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A Novel Classification Approach for Detecting Diabetes Mellitus and Nonproliferative Diabetic Retinopathy

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***Abstract*—**Nowadays, most of the countries face a complicated health problems and one among them is Diabetic Mellitus (DM) which lead to Diabetic Retinopathy (DR). The Government and the Medical Care Health Officials found it so difficult to detect them accurately. So, in order to synthesize it evident, a new approach of non-invasive automated method is used which helps to detect DM and Non-Proliferative Diabetic Retinopathy (NPDR). This can be done by comparing the diseased sample with healthy sample using a tongue, based on color, texture and geometry. The existing system use Support Vector Machine (SVM) for classification. But this SVM classifier is highly algorithmic complex and the speed is also quite low. To make them simpler and faster a fast new support vector machine called Twin Support vector Machine (TWSVM) can be introduced. In the proposed work, TWSVM classifier can separate the DM and NPDR using the color, texture and geometric features. These features can be extracted with the help of a tongue image capturing. It can result in faster computation time of proposed system comparing to the existing system.

***Keywords*—** Diabetic Mellitus, Non-Proliferative Diabetic Retinopathy, Support Vector Machine, Twin Support Vector Machine

I. INTRODUCTION

Imaging technology in medicine[1] plays an important role in diagnosing the interior portion of the human body by the doctors. Even the doctors finds very helpful for keyhole surgeries rather than a major operation. Devices like CT Scan, MRI, Ultrasound are used in this.

A. Diabetic Mellitus

Diabetic mellitus[2] is a disease which damage the pancreas,which produce insullin. Glucose and sugar present in our blood tries to enter the cells in the body to produce energy. If the insullin doesn't function properly, then they cannot enter into the cells. This may result in the rising of sugar level in blood, creating the disease called diabetes.

There are 2 types of diabetes mellitus. Both types of diabetes have the risk that may lead to long-term complications. they may develop after several years say 10-20 years. They initially damage the blood vessels. Diabetes may increase the risk of cardiovascular disease. people used to die due to coronary artery diabetic disease, stroke, and peripheral vascular disease.The complications of diabetes may include damage to the eyes, kidneys, and nerves.

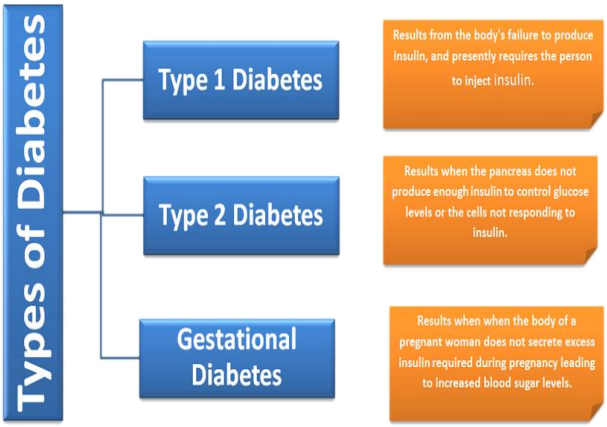

Fig. 1: Types of Diabetes

B. Diabetic Retinopathy

Diabetic Retinopathy[3] is a disease that are caused when there found a damage to the blood vessels present in the retina of the eye, that may result in slow eye sight loss and even blindness.Diabetic retinopathy may not have any early symptoms. Sometimes the person who have blurred vision can find it hard to do their activities like reading or driving and sometimes the vision may get loss during the night or the day.

In the acute stage,the person suffering from non-proliferative diabetic retinopathy (NPDR) my have no symptoms of vision loss and person may have 20/20 eye sight power.In this,blood vessels may get leak into the macular region.

In the advanced stage, the blood vessels that are found abnormal form present at the backside of the eye is called proliferative diabetic retinopathy (PDR). In this,it may burst and bleed, even it blur the vision, When the bleeding occurs for the first time, it may not be too severe. In most cases[4], it will show only a few specks of blood or spots in a person's eye and the spots gets vanish after few hours.These spots may result in large amount of leakage of blood, that blurs the vision. In extreme cases the person may have the problem of vision with blood. For example, the person reading a news paper finds blood spots on the paper but it is just an illusion where other people cant see them.

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C. Tongue Diagnosis

Tongue diagnosis[6] is a diagnostic methods which is used to detect any abnormal changes occur in the tongue. The advantage of tongue diagnosis is simplicity and immediacy.

II. EXISTING WORK

This work proposes a non-invasive method to detect DM and non-proliferative retinopathy(NPDR). The starting stage of the DR based on the three groups of features that can be extracted from tongue image. The features are as follows:

- Color
- Texture
- Geometry

To capture the tongue image of the tongue[7], the image capturing device is used. The figure shows the tongue image capturing device.

Fig. 2

A tongue color gamut represents the tongue color features done with 12 colors.

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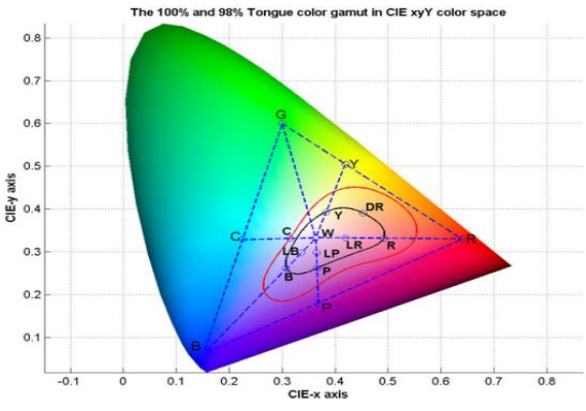

Fig. 3. Tongue color gamut can be represented using several points by drawing lines from the RGB color space.

Color	[R G B]
C (Cyan)	[188 188 185]
R (Red)	[189 99 91]
B (Blue)	[183 165 180]
P (Purple)	[226 142 214]
DR (Deep red)	[136 72 49]
LR (Light red)	[227 150 147]
LP (Light purple)	[225 173 207]
LB (Light blue)	[204 183 186]
BK (Black)	[107 86 56]
GY (Gray)	[163 146 143]
W (White)	[200 167 160]
Y (Yellow)	[166 129 93]

Table 1

Tongue surface has 8 blocks of texture value. Also these blocks are used to characterize the 9 tongue image features. Hence 13 features are been extracted to represent the geometry features based on the measurements like area, distance,length, their ratio. By applying a combination of 34 features, the proposed method can easily differentiate between healthy tongue and Non-Proliferative tongue images by using these features. These three groups may give an average accuracy of 80.52% and 80.33% respectively. Here Support Vector Machine(SVM) is used for classification purpose. But it is very complex with low speed.

III. PROPOSED SYSTEM

To detect the DM and NPDR, the initial stage of DR based on three groups of features extracted from tongue images. The features are color, texture, and geometry. The image of tongue is captured using a device called image capturing device. Then adaptive median filter can be used for removal of noise from tongue image. The tongue color gamut is used to represents all possible colors which appears on the tongue surface. To compute the texture value of each block, the 2-D Gabor filter can be applied. The texture of tongue images separate eight blocks. Here the Healthy samples may have a higher texture value and DM samples have lower texture values. The texture features can be extracted from the tongue image. Finally 13 geometry features can be extracted from tongue images. These features are based on measurements, distances, areas, and their ratios. To solve the problem in the existing system TWSVM classifier can be used. TWSVM is kind of the latest emerging machine learning approaches that are suitable for classification and regression problems. TWSVM is a simple algorithm that takes much less computational time than the SVM.

IV. CONCLUSION

Thus in the proposed work, a fast new support vector machine(TWSVM) classifier can be used to reduce the complexity of the SVM classifier. It may result in high precision and low resolution tongue images can be processed well. It may also support with good recognition accuracy that can be achieved in tongue recognition. The execution time can be reduced when compared to SVM.

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