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DIAGNOSTIC METHOD OF DIABETES MELLITUS BASED ON TONGUE IMAGE USING HYBRID FEATURES AND RBF KERNEL

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***Abstract* --- Diabetes mellitus (DM) is one of the recent health problem facing by most of the people in the world. A non invasive approach is done for detection of diabetes mellitus. It is based on person tongue image using the features of color, texture and geometry. Features extraction are by different color spaces i.e. RGB to HSV. First image is captured using device then it is undergone with enhancement and background removal. Then all 3 features (color, texture,geometry) are extracted. With all this it is easy to distinguish a diabetes mellitus patient and normal person from their tongue image.**

***Index terms*-diabetes mellitus , enhancement, background removal, color features of tongue, texture features, geometry features of tongue.**

I. I INTRODUCTION

Diabetes mellitus and its complication are of the major health problems in worldwide. World Health Organisation (WHO) stated that by the year of 2030 diabetic will reach to 366 million. So alternative non-invasive method should be considered. This diabetes mellitus is of two types as DM1 and DM2.DM1 indicates the insulin needed for survival. This is B-cell destruction. The next type DM2 is the common one. To avoid this maintaining healthy lifestyle, exercising and eating well is must. If it is not maintained, its effect leads to diabetic retinopathy (DR). Thus results in microvascular complication.

If a person having 20 years of DM1, their survive results in DR major. In early stage diabetes was identified by invasive method (piercing blood) and its effect DR is identified by exposing eye to bright flash in case of angiography. So non-invasive method is needed. Thus this paper deals with non -invasive method to detect diabetes mellitus. It involves 3 features color, texture and geometry. In this method LS-SVM classifier is used for pattern recognizing.

The rest of the paper involves the following section. Section II includes input tongue image and preprocessing, Section III includes features extraction and Section IV describes classification and discussion and concluding with remark.

II. LITERATURE SURVEY

Computerized tongue diagnosis based on Bayesian network -Bo Pang, David Zhang:In this, first two of quantitative features, chromatic and texture measures are extracted by digital image processing. Then Bayesian network is employed for diagnosis of diabetes. This method is western medicine technique. The advantage of this method is elimination of evaluation. The estimate prediction accuracy of BNC is upto 75.8%. The experiment demonstrate the effectiveness of this method.

Diagnostic method of Diabetes based on support vector machines and tongue images-Jianfeng Zhang, Xiaojuan Hu: In this paper along with features, there is a combination of SVM kernel parameters and input variables are analysed for diagnosis. In this, parameters are optimized by GA(genetic algorithm). Here segmentation is by division and merging algorithm which is based on color of image. Once conforming optimal solution then decode it to complete analysis. For study purpose sensitivity, ROC and specificity are used to assess classifier performance. This paper provides reference for analysing data and processing algorithm.

A. Existing method

In existing system, edge detection method results in poor detection of edge. Global threshold algorithm and neural network has disadvantage forlarge features and characteristics of image makes the detection of disease difficult.

B. Proposed Method

In this method LS-SVM (least square support vector machines) is implemented. The advantage of this is ,it is easy to implement non linear decision regions and convergence to minimum mean squared error solutions.

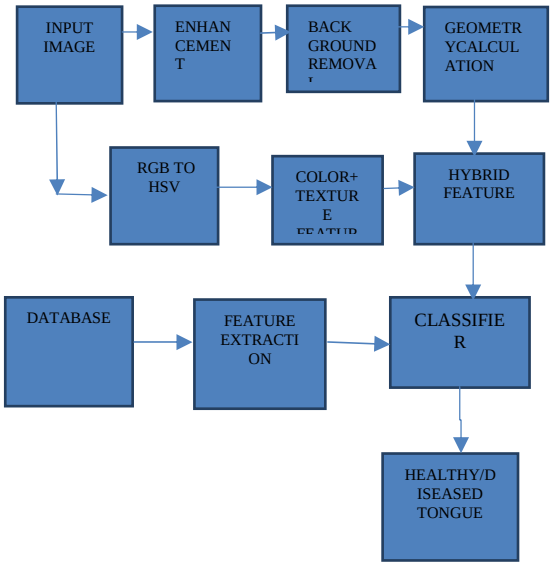
III. INPUT TONGUE IMAGE AND PREPROCESSING


a)before food (bf) b)after food(af)

The tongue image of person is considered as input image. This image is got through the capture device and preprocessing is done to produce uniform illumination. The preprocessing method includes smoothing ,background subtraction and mean.

IV. FEATURES EXTRACTION

The features extraction for image involves the following:

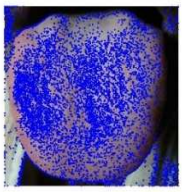
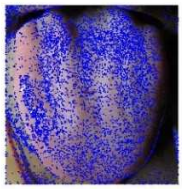


Enhancement- Image enhancement is suitable for display or image analysis. Image is sharpen or brighten based on histogram equalization and linear contrast adjustment.
Background removal-background areas are removed for image recognition. Then the image is ready for arrangement of colors or in selected region of an image. This helps in segmentation.

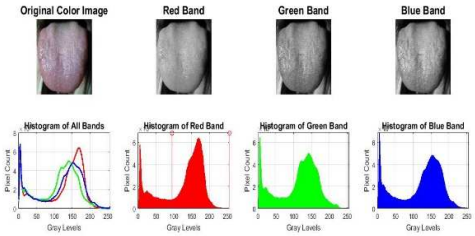

(a)bf image enhanced (b) af image enhanced

The above figure shows the background removal of two image c)bf and d) af
geometrical calculation is based on region of tongue image. These features are based on measurements, distance and area along with their ratio. The below figure represents the features extracted from tongue by geometry mean.

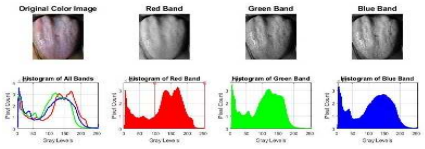
(i) (ii)

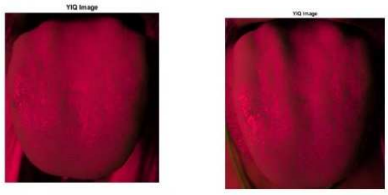



The first figure indicates the tongue buds are opened before intake of food. (increased in blue indication)The next figure shows buds are reduced after food in take.
The input image is undergone with color conversion. Color is the most important feature for pattern recognition since it is attached with human perception for color identification. Hue relates with spectrum, saturation indicates purity of color and value shows the pixel is light or dark. Image texture gives the information about the spatial. The below figure shows the output of original image as in RGB form along with histogram band for all color. This is for before food image.



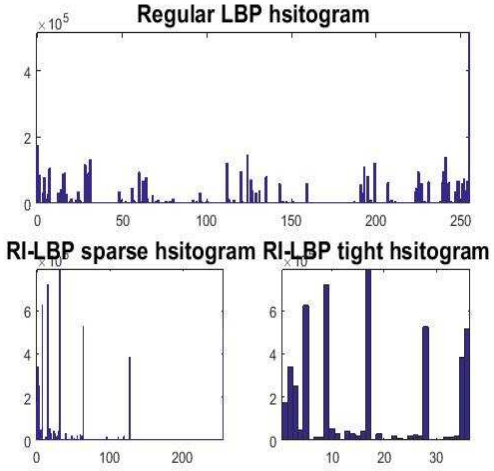
The below figure represents the original image after in take of food in RGB band with histogram representation.



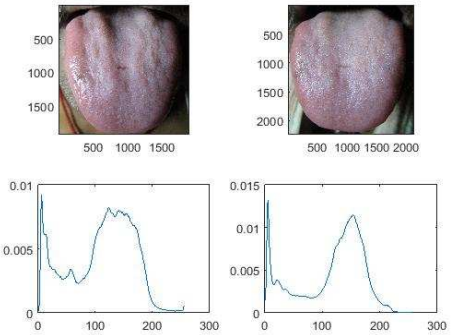


(c) (d) (e) (f)

The above image has its components as Y,I,Q(luminance, in phase, quadrature).This is the rotation of RGB color space.Texture analysis is based on spectrum and gray level.

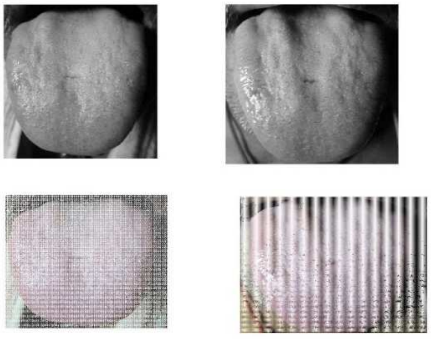


This graph shows the local binary patterns(LBP) for sparse and tight histogram. Then two input image is taken for histogram comparison which shows strong value for after intake of food.



The gray level co–occurrence matrix(GLCM) considers the relationship between two neighbouring pixels, the first is reference pixel and the second is neighbour pixel. The GLCM tabulation often involve combination of pixels brightness values occur in an image.

(a)bf image (b)af image



It is one of the best texture analysis method. Above is the effect of GLCM of an image. In this module1 is contrast of an image followed by block matching algorithm and entropy.

V. CLASSIFICATION AND DISCUSSION

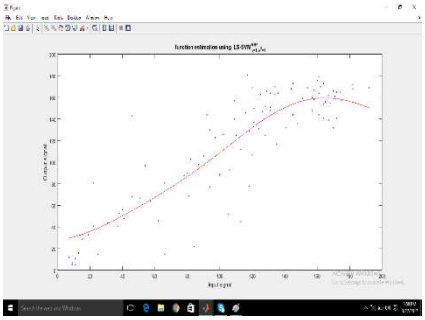
LS-SVM (least square- support vector machine) is based on using a quadratic error criterion with equality constraints. It is modified with the equation

$$\min J(w,b)=\min 1/2 \; \|w\|x^2+c\sum_{i=1}^{t}\theta_i^2$$

For proper output, parameter should be selected properly. The memory requirement for this is less. CDMA signal model is one of the application of LS-SVM. This is extended to construct non linear decision function. It is supervised learning method.

RBF Kernel function used in support vector machine classification. The radius of it good structural equalizer.It is for pattern analysis. The kernel function is characterized by

$$K(\vec{x_i}\ \vec{x_j}) = \varphi(\vec{x_i})\varphi(\vec{x_j})$$



From the above figure it is easy to identify whether the person is under diabetes or not. It involves the combination of LS-SVM and RBF Kernel.

Al the results of this paper under each block defines the person status of their tongue regarding indication of diabetes or not. In this kernel linear function is mapped into kernel spaces. Thus accuracy is maintained by performance of sensitivity and specificity. The accuracy is higher than the optimal combination of fewer features.

VI. CONCLUSION

In this paper, image of tongue through camera is captured. Features extraction from tongue image is proposed from three group includes color, texture and geometry.LS-SVM used to establish the classification for diabetes model which provided good result. Preprocessing of data and its parameters has impact in result. Several experimentation are done with different tongue image from different person. Then advantage is that information provided is not lost as considered about the previous one. Hence the classification produced good efficiency with greater accuracy of 95%.

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