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Research Article

Detection of anaemia from Tongue Datasets by Image Processing

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ABSTRACT

In the process of respiration in the human body, inhales the oxygen and that is used for breaking down the sugars and carbohydrates into glucose. This in turn gets converted in to energy and blend in to the body. For the conversion the hormone named insulin in the blood stream plays the vital role. The pancreas is responsible for the secretion of insulin and not required quantity is secreted thee process of energy conversion face hurdle. This will increase the glucose level in the blood and also in urine. This is the key term for the work on finding the diseases. The main objective of this project is to detect Diabetes Mellitus (DM), Non Proliferative Diabetes Retinopathy (NPDR) and anaemia by comparing the tongue of the patient with the tongues samples of healthy individuals pre-loaded in the system. The features of the patient's tongue are extracted and compared with the features of tongues datasets in the system. The human tongue is capable of indicating diseases based on its color, texture and orientation. By using this feature extraction an attempt is made to detect anaemia and also indicating the levels.

Keywords: Anaemia; colour; DM; NPDR; texture; Geometry.

INTRODUCTION

The tongue according to Ayurveda is a strong diagnostic tool which is used to indicate one's health. Using the tongue image we are going to detect DM, NPDR and Anaemia. Diabetes is caused by insulin hormone which is used to convert energy into glucose if it is not secreted in required quantities by pancreas or secreted insulin is not used, the conversion of glucose in to energy is not taking place to the required level, thereby increases the level of glucose in the blood stream and hence also found in the urine. This condition is called Diabetes Mellitus. Diabetic Retinopathy (DR) is one of the common effects of prolonged DM, which affects the eye sight of the patient. In some cases the blood vessels in the eye swell and leak fluid or even close off completely and in some cases, abnormal new blood vessels grow on the surface of the retina. The early stage of DR is called Non Proliferative Diabetes Retinopathy (NPDR) (Kiran, Pallavi, 2015). Anaemia is caused due to the lowering of red blood cells or haemoglobin in the blood. An anaemic person will be more tired than a normal person and symptoms such as swollen tongue, change of tongue colour, reduction in or loss of tongue papillae which will be reflected in tongue and it is useful for detecting whether the patient is anaemic or not. The geometric feature of the tongue helps in diagnosis (Shivai et al., 2015), (Tina, Hussain, 2015)

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Literature survey

Support vector machines

This model uses Support Vector Machines (SVM) with spiral bit premise work to group diabetes datasets. SVM is an arrangement of related directed learning technique utilized as a part of therapeutic determination for order and relapse. They have utilized Pima Indian diabetes informational index, given by Vincent Sigillito, which is accumulation of restorative analytic report gotten from 768 records of female patients of no less than 21 years of age. These datasets are prepared and tried on SVM as classifier. The proposed display accomplished 78% exactness which can be effectively utilized for diagnosing diabetes disease (Shveta, Gurmeen, 2015). To overcome the glare in the exactness of the SVM, the proximal SVM classifier approach is utilized (Sujatha, Divya, 2015).

B coloring technique in clustering analysis

The researchers proposed a grouping calculation which depends on a chart b-shading strategy, used for clustering process by Pima Indian diabetic dataset. They have executed, performed tests, and made correlations on their approach with KNN Classification and K-means grouping. The execution was better regarding exactness and affectability. The precision of

b-shading approach tests was accounted for as 93.676% (Vijayalakshmi.D, Thilagavathi.K, 2012).

LDA-support vector machine and feed forward neural network

Linear Discriminant Analysis and Support Vector Machine proposed by Ankita et al., were utilized for the finding of Pima Indians Diabetes dataset. In this procedure, LDA is utilized to diminish the element subsets and SVM is in charge of arrangement of information. This was contrasted and SVM with Feed Forward Neural Network (FFNN) and was found that the proposed SVM+LDA gives better arrangement precision as 77.60% with 2 features (Ankita et al., 2014).

Limitation of Existing system

- Difficulty in implementation
- Complexity
- Time consumption
- High cost
- Discomfort to patient
- Low classification accuracy
- Requires a number of lab assistants.

Proposed work

In this project an attempt is made to detect Diabetes Mellitus, Non Proliferative Diabetes Retinopathy and Anaemia as well as indicate the level (low, medium, high) of the disease by obtaining the tongue image of the patient within a few minutes by extracting the features of tongue such as color, texture and geometry. Figure 1 narrates about the process involved in the work. The tongue image is loaded and it is pre-processed to remove noise and resize. Then it is divided into color, texture, geometry and finally by SVM and SFS decision is made.

Algorithm

The flow of proposed algorithm is as follows.

1. Input image is selected from tongue image database.
2. Pre-process the image to remove noise
3. For colour features,
    a) 12 colours are extracted & converted to corresponding LAB values.
    b) The Euclidian distance is calculated.
    c) Mean average & standard deviation is calculated.
4. For texture features,
    a) The tongue image is divided in 8 blocks strategically located on tongue.
    b) A filter is used for texture feature extraction of each block
5. For geometry features, extract various shape features and their ratios using mathematical formulae.
6. For matching,
    a) Divide the database into training and testing set.
    b) SVM is used for training and classification
    c) Determine whether the input image is DM/NPDR/Anaemic/Healthy.
7. Use Sequential feature selection (SFS), to select best features for matching.
8. Result.

METHODOLOGY

Image acquisition: Image acquisition is the process of obtaining the digital images. In this process, the digital image of the patients tongue is to be obtained, which requires devices namely Physical device and Digitizer (Figure2).

Resizing: The input image is converted to resized format that is suitable for processing of the image. A scaling factor is used to resize the image to larger or smaller size and in this process, the image is scaled to a factor of larger size.

Gray scale image: In this process the RGB format or color map is converted to gray scale intensity image. It converts RGB images to gray scale by eliminating the hue and saturation information while retaining the luminance (Figure3).

Edge detection: In this process, edges are detected using canny technique in which two thresholds are specified. One represents high threshold and the other represents low threshold. Using these threshold values, the strong edges and weak edges are detected.

Extracting features: After obtaining a total of 34 features based on color, texture, geometry these features are related to the data sets of the healthy individuals and analysed.

Contour plot: This process segments the image into foreground and background segments. The initial contour location is specified closer to the object that is to be segmented. Then the image of the object is segmented using edge by using 400 iterations.

Cropped image: The segmented image portion for analysis is cropped and details can be extracted from it. A global image threshold is then calculated using Otsu's method. The image is then converted to binary image based on the threshold. The binary image is then converted to black and white image in true color RGB format. The black and white cropped image is then displayed.

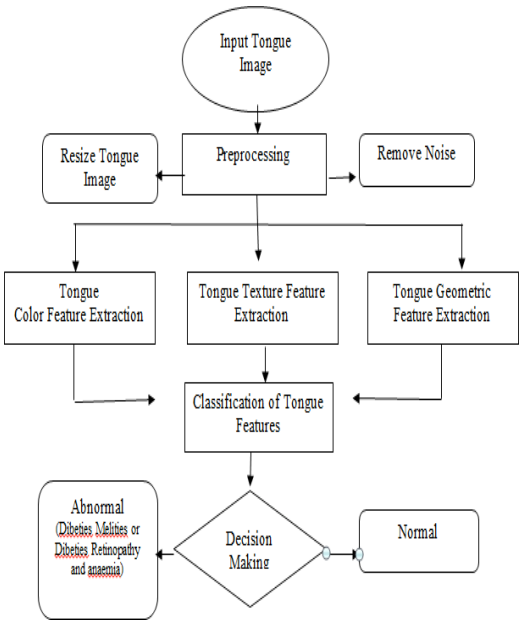


Figure 1: Work flow

Figure 2: Tongue image

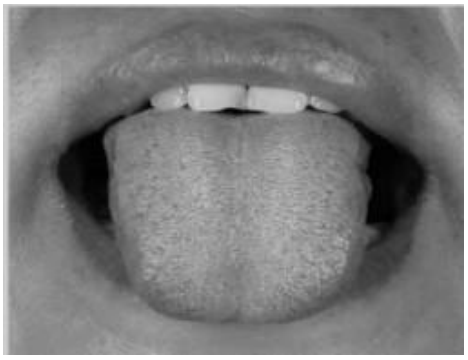
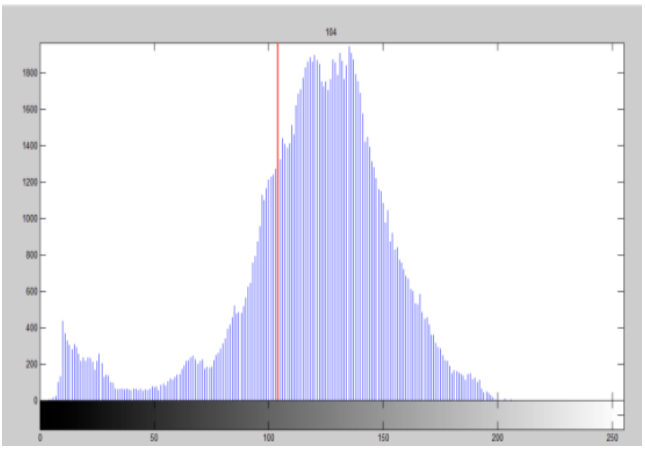
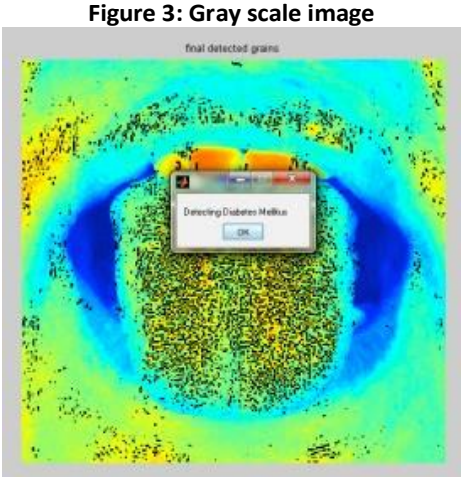


Figure 3: Gray scale image





Corrected edge image: This process suppresses structures that are lighter than their surroundings and that are connected to the image border.

Colour and orientation feature extraction: The centre levels and surround levels are defined for obtaining the colour features. A cell array is then created for storing the colour features. Orientation refers to the position or direction of the object. Here the position and location of the tongue is analysed.

Histogram: The histogram is an effective tool not only for image quality assessment but also for manipulating the contrast and brightness of an image. The histogram of an image is a plot of the number of occurrence of gray levels in the image against the gray level values. The RGB format image is first converted to gray scale format and histogram for the gray scale image is drawn. The features of histogram are provided in the (Figure4)

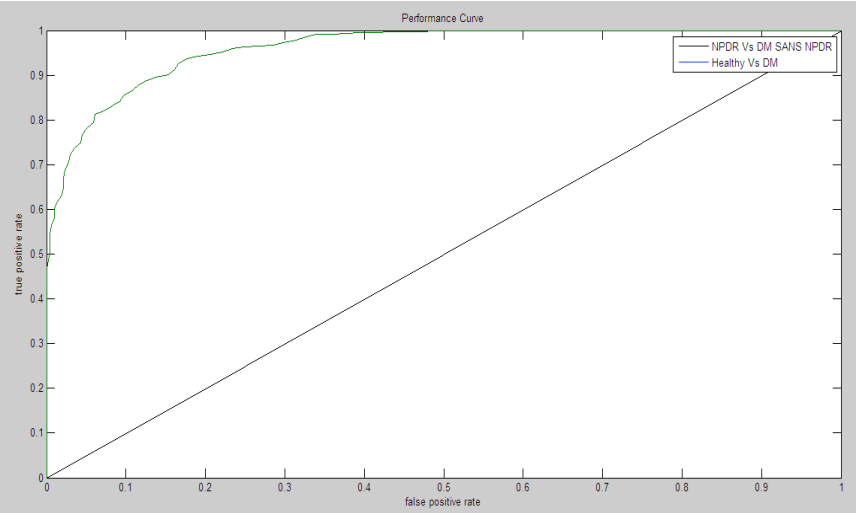


Figure 4: Performance curve

- The segments of the histogram of the dark picture are focused on the low (dim) side of the dim scale.
- The segments of the histogram of the bright picture are focused on the high side of the dim scale.
- A picture of low difference has histogram that is thin and it is focused to the centre of dim scale.
- A picture with high difference has a histogram that covers a wide scope of the dim scale, the circulation of pixels will be uniform with not very many vertical lines being higher than the other.
- Along these lines, a histogram which has a wide range will be a picture high differentiation.

Detection: All the required features such as color texture and geometry are obtained. These values are then compared with the datasets from healthy individual and detection of Diabetes Mellitus, Non Proliferative Diabetes Retinopathy and Anaemia, and their degree is arrived (Figure5).

Estimating levels: A performance curve is then finally drawn indicating the level (high, medium or low) or the stage up to which the disease as advanced. Thus in this system, a narrative classification approach is used to distinguish Healthy/DM and NPDR/DM-sans NPDR samples by utilizing three type of features (Figure6).

CONCLUSION

The proposed system was implemented by extracting the color, texture and geometry features of tongue and used for detection of diseases such as Diabetes, Non Proliferative Diabetic Retinopathy and anaemia. It is easy to understand and efficient method with significantly lesser computations. With the help of tongue image detection of other diseases like nephritis is possible and also indicates the disorder in the body in parts such as kidney, intestine, spleen, pancreas, liver, stomach, heart and lungs. Therefore by extracting the features and obtaining a more precise readings helps in developing the efficient system for disease prediction.

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