Tongue Diagnosis by Image Segmentation

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***Abstract*— Tongue image analysis is a key component in clinical medicine. Tongue diagnosis is unique and important area in diagnosing for most of the diseases. Tongue diagnosing is vast area which helps by processing the tongue images, but the processing of tongue image is not easy task to carry out. But difficulties strikes due to the irregular shape and size of the tongue, here interference of lip also occur with the tongue etc. In this paper, we proposed the K-means clustering image segmentation method for processing the tongue image. The method has some phases such as first, shape detection phase, second, colour extraction and third, texture extraction etc. For shape extraction we use region growing algorithm with an edge detector and it also helps in the pimple detection and cracks detection, for colour extraction we use colour intensity method and for texture extraction we use Local Gabor XOR Pattern it is well known as LGXP method, which is very efficient technique in finding texture from an image. The main aim of this segmentation of tongue image is to reduce the complexity as much as possible.**

Keywords- **Tongue segmentation, Pattern recognition, colour intensity, LGXP, Pimple and cracks detection.**

I. INTRODUCTION

Tongue image processing are very crucial part in medical history it always take more attention in the field of image segmentation and disease analysis only because of its irregular shape, size, colour, texture and lip interference etc. The tongue is mainly concentrated on its edges, size and shape so it should be given a special attention for processing the medical image. Hence, for the diagnosis of tongue image, firstly the shape feature, colour feature and texture feature of the tongue are examined individually in specific method. By the help of shape extraction method we can easily able to identifying the characteristics of different shape of the tongue, colour identification method is used for identifying different intensities or brightness on the surface of tongue which affecting the human body and texture identification gives different pimples, cracks after processing the image.
The segmentation of tongue image helps in identifying the colour and texture of the tongue, with all the irregularities in infected parts. In the present paper there are two major criteria for concentrating in analysis for automated tongue.

The first objective of tongue is colour, texture and sticky coating and peeled coating with the support of image analysis. Another one is the automatic image segmentation of the tongue. Rather than these two concerns, there are other tongue diagnosis has its unavoidable restrictions.

Tongue segmentation is one of the most useful techniques in the field of automated tongue diagnosis system which is very tough due to the complexity of pathological tongue, variance of tongue shape and infringement of the lips. Thus, a number of researches have been carried out for to find an effective remedy for the problem associated with the tongue segmentation.

The tongue image processing is a difficult task, because of the unavailability of specific methods for this kind of processing. Various methods have been newly developed to efficiently process the image of the tongue. Since the need of an accurate results and well equipped tongue processing method which comes frequently by the help of researchers have made significant advancement in the field of tongue diagnosis, there are still many unsolved problems with the existing algorithms.

Some methods are only deal with the detection of syndromes in tongue diagnosis consequently. Second, the real validity of these used techniques and their systems are usually derived from comparing the results for diagnosing results and the judgments of tongue diagnosis made by skilful practitioners with experimental analysis.

The segmentation of the body of tongue plays a significant role in automatic tongue diagnosis in the field of Traditional Chinese Medicine. If there are comparable grayscales near the boundaries of tongue, it is tough to excerpt the body of tongue suitably with some standard methods directly.

II. TONGUE ANATOMY

The tongue is a mass of muscle that is almost completely covered by a mucous membrane. Tongue images are the elementary features for diagnosis various diseases. For the ease of the diagnosis, the tongue images should be processed clearly and properly.Tongue image processing is quite a tough task due to the tongues particular features like, its irregular shape, interference with the lip etc.

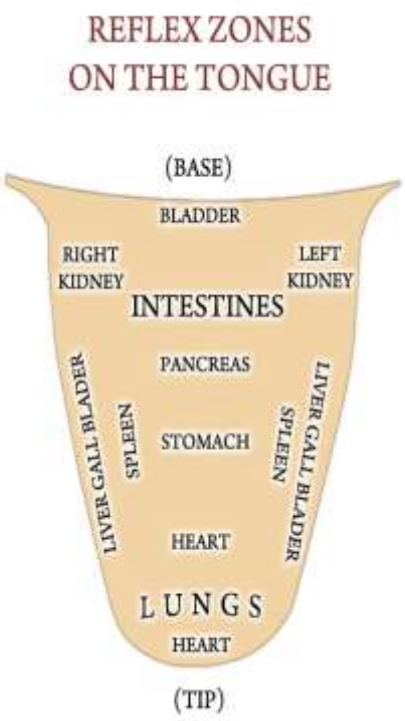


Fig. 1 Reflex Zone on the tongue which indicates all organs of our body.

With the help of Reflex Zone we can check the infected part of our body. Because if main problem occur in any part of our body it reflects back on tongue little bit. As we can see in Figure1 every organ has indicated at specific place on the tongue. By seeing these we can predict the infected area of the body, but we cannot find which kind of problem it is.

So it's difficult to get an effective diagnosis of diseases without an effective tongue image processing methods. The main features that are used for diagnosing the tongue include shape, colour, pimples, cracks and texture of the tongue.

The symptoms of body problem such as heartassociated problems, kidney related problems etc. will bereflected as abnormalities on the tongue. So, most ofthe diseases can be detected easily by the examination of the tongue. For detailed analysis of the tongue, we use thetongue images,with the help of the clear tongue images a detailed diagnosis of tongue can be possible. Now, let usconsider some tongue images and do disease analysis.Themain features that we consider for tongue diagnosis are shape, colour and tongue body cracks and pimples.

Diseases caused by the virus and bacteria result in the difference in colour. Thus, tongue can be characterized within different measures. The common measures of the tongue can be detailed as follows:

Width: A wide tongue on the whole shows a composed physical and mental character. A lack of physical flexibility with noticeable strengths and weaknesses is depicted by a narrow tongue. They may be sharp thinkers but generally have a narrow view. A generally loose and expanded physical condition and a tendency to have more psychological concerns are related to a wide tongue.

Tip: A flexible yet firm physical and mental condition is mirrored by a rounded tip. A pointed tip reveals a tight, perhaps even rigid physical condition and an antagonistic or even unpleasant mentality. A very wide tip shows an overall weakness of the physical body and a limp or even "spaced out" mental situation.

Thickness: A flat tongue echoes a composed condition and the competence to docilely adapt to situations. A calmer and easy going trend is depicted by a thin tongue. It also reflects a more mental orientation. A more bodily orientation is reflected by a thick tongue, they tends to be self-confident or even forceful.

Colour: Inflammation lesions or ulceration and sometimes a deterioration of the associated body part are pointed out by dark red. White designates stagnation of blood; fat and mucus deposits or feebleness in the blood leading to such disorders as anaemia. A disorder of the liver and gallbladder is specified by yellow.

This results in a surplus secretion of bile, deposits of animal fats, 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.

Texture: The texture of the tongue mainly consists of two states; a swollen or enlarged tongue indicates full state. A shrivelled or withered looking tongue indicates an empty state.

III. CLASSIFICATION OF TONGUE

Geographic tongue (migratory glossaries) is characterized by a benign, asymptomatic bright red patch (or patches) with a gay or white margin on an otherwise normal tongue. Fissured tongue (scrotal tongue) is characterized by numerous small furrows or grooves on the dorsal surface of the tongue.

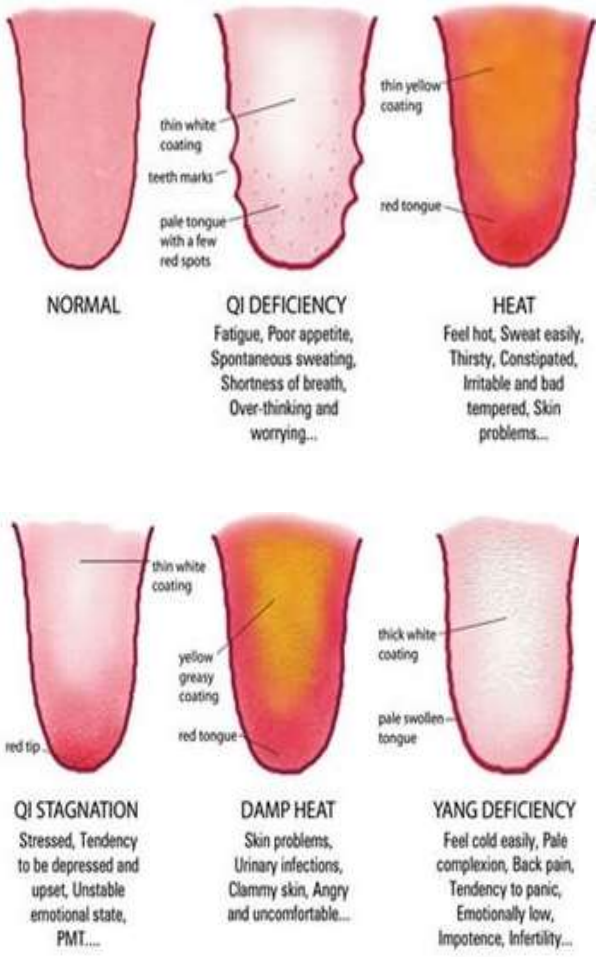
In black hairy tongue, hyperplasia of fusiform papillae leads to bacterial trapping; entrapped pigments and desquamation may lead to the dark discoloration of the tongue. This is the newly found pattern of the tongue. This is not long term problem. It can be treated by medicine only.

In this kind of infection small hair grows on the surface of the tongue, this is occur due to when you do not clean your tongue regularly and lives in a lot of dust.

Fig. 2 Geographic tongue (Hairy Tongue)

As we can see in the Figure 2 brown colour of small hair grows on the surface of the tongue. This is not so complicated infection; it may get cured with medicines. It is an acute type of disease.

There are more types of tongue whose problems can be checked by seeing surface area of the tongue.



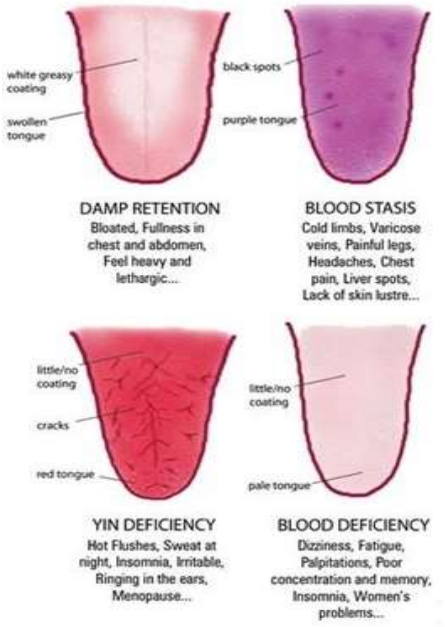


Fig. 3 Various kind of defected tongue whose problems can be detected by seeing their surface.

Tongue has different colour, shape and texture such as pimples, cracks etc. As we can see in Figure 3 that first one is normal tongue so it is taken as reference tongue. Next one has teeth marks on the edge of the tongue. Similarly all tongues have their different aspects such as white coated on its surface, yellow colour in the middle of the tongue, purple colour of the tongue, redness with cracks on the tongue etc.

IV. PROPOSED METHOD

K-MEANS CLUSTERING for image segmentation is a partitioning method. The function k-means partitions data into k mutually exclusive clusters, and returns the index of the cluster to which it has assigned each observation. Unlike hierarchical clustering, k-means clustering larger set of dissimilarity measures), and creates a single level of clusters. The distinctions mean that k-means clustering is often more suitable than hierarchical clustering for large amounts of data.

K-means treats each observation in your data as an object having a location in space. It finds a partition in which objects within each cluster are as close to each other as possible, and as far from objects in other clusters as possible. You can choose from five different distance measures, depending on the kind of data you are clustering.

Each cluster in the partition is defined by its member objects and by its centroid, or centre. The centroid for each cluster is the point to which the sum of distances from all objects in that cluster is minimized. K-means computes cluster centroids differently for each distance measure, to minimize

the sum with respect to the measure that you specify. You can control the details of the minimization using several optional input parameters to K-means, including ones for the initial values of the cluster centroids, and for the maximum number of iterations.

K-means is one of the simplest unsupervised laming algorithms that solve the well-known clustering problem. The procedure follows a simple and easy way to classify a given data set through a certain number of clusters (assume k clusters) fixed apriority. The main idea is to define k centres, one for each cluster. These centres should be placed in a cunning way because of different location causes different result.

At this point we need to re-calculate k new centroids as barycentre of the clusters resulting from the previous step. After we have these k new centroids, a new binding has to be done between the same data set points and the nearest new centre. A loop has been generated. As a result of this loop we may notice that the k centres Change their location step by step until no more changes are done or in other words centres do not move any more.

I write MATLAB segmented code for K-means clustering. But this program only access the image in PNG (portable network graphics) format. So, I give the below image as input in this image segmentation code.

Fig. 4 Input image which is infected as white coated layer.

In the coding of matlab, the program has made which take an image as input that is showed in Figure4. But the image only in png format because that matlab code only run for .png extension of the image. After compiling the program we get gray conversion of input image first then it forms clusters of image.

V. RESULTS AND DISCUSSION

We have implemented our proposed approach using MATLAB (MATLAB 2012) and the results showed that the approach produce better results in tongue image segmentation methods. Let us have a detailed look with the different tongue image samples.

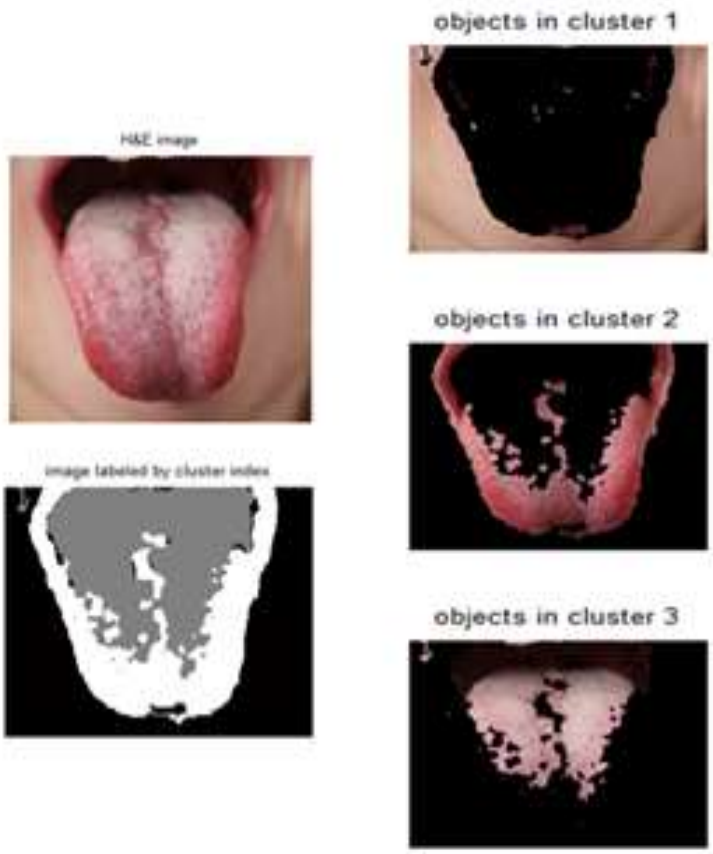


Fig. 5 Output image after applying K- means clustering segmentation code in MATLAB.

As we seen our outcome of the matlab program for k-means clustering image segmentation in Figure 5 clearly. In the last, the objects in cluster 3 we get our final segmented partition of the tongue which has white coated layer on its surface on the tongue.

When we consider the shape feature of the tongue it is clear that we obtain the correct shape of the tongue. The occurrence of white coating is very low in tongue images, even though our method out performs other methods in the case white coating detection.

When we consider the pimples in the tongue, our method performs better with the help of the region growing algorithm. The intensity method we adopt is providing good result in finding the colour feature of the tongue. The dominant colour also can be easily identified with the help of our method.

The above figure shows the significance of the dominant colour detection and colour feature extraction using our proposed approach. We have experimented method on different types of tongue images. The results provided satisfactory outcomes.

VI. CONCLUSIONS

The tongue image segmentation plays significant in the field of tongue image processing and hence there are different methods which introduced the effective processing of tongue images sharply. But with the one or more drawbacks in the image processing, newly techniques are becoming very necessary. Thus, in our method we have introduces k-means clustering method in which every process is occurring in a step by step format.

In our proposed method, we have provided method to detect the peeled coated layer on the surface of the tongue. After applying MATLAB software program for image segmentation, we get the evaluation of the results as partition of the tongue infected area. The method we proposed gives the appropriate result and it adds that the –means clustering approach is well suited for the tongue image processing.

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