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Research Article

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Diagnosing diabetics with reflex zones of the tongue using colour image segmentation

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ABSTRACT

The tongue is a brawny organ that capacities to deglutition, taste and speech. It goes about as an effectively available organ for the assessment of wellbeing in patients. Any anomalous working of the Stomach, Pancreas, Liver Gall Blader and Intestines will be reflected on the tongue. The characteristic changes happen in the tongue can be truly helpful and will provide some clues for diagnosing a percentage of the diseases. Things to be considered in tongue for diagnosing would be shape, color, size and texture to identify the disease at the prior phase of any disease. In this paper, the color image segmentation strategy and an imedicalapp is developed to detect Diabetes Type-II. This system framework comprises of capturing the image, preprocessing of the image, extraction the texture feature and symptomatic analysis.

Keywords: Color Image Segmentation, Diabetes Type-II

INTRODUCTION

Type II diabetes [1] , once called non-insulin-dependent diabetes, is the most ordinary type of diabetes, The bodies of individuals with type 2 diabetes create insulin, however either their pancreas does not create sufficient insulin or the body cannot utilize the insulin well enough. The smears were acquired from three unique oral sites: Buccal mucosa (cheek), tongue dorsum, and floor of the mouth in 10 control individuals and 10 type II diabetic patients.

The texture and appearance of the tongue [2] says a lot in regards to the condition of our health. The technology recommends that it may soon be workable for trained physicians to conduct digital investigations of individuals' tongues to diagnose ailment. Digital imagery of tongue patterns with soft input analysis to determine whether or not a person is sick. Digitized imagery that maps the size, texture and color of a person's tongue can be utilized, to assess whether or not disease is present and treatment is needed. Tongue images are the basic features for diagnosing different sicknesses. For the simplicity of the analysis, the tongue pictures ought to be handled plainly and appropriately. The indications of any of the body issue, for example, heart related issues, kidney related issues, stomach related issues, and so forth will be reflected as abnormalities in any of the features of the tongue. So, vast majority of the ill can be discovered effectively by the examination of the tongue. The Reflex zones of the tongue [3] are given in Figure 1.

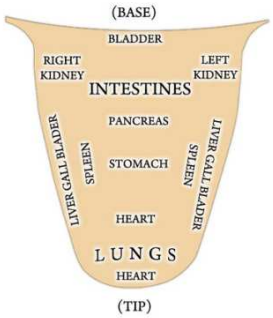


Fig 1: Reflex zones of the tongue

In the existing techniques, both chromatic and textural features are used to build the mapping from a tongue image to corresponding diseases by a statistical way. Also to capture an image, digital camera is used which captures images with high resolution and may causes run time error in program. Sometimes, even images could not be processed further. In short, High image resolution increases the Processing time and Multiple Image cannot be Process at a time are the problems faced. These problems are overcome by the proposed method.

1. OBJECTIVES AND CONTRIBUTION

Medical diagnosis using the tongue is one of the kind and vital diagnostic strategy of Traditional Chinese Medicine (TCM) [4]. Yet, the clinical utilizations of tongue diagnosis have been restricted because of two factors:

(1) Diagnosing the tongue is generally based on the capability of the eye for detailed discrimination
(2) The precision of tongue diagnosis depends on the skill of physicians

Customary tongue diagnosis is always committed to the identification of syndromes other than diseases. To address these issues, we present a Tongue Computing Model (TCoM) for the finding of Diabetes in light of chromatic and textural measurements. These metrics are computed from true colour tongue images by using appropriate techniques of image processing. Applying our way to clinical tongue pictures, the trial results are empowering. There are 5 causes of Tongue symptoms that are related to diabetes or a family history of diabetes (from a list of 430 aggregate reasons) [5]. These diseases and conditions may be more probable reasons for Tongue symptoms if the patient has diabetes, is at danger of diabetes, or has a family history of diabetes.

- Angina - angina occasionally causes tongue pain
- Candidiasis - white patches on tongue
- Mouth conditions - Mouth ulcer
- Oral candidiasis
- Oral thrush - white patches on tongue

Figure 2 gives the step by step approach for Diabetic Diagnosis using Tongue Image

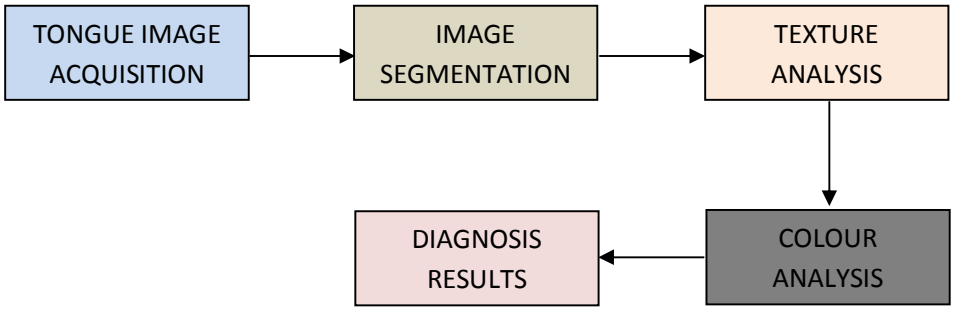


Fig 2: Block Diagram of Diabetic Diagnosis

2. TONGUE IMAGE ACQUISITION

Prior to initiate any video or image processing, an image must be caught by a camera and changed over into a manageable entity. This practice is known as image acquisition. Although some research has been carried out in skin color characterizing and tooth color analysis to date, there has been no comprehensive study on tongue color distribution analysis. The two important factors to be considered when designing a image acquisition device are:

(a) Illumination, including the illuminant and the environment, and
(ii) Imaging camera (IPhone), including the imaging Macro mode lens with added lighting of UV rays.

As per tongue diagnostic practices, the best illumination for tongue examination is sun light in open air. The most typical strategy is by digital photography with an advanced digital camera however here to capture a digital photography, I phone is utilized.

(a) (b)

Fig 3: Tongue image acquisition in different conditions

(a) Image is acquired before food (b) Image is acquired after food

This paper considered two different case of a tongue as in Figure 3 viz., before taking food and after taking. Such difference is chosen to show how this proposed technique performs for different cases.

3. COLOUR IMAGE SEGMENTATION:

Image segmentation is valuable in numerous applications. It can recognize the regions of interest in a scene or interpret the data. We categorize the existing segmentation algorithm into region-based segmentation, data clustering segmentation, and edge-based segmentation. Region-based segmentation includes the Seeded Region Growing (SRG) and unseeded region growing algorithms. All of these techniques expand each region pixel by pixel taking into account their pixel value or quantized value so that each cluster has high positional connections. The standard methodology is to discover a point close to the center of the target image, which is utilized as the center of image, and afterward to give an initial two-dimensional curve and make it astringe to the edge of the target as per dynamics mechanism.

This methodology is proper when the general form of the target is fixed. However human tongue is not generally flat when extended out of the mouth.

The particle swarm optimization (PSO) [6] is a type of evolutionary computation method based on the social behavior. PSO is a simple but great explore method which has been applied effectively to a wide range of search and optimization problems, including analyzing one of the issues in image processing such as image segmentation This paper presents a method for image segmentation based on PSO and SRG METHODS. The algorithm of PSO is applied along with SRG method for refining the position and similarity difference value of each seed point. Finally, in the proposed method, region merging is applied to merge small regions in the segmented image.

Image Segmentation Based On PSO-SRG

The fundamental idea of this algorithm is to generate a swarm of particles which move in the space around them searching for their target or the place which best suits their needs specified by a fitness function The algorithm of SRG find homogeneous regions around a set of given points called seeds. There are two problems associated with the SRG method, the first one is the selection of the similarity criteria for pixels in regions and the second is to select the seeds, which have an effect on the quality of segmentation. This work present a new segmentation method based on PSO and SRG [7] methods. The PSO-SRG method tries to solve these two issues of SRG method. The similarity criteria that will be found by PSO-SRG algorithm is the best difference between the gray value of examining neighbor pixel and the mean of intersected region

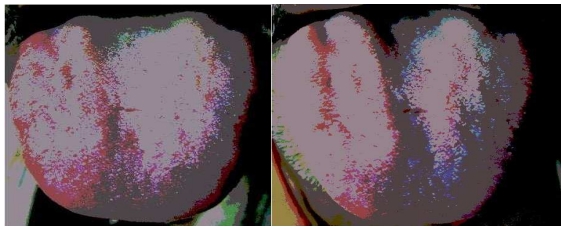


Fig 4: Colour image segmentation

4. TEXTURE ANALYSIS

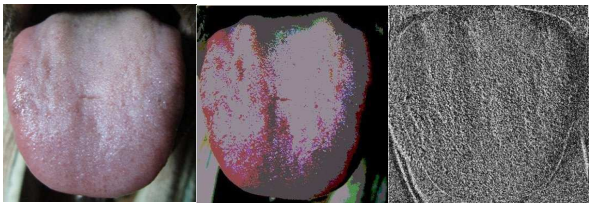
Texture analysis [8] describes the symptoms of diseases and so it is considered to be an important criterion in disease diagnosis. The roughness or bumpiness refers to difference in the intensity values, or gray levels. Inflammation lesions or ulceration and deterioration of the associated body part are pointed out by dark red in tongue. White designates stagnation of blood; fat and mucus deposits or feebleness in the blood leading to such disorders as anemia. A disorder of the liver and gallbladder is specified by yellow. This results in a surplus secretion of bile, particularly in the middle organs of the body, and likely inflammation. Blue or purple shows the stagnation of blood circulation and a grave fading of the part of the digestive system that is connected to the zone of the tongue. Internal conditions can be understood by analyzing the color on the underneath of the tongue. Surplus of blue or Green shows maladies in the blood vessels and in blood quality and circulation. Surplus purple color mirrors ailments of the lymphatic and circulatory system. It designates a fading of the immune capacity of the blood vessels.

5. COLOUR ANALYSIS

The human visual system can distinguish hundreds of thousands of different color shades and intensities, however only about 100 shades of grey can be distinguished. So, a great deal of extra information may be contained in the color [9], and this extra information can then be used for image analysis.

6. OBSERVATION

In this paper, we have introduced a method in which every process is occurring in a step by step manner. In our proposed method, we have provided methods to detect the white coating, differentiation of color, split, pimples and buds of the tongue. From the evaluation of the results it is showed that the methods we proposed gives the appropriate results and is well suited for the tongue image processing. Additional enhancement to the system can be done by improving the localized intensity methods and calculation of the features and giving an empirical table to identify the disease. Figure (5) and (6) gives the pictures of tongue image acquired, tongue Image segmented output and the texture analysis output for both before and after food is taken respectively.



(a) **(b)** **(c)**

Fig 5: (a) Acquired Tongue Image (b) Image Segmented Output (c) Image after texture analysis before food

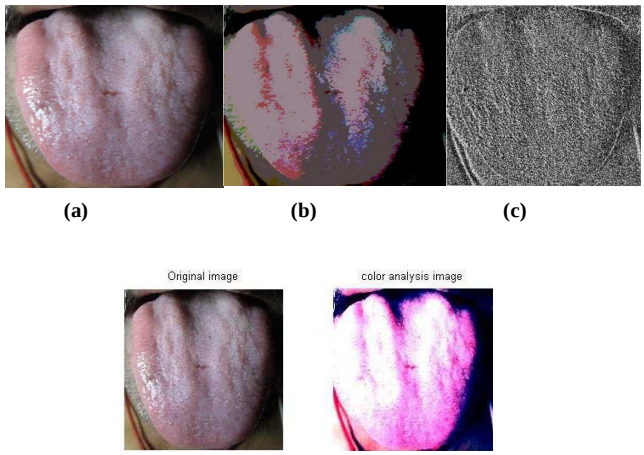


Fig 6: (a) Acquired Tongue Image (b) Image Segmented Output (c) Image after texture analysis after food

Figure (7) and (8) gives the Histogram output of RGB colour analysis before and after food respectively.

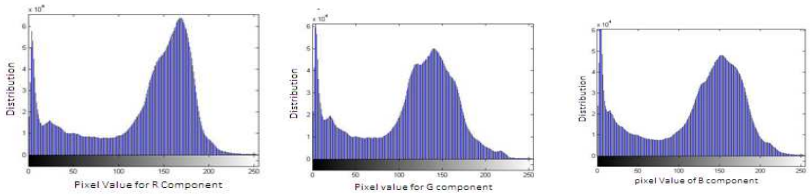


Fig 7: Histogram of RGB color analysis before food

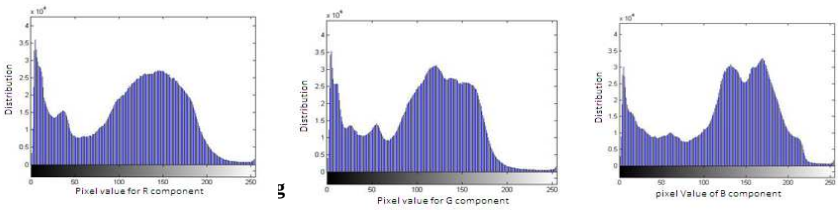


Fig 8: Histogram of RGB color analysis after food

CONCLUSION

The tongue image enhancement is one of the important research methods in the tongue image processing and hence there are different methods introduced for the effective processing of tongue images. But with the one or more disadvantages in the processing, new techniques are become necessary. Thus, in our method we have introduced a method in which every process is occurring in a step by step manner and the differentiation can be made between the normal and diabetic patients through the tongue diagnosing using color image segmentation method and the results obtained are effective.

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