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Texture Analysis of Diabetics Tongue using Binary Pattern

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ABSTRACT

One of the most important diagnosismethods is tongue analysis. Usually, tongue analysis technique involves in image processing. But it's hard to process a tongue image due to its dissimilarities and irregularities. In this paper, we propose a method to overcome these by using texture analysis technique. This process comprises of four steps: Image Acquisition, Image segmentation, texture analysis and color analysis. The image acquisition provides the processing basis. Image segmentation is performed using texture analysis. The experiment results showed that the tongue is segmented and analyzed rightly.

Keywords: Tongue analysis, image processing, texture analysis, level set algorithm, texture classification

1. INTRODUCTION

Tongue analysis is one of the diagnosis processes in the patient administration. The tongue has an association with the meridian and interior organs. The tongue has numerous connections and relationships in the body. The tongue has a special relationship with the Heart. It is therefore extremely helpful and vital amid an investigation for confirming TCM diagnosis. Any neurotic change in the heart and lungs corresponds to the tongue tip while that of liver and gall bladder corresponds to the respective sides of the tongue. The doctor can understand the physical and mental condition of the patient by examining the features of the tongue. For the analysis of tongue image, we have to extract the shape, colour and texture feature from the central rectangle area. The framework consists of obtaining the correct colour and finding coating by filtering and enhancement and detection of pimples and cracks of the tongue.Our proposed method is a sequential process; results rely on input and output, so the expected outcome of diagnosis is tongue.

In traditional Chinese medicine, diagnosis using tongue is an important diagnostic method. But it has a very constrained application because of its subjective and test based nature. In Tongue image processing, the pictures of the tongue are the elementary components for the diagnosis of different sickness. For the simplicity of the analysis, the tongue pictures ought to be handled openly and appropriately.[1] Due to previously mention issues like irregular shape of the tongue, lips, etc., it's hard to diagnose the disease with the tongue image processing. Tongue diagnosis is one of the necessary fields in diagnosing most of the illnesses. Tongue diagnosing has received more consequence among the experts. It is usually carried out by processing the tongue images, which processing of tongue image is not an easy task to do. The difficulty strikes because of interference of lip with the tongue, the different shape of the tongue, the irregular shape of the tongue, etc. [2]

2. RELATED WORKS

To find most of the diseases tongue diagnosis is widely used by the experts tongue images are collected to perform tongue diagnosis, but tongue image processing is not an easy way due to the irregular shape,

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disturbance of lips, and different shape for each person. The sequential method was used to process the tongue imaging in this work.Three processes are carried out first find the form of the tongue, second colour extraction, crack detection and pimple detection is found then finally LGXP method is implemented to determine the texture of the tongue image. This process reduces the complexity of analyzing the tongue image. [2] In traditional Chinese medicine tongue diagnostics is an essential one. So tongue area from the digital image is extracted to perform automatic tongue diagnostic system. Due to the weaker edges of the tongue, simple segmentation methods will fail to obtain details efficiently over the tongue surface. Here we combine two methods namely watershed transform and active contour model are proposed to perform unique segmentation. The watershed transform achieves initial shape, and the precise edge is converged using active contour model. These techniques provide us more efficient results on tongue diagnosis [3]. Colour image matching problem in medical diagnosis is the theme in this work. . In this paper, a colour mapping technique is used on different metrics in different colour spaces on tongue image. We consider distance measurement in coordinate space, but not solved the reflexivity axiom problem. To overcome reflexivity axiom problem, we proposed probabilistically combined metric and sorted metric methods. Sorted metric will over the reflexivity axiom in coordinate space, and probabilistically combined metric is used to improve the matching performance in colour matching technique. The analysis is done on tongue image using the proposed methods for matching and analyzing the results generated [4]. Tongue diagnosis is a preliminary test in medical diagnosis. By characterization, the accuracy of tongue diagnosis can be determined. Here, image tongue characterization is used; digital colour tongue images are acquired using TIAI.

The overall accuracy analysis is increased using colour calibration, quantitative analysis and tongue area segmentation. The colour tongue and its coating, cracks are characterized to improve the overall accuracy of the analysis. The accuracy of theas well over 85% using the proposed characterization method [5]. The characteristics of 12 tongue characteristics are analyzed elaborately. Based on a database of 9000 tongueimages, colorimetric imaging system the tongue is characterized by CIE chromaticity diagram. SVM algorithm and colour gamut boundary descriptor are used to derive the chromaticity diagram. By this method, 12 tongue characteristics are obtained. To prove the effectiveness, a new colour feature extraction is proposed for diagnosis [6].

3. EXISTING SYSTEM

Image segmentation partitions a digital image into multiple segments. The aim of segmentation is to simplify and change the presentation of an image into meaningful and easier to analyze. Image segmentation is used to locate boundaries and objects in images. Image segmentation is the process of allocating a label to every pixel in an image. Image segmentation is a set of segments that cover the entire image. Pixels in a region are similar to some characteristic or computed property, such a colour, intensity, or texture. Adjacent areas are different in the same characteristic(s). After image segmentation can be used to create 3D constructions with the help of interpolation algorithms. The segmentation of the image is useful in the medical field, computer vision and satellite imaging. The criteria for image segmenting are very hard. There is a vast amount of literature available to analyze and understand the segmentation techniques. The technique in medical image segmentation mainly works on fuzzy-c means and Otsu's method after applying a vector median filter, for segmentation and has tried to prove the hard-wearing of their method. Noise is added to sample image to obtain better results.

4. ALGORITHM

Image segmentation is change into a set of visually distinct and same regions on individual properties. The aim of segmentation is clearly differentiating background object in an image. Tongue area segmentation is important because it is used for analysis of tongue images to extract tongue area out. In tongue segmentation,

they are many methods proposed; they are threshold segmentation, Region growing, watershed, snake and so on. And in that tongue segment is best. The Level-set algorithm is applied in image segmentation.

4.1. Compression Based Method

The optimal segmentation is one which maintains the overall segmentation and coding length of the data. Segmentation is used to compress the image by finding any particular pattern or if there is any connectivity in image characteristics. Each part of the image is modeled using probability distribution function that can be achieved by representing each segment by its texture and boundary. The regions in raw images have a smooth contour that is feasible for boundary encoding. The continuous coding can be attained in short code by using Huffman code to encode the difference chain system. Lossy compression is used for texture encoding. The texture modeling is done by using normal distribution. The aim is to find the segmentation method that will produce shortest code length that can be achieved by agglomerative clustering method. The number of bits required to encode the image is acquired using the prior scheme.

4.2. Histogram Based Method

Histogram-based methods are very efficient than other image segmentation methods. The histogram is enumerated from pixels in the image, and the peaks and valleys in the histogram are used to find the clusters in the image. Grouped images are divided into smaller groups. This operation continues with smaller clusters up to terminal groups are formed.

4.3. Colour Histogram

An image can be encoded using global colour histogram that is the widely used feature because it is easy to extract. The distance in the colour histogram is used to determine the distance between two images. LCH (local colour histogram) can provide spatial information and information depending colour distribution region. Initially, colour histogram for each block is extracted by segmenting the image into blocks. The distance is then calculated by comparing the newly formed image histograms and the original image. The sum of all the distances is used to determine the distance between the two images.

4.3.1. Disadvantages

The histogram-seeking method is not suitable for extracting significant peaks and valleys from an image. Histogram analysis is adequately proper in the areas where multiple frames are engaged. Histogram analysis can be applied to single frame images but should use multiple times on the same image. The results are collected and merged into a single image will produce the current peaks and valleys of the image. This technique can also use as per pixel basis that will help us to identify the various colours, in particular, pixel location. This technique will be most suitable for active objects with static environment. This method is used to generate segmentation in the video tracking process.

4.4. Region Growing Method

Region growing method is mostly depends on assumption of values in neighbouring pixels. This method assumes whether the neighbouring pixels have same values if the neighbouring node as the same values then they are grouped into same cluster in the same way many clusters are created to form a perfect pixels arrangement. The result of this method is very important in image analysis but influence of the noise will be more in this method.4connecteness of edges was compared with intensity difference was performed to generate graph of pixels using Region Merging (SRM) method. Each pixel value generates aPixel region. The pixel regions ere compared and grouped into priority queue to find whether the regions are going to merge are not using statistical analysis.

Seeded region growing method is effective in one region growing method. This method collects a group of seeds as input along with the image. This seeds are used to perform segmentation of objects in the input image. Pixel intensity value and mean are taken as the output. The values are compared to assign to a particular region. This process was continued until all pixels are compared in whole input image.

The segmented image depends on the input seeds, if any noise present in the image will result in poor alignment of seeds in the output.The alternate region growing method is non-seeding growing method. This method does not use seeds to segment the objects from the image. It uses Image iterations are created to analyze the neighbouring nodes the process is same as seeding method.

4.5. Segmentation of Sublingual Veins

Sublingual vein inspection will provide exceptional data necessary to monitor health condition of humans. Diagnosis of portal hypertension and blood stasis can be validated using shape and breadth of sublingual vein. An image acquired by camera under normal light was used in experimental research papers for sublingual vein analysis.

5. METHODOLOGY

In Tongue image processing, the pictures of tongue are the elementary components for the diagnosis of different sickness. For the simplicity of the analysis, the tongue pictures ought to be handled clearly and appropriately. Due to previously mention issues like irregular shape of the tongue, lips etc., it's hard to diagnose disease with the tongue image processing. The principal characteristics of tongue are considered for image processing. The changes in these characteristics reflect the abnormalities of the body. With the help this analysis, it is easy to diagnose most of the diseases. For the comprehensive analysis, detailed images of tongue are used. Now, let us consider some tongue images and the disease analysis.

5.1. Texture Analysis

The foremost step in image processing is image acquisition as it captures the necessary image and provides a basis for processing. Then the second step, Image segmentation, is used to partition the image into a set of visually distinct and similar regions with respect to certain attributes. The image segmentation is implemented mainly to recognize the object and the background in the image. With this, the tongue area is extracted out completely. For image segmentation, the Level-set algorithm is used. The initial position of the tongue is decided by the Hue (H) and value (V) of HSV space. The middle region of tongue that corresponds to pancreas region is segmented separately. In the next step, Texture analysis, three principles are used to analyze texture such as statistical, structural and spectral.

The statistical approach yields smooth and coarse texture. Then the structural technique deals with the grouping of image basics. The image basics include texture description based on parallel lines. The final principle spectral technique is based on fourier spectrum. It identifies high energy narrow peaks in the spectrum.In the fourth step, color analysis, color is extracted from different color spaces.

It explains the position of the color in the color space like RGB, CIELAB, CIEYXY, HSV and CIELUV. RGB is an additive color system which is applied to use CRT to display images. It is used in most of the application and also it is very easy to implement. CIE has three primaries *x*, *y* and *z*. In this *y* is proportional to the luminance, *x* and *z* as an additional component. CIE is used to equalize amounts of the three primaries which are required to match the light.

HSV (Hue-saturation-value) is the most cylindrical coordinate representation of points in an RGB.HSV has discontinuities, which make the system noise sensitive. Hue is the color type and saturation is refer to the intensity of specific hue. Value refers to the brightness of the color. Finally the analysis between

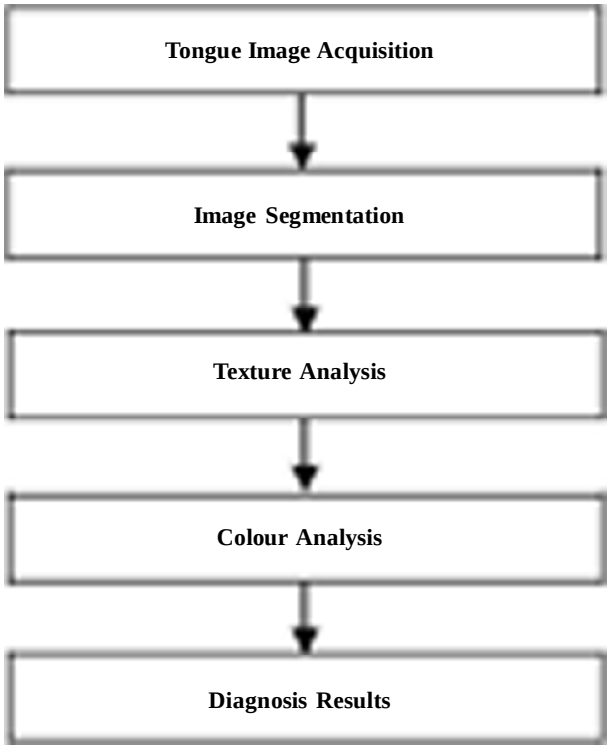


Figure 1: Block diagram of texture analysis

normal and diseased tongueis based on the color and texture features extracted from a set of tongue images.

5.1.1. Applications

The texture analysis has four major applications domains such as texture classification, texture segmentation, shape from texture, and texture synthesis.

5.2. Texture Classification

Texture classification assigns texture to some texture classes. The two classifications are supervised and unsupervised classification.Asupervised classifier learns a definition for each texture class. Unsupervised classification does not require knowledge to distinguish different classes from the textures given. The last class is semi-supervised. It has partial prior knowledge. Most of the classification methods involve a two-stage process. In the first stage, feature extraction, each texture class is classified with respect to feature measures. It identifies and selects that are relevant features such as rotation, scaling and translation. It finds hard time in designing a universal feature extractor since it depends on problems. Then classification is the second stage. Here, the classifiers determine the input texture classification based on measures of preselected features obtained. It identifies the selected features and yields texture classes. The textons create a global texton dictionary, in which each material is denoted by a probability density function. It is represented in terms of spectrum oftexton frequency. This sorts image data into clear information.

5.3. Texture Segmentation

Texture segmentation distributes an image into an array of unconnected regions based on texture properties. These results are used in further analysis like object recognition. Segmentation involves in feature extraction and derives a system to differentiate textures. The supervised texture segmentation deals with boundary separation by detecting different texture regions.While the unsupervised segmentation recovers various

texture classes before segmenting the image into regions. It is more expensive than supervised segmentation but it is more flexible.The segmentation is very crucial in TDs. Region growing, edge detection and other low level techniques do not segment tongue while the high level image processing technique is proposed.

5.3.1. Shape From Texture

Analyzing the texture properties of a 2 dimensional tongue image makes it difficult to estimate a 3 dimensional surface shape. Weak isotropy and homogeneity of a texture provides a suggestion of shape. When the surface is seen from a slant, perspective projection results in texture gradient. So the perspective transformation gives the surface shape parameters [7]. Hence, through a suitable texture gradient measure, object shape and depth map can be recovered. Shape from the texture recovers true surface orientation, reconstructs surface shape. It is also used for inferring the 3D layout of objects. A plane vanish line is extracted from texture deformation.

5.4. Texture Synthesis

Texture synthesis creates a wide texture from tiny texture samples. The created texture differs from sample but has identical features of those samples. It can handle boundary condition and neglects repeated verbatim. It gives an empirical solution to check the texture analysis. The texture synthesis needs a clear texture description. The reproduction of textures is more difficult.

6. RESULT ANALYSIS

In this chapter we analyzed the different postures of tongues and compared the difference in the visualization in the tongue images and also provide the results for color analysis of tongue image, segmentation image,

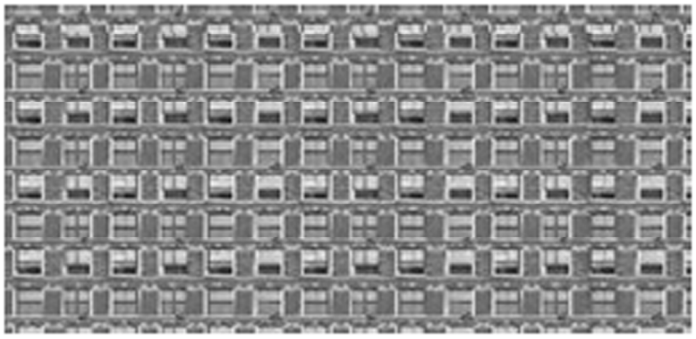
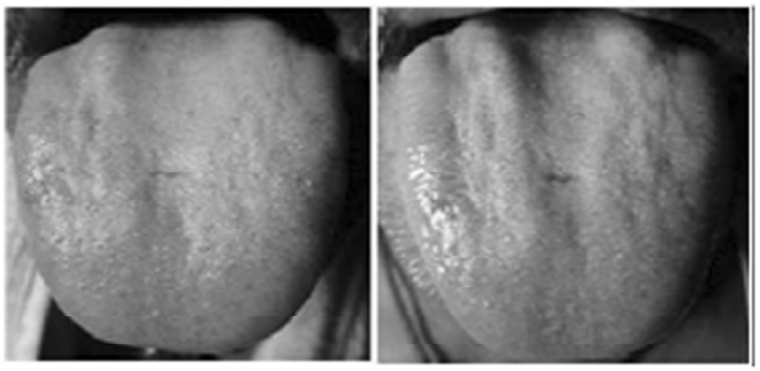


Figure 2: Synthetic Texture

Comparison of Tongue

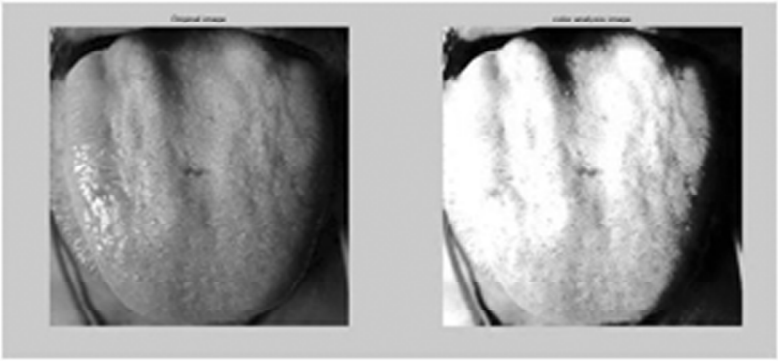


After food **Before Food**

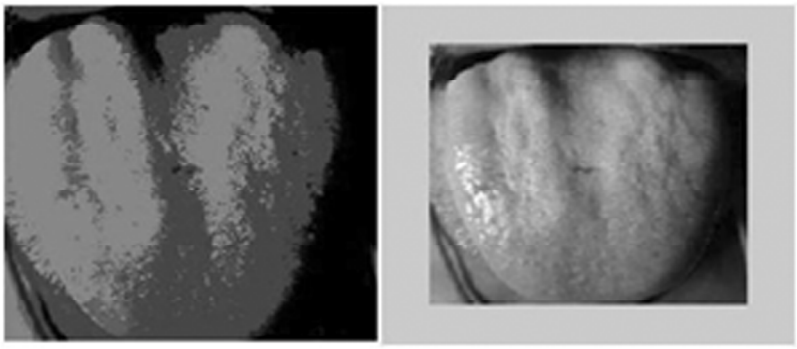
Figure 3: Normal Tonguez

gray scale image and filter outputs are provided below. This output provides as brief knowledge about the tongue diagnosis in modern medicine.

The above figure shows the comparison of the tongues in three categories: Normal tongue, before food and after food. An image shows the difference in presence of pores and white sediments in these images.



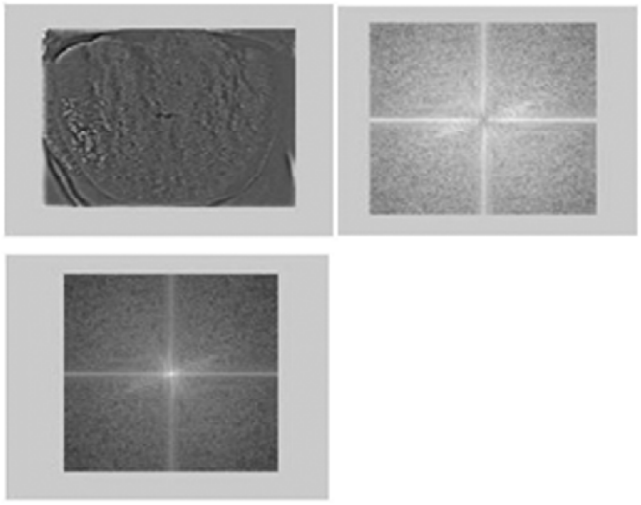
The above figureis the output of color analysis. The whiter segments are more visible in the result image after applying color analysis technique in normal image of tongue. This image shows a normal tongue and the output result after performing colour analysis.



Segmented image **Gray scale image**

The above Figure shows the segmented result of the normal tongue and gray scale output of the same images.

The above Figureshows the filter output of normal images.



7. CONCLUSION

The tongue diagnosis of diabetes mellitus based on pathological changes on the surface of the tongue establishes a relationship between tongue appearance and diseases. The analysis between normal and diseased tongue is based on the color and texture features extracted from a set of tongue images. Experiments are implemented and results are promising. The main contribution is to bridge the gap between tongue signs to western medicine defined diseases. From the result it is showed that the method we give the appropriate results and is well suited for tongue analysis and clinical application.

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