Tongue Image Analysis for Medical Diabetes Diagnosis using Canny Edge Algorithm

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Abstract: Tongue diagnosing is one amongst the vital areas in diagnosing most of the diseases, so tongue designation has received more significance among the experts. Tongue diagnosing is usually carried out by processing the tongue images, but the processing of tongue image is not easy task to carry out. The difficulty strikes because of the irregular shape of the tongue, interference of lip with the tongue, the different shape of the tong etc. In this paper, we proposed support vector machine (SVM) based tongue classification method for processing the tongue image. Shape detection Hough transformation is used, an edge detectors uses canny edge algorithm for extracting the shape of the tongue, Gabor features are used to extract the texture features of the image. Color feature extraction is done by extracting 12 color features, color image segmentation strategy and region of interest is used for segmentation. Finally, classification is done by using SVM classifier.

Keywords: Tongue diagnosis, SVM, Canny Edge Algorithm, Gabor features.

I. INTRODUCTION

The truth that the general health of an individual is reflected in his tongue is from the times of Hippocrates. Tongue analysis is one of the most broadly utilized diagnostic methods among the four diagnostic processes Traditional Chinese Drug (TCM). The use of tongue diagnosis lies in its straightforwardness and quick assessment of the tongue can instantly clarify one’s physical problem with the goal that individuals looking for social insurance can have their tongues routinely examined. However, this is limited by the way that the clinical skill of tongue diagnosis is chosen by the experience and knowledge of the practitioners. The diagnostic results are based on the abstract investigation of the inspectors might be unreliable and conflicting. Which means various specialists may accomplish various result for the equal visual experience of tongue. In this manner, it is necessary to have a quantitative diagnostic process for tongue analysis to reduce human errors and mistakes.

Automatic tongue associate lysis system fitly becomes an inevitable pattern. Partition of the tongue phase from pictures of the lower face together with the mouth and teeth is that the preliminary step within the automation of tongue diagnosis (analysis), within the breakup of the tongue phase, HSI shading space change and morphology are joined to separate the picture of the surface of the tongue [1,2,3]. Polar coordinates conversion and marginal sifting [4] are used to identify the six edges and directions and focus of the outside of the tongue in the images. The watershed change is utilized online rework instrument without copyright infringement[5,6]. To circumvent to the circumstance the qualitative and subjective issues of traditional analysis (diagnosis) of tongue, a few systems supported tongue diagnosis techniques have been found [7]. Tongue recognizable proof is one in all the first significant examining systems those are utilized to take a gander at any comparable changes inside the tongue and furthermore the covering of the tongue in making finding of sicknesses. The heaviness of tongue ID lies in its effortlessness Associate in Nursing snapiness at regardless of direction there's an obscure issue stacked with irregularities; investigation of the tongue immediately clarifies the natural psychotic system. Along these lines, it's of incomprehensible motivating force in each middle applications and self-recognizable proof. Furthermore, tongue analysis (diagnosis) is one in every single symptomatic method that accords with the first encouraging heading along the edge of torment and no damage. Tongue ID has contended such an extraordinary job inside the conclusion and furthermore the ensuing treatment of miracle Associate in Nursing it's pulled in an expanding live of idea each in clinical medicine and in biomedicine. In any case, normal tongue distinguishing proof has its unavoidable restrictions. From the start, the clinical ability of tongue analysis (diagnosis) is found by the skill and learning of the specialists.

Second, environmental factors, such as complexities in light-weight sources and their brilliance, affect the specialists in getting reasonable demonstrative outcomes from the tongue. Finally, antiquated tongue ID is personally connected with the unmistakable nearness of disorders, and it isn't appallingly positively surely understood by Western and stylish medications. During this methodology, that it's important to construct Associate in Nursing objective and quantitative indicative typical for tongue ID.

II. RELATED WORK

B. Saritha [1], proposed the objective of giving a robotized arrangement of tongue investigation isn't to switch standard demonstrative analytic strategies, yet to help specialists with making their call by giving an early alarm signal which will incite any examination by totally various techniques, for example, MRI, CT, X-Ray and endoscopy.
Bo Pang Associate in Nursing et al. [2] Tongue recognizable proof is normally founded on the capacity of the consideration for cautious separation. The precision of tongue recognizable proof relies upon the mastery of specialists. Standard tongue investigation is frequently devoted to the unmistakable presence of disorders other than illnesses.

Chuang-Chien Chiu et al.[3] proposed computerized tongue examination system (CTES) in view of mechanized picture analysis to quantize the tongue properties in customary Chinese medicinal analysis. The CTES is useful to give the doctors a methodical and target indicative standard for the tongue analysis in the clinical practice and research. XingzhengWangaetal.[4] talked about Several significant presentation indicators, including illumination uniformity(consistency), system reproduce ability and exactness, are intricately tried. Exploratory outcomes demonstrate that caught pictures are in high calibre and keep stable when acquisitions are rehashed. Bo Pang an et al. [5] have been proposed Computerized tongue review technique mean to recognize and conclusion the ailment prior. Initial, two sorts of quantitative highlights, chromatic and textural measures, are removed from tongue pictures

III. PROPOSED METHOD
To see the DM and NPDR, the underlying phase of DR is predicated on 3 groups of choices extricated from tongue pictures. The choices are shading, surface, and shape. Then median filter can be used for removal of noise from tongue image. For matching, divides the database into training and testing set. Then SVM is used for training and classification to determine whether the input image is diseased/ healthy.

![Fig 1 Block diagram of proposed method](image)

**Tongue Color Feature Extraction**

After to catching the tongue picture, division is done to separate closer view pixels from foundation pixels. Tongue shading extent [21] speaks to every single imaginable shading that show up on the tongue surface inside the red boundary. The tongue shade gamut was set up by plotting the cortical territory pixels onto the 1931 shade diagram. it’s revealed that ninety-eight of the tongue pixels exist in the dark limit. a total of twelve hues were assigned with the help of RGB shading territory, hues exemplify C (Cyan), R (Red), B (Blue), P (purple), DR(Dark Red), LR (Light Red), circle (Light Purple), LB(Light Blue), BK (Black), GY (Gray), W (White) and Y (Yellow). The fundamental guideline behind element vector extraction is to coordinate every pixel's shading force with the twelve shading focuses and allot the nearest shading [4]. All closer view tongue pixels in RGB shading territory are conceived again to CIEXYZ shading space reliable with the resulting condition

\[
\begin{bmatrix}
X' \\
Y' \\
Z'
\end{bmatrix} =
\begin{bmatrix}
0.4124 & 0.3576 & 0.1805 \\
0.2126 & 0.7152 & 0.0722 \\
0.0193 & 0.1192 & 0.9505
\end{bmatrix}
\begin{bmatrix}
R \\
G \\
B
\end{bmatrix}
\]

CIEXYZ is converted to CIELAB using

\[
\begin{align*}
L^* &= 166.f(Y/Y0)-16 \\
a^* &= 500.[f(X/X0)-f(Y/Y0)] \\
b^* &= 200.[f(Y/Y0)-f(Z/Z0)]
\end{align*}
\]

where X0,Y0,Z0 are the CIEXYZ tristimulus estimations of the reference white reason. when discovering all frontal area pixels, the in general of each shading is added and isolated by the aggregate of assortment of pixels. This structures the shading highlight vector where \(v=[c1, c2, c3, c4, c5, c6, c7, c8, c9, c10, c11, c12]\).

![Fig 2 Flow chart of Gabor filter](image)

**Edge discovery**

Shrewd Edge detection, the keen edge observer is a balance recognition administrator that uses a multi-organize equation to distinguish a decent change of edges in pictures, its point was to locate the best edge discovery recipe.
The technique will be abridged beneath:
1. The picture is pressed utilizing a Gaussian channel with a to such an extent that change , to decrease commotion.
2. The local slope and edge heading are processed at each reason exploitation very surprising administrator.
3. Apply non-maximal or essential concealment to the inclination extent.
4. Apply edge to the non-maximal concealment picture.

SVM
SVM grouping utilizes various planes in space to isolate information focuses utilizing planes. An SVM model is a representation of the models as focuses in space, mapped with the goal that the instances of the separate classifications or classes are partitioned by a dividing plane that maximizes the margin between various classes. This is because of the reality if the isolating (dividing) plane has the biggest separation to the closest preparing information purposes of any class, it brings down the speculation mistake of the general classifier. The test or question focuses are then mapped into that proportionate space and foreseen to have a spot with an order depend on which side of the gap. The main advantage of SVM grouping is that SVM performs well on data sets that have many attributes, notwithstanding when there are just a couple of cases that are accessible for the preparation procedure. Be that as it may, a few drawbacks of SVM arrangement incorporate restrictions in speed and size during both preparing and testing period of the calculation and the determination of the portion work parameters.

IV. EXPERIMENTAL RESULTS

Input image

Grayscale image

Equalized image

Fig 3 Input image

Fig 4 Grayscale image

Fig 5 Histogram of input image

Fig 6 Equalized image

Fig 7 Histogram of equalized image
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Fig 8 Segmented Tongue

Fig 9 Red plane

Fig 10 Green plane

Fig 11 Blue plane

Fig 12 Lightness

Fig 13 Green-Red
This paper conducted a comprehensive and fundamental research on statistical distribution characteristics of tongue colors. In our proposed method, we have provided methods to detect the shape, color and texture of the tongue. From the evaluation of the results it is showed that every method we proposed gives the appropriate result and it adds that the proposed approach is well suited for the tongue image processing. A distinct computerized tongue diagnosis approach for the diagnosis of diabetes mellitus based on a quantitative analysis of the pathological changes on the surface of the tongue.

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E.Srividhya, doing her PhD at Bharath Institute of Higher Education & Research, under the title “Diagnosis of Diabetes by Tongue Analysis using Image Processing”. Despite teaching the students, she has filed a patent “Smart Diagnosis System for Diabetes” in 2018, and has 10 publications in International and national journals. Currently she is working as an Assistant Professor in Department of Computer Science and Engineering, AarupadaiVeedu Institute of Technology, Chennai.

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