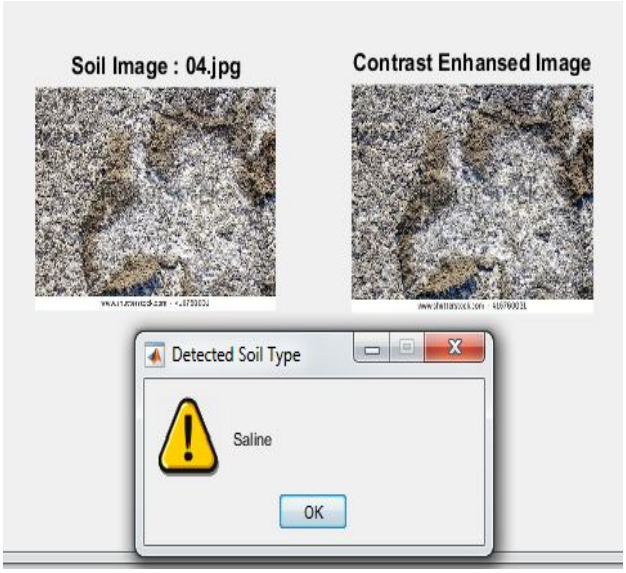


Fig 5 Soil detection

VII. CONCLUSION

Various methods for finding soil characteristics and classification and to classify the soil by using different algorithms. But it's very challenging to classify the soil with high accuracy and low cost. In this paper we implement an algorithm which is used for soil classification by making use of SVM(Support Vector Machine).In this we also used ANN method for classification.

We use our proposed method on different soil images and results are taken . Fig 6 shows analysis of classification of different images using our method.

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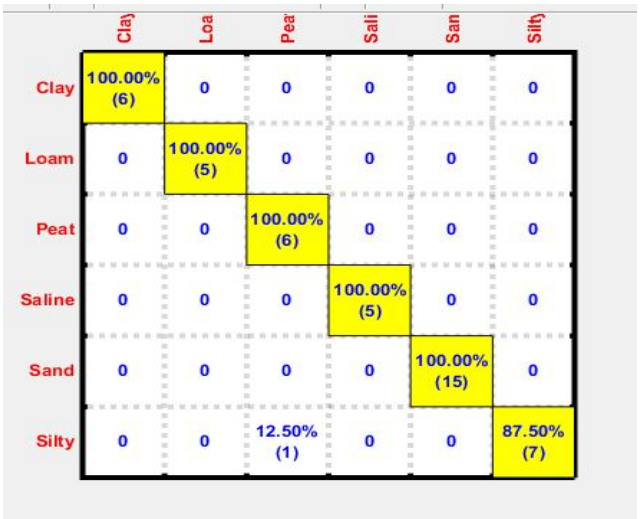


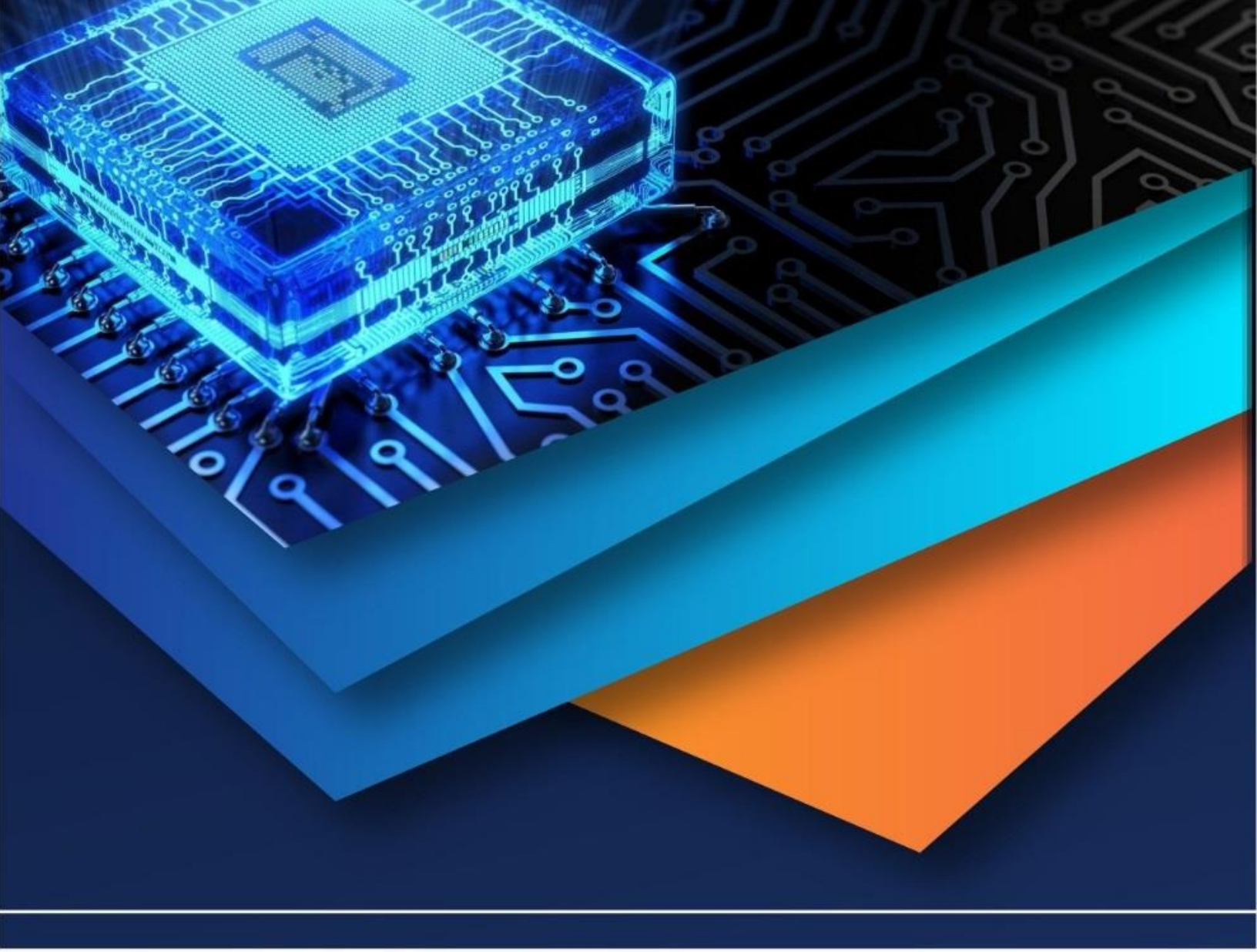
Fig 6 Classification of images

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