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DIABETES MELLITUS DETECTION BASED ON FACIAL BLOCK TEXTURE FEATURES USING THE GABOR FILTER

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ABSTRACT

Diabetes mellitus (DM), commonly referred to as diabetes, is a group of metabolic diseases in which there are high blood sugarlevels over a prolonged period. Symptoms of high blood sugar include frequent urination, increased thirst, and increased hunger. If left untreated, diabetes can cause many complications.Acute complications include diabetic ketoacidosis and nonketotic hyperosmolar coma. Serious long-term complications include cardiovascular disease, stroke, chronic kidney failure, foot ulcers, and damage to the eyes. Now a days, researchers have discovered that there are non-invasive ways to detect Diabetes Mellitus based on the analysis of human facial blocks. Firstly, four facial blocks are taken from a facial image are extracted. Afterwards, we use a 2- D Gabor filter bank to extract texture features from the four facial blocks samples.Prevention and treatment involve a healthy diet, physical exercise, maintaining a normal body weight, and avoiding use of tobacco. Finally, Simplified Patch Ordering and Improved Patch Ordering are applied to classify Diabetes Mellitus and Healthy he disease.

Keywords-diabetes mellitus, Gabor filter,facial block texture features,k-nearest neighbors,support vector machine.

I. INTRODUCTION

Diabetes is a diseases with a variety of causes. People with diabetes have high blood glucose, also called high blood sugar or hyperglycemia. Diabetes is a disease in which the body is unable to properly use and store glucose, exploratory surgery was routinely performed when a patient was critically ill and the source of illness was not known. In dire cases, the patient's thorax, for instance, was surgically opened and examined to try to determine the source of illness. Diagnostic imaging was first performed in 1895 with the discovery of the x-ray. For the first time, physicians could see inside the body without having to perform exploratory surgery. Thus diagnostic imaging is a "non-invasive" way to look at internal organs and structures. Here we use Gabor filter for feature extraction. Gabor filter is a linear filter used for edge detection. As the Gabor filter is similar to the human visual system, it is effective in feature extraction.

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This is especially useful in feature extraction, where Gabor filters have succeeded in many applications, from texture analysis to iris and face recognition. A comparison was made between the color features of the two classes and classification was performed between Healthy and DM using a combination of facial blocks and SRC. The principle of SRC is to represent a test sample as a linear combination of the training samples, or a dictionary of atoms from the training samples.In propose system, we implement a new noninvasive method to detect DM based on facial block color features with a sparse representation classifier (SRC). Finally, the mean of the vector is computed and assigned the texture value of the facial block. After extracting the facial block texture features, *k*-NN and SVM are used to classify DM samples vs. Healthy samples.

1.1. Problem Statement:

In this project, the Diabetes Mellitus can be detected in a non-invasive manner through the analysis of human facial blocks. Algorithms have been developed to detect Diabetes Mellitus using facial block colorfeatures, use of its texture features to detect this disease has not been fully investigated. We propose a novel method to detect Diabetes Mellitus based on facial block texture features using the Gabor filter. For Diabetes Mellitus detection we first select four blocks to represent a facial image.

1.2. Objective:

The main objective is to detect Diabetes Mellitus using facial block color features, use of its texture features to detect this disease has not been fully investigated. We propose a novel method to detect Diabetes Mellitus based on facial block texture features using the Gabor filter.

In this method cause, symptoms, and the origin of the disease can be reflected on the face through color changes. However, the diagnostic result given by the practitioner based on years of experience can be thought of as subjective or qualitative. To eliminate this bias, computerized facial diagnosis based on quantitative feature extraction and analysis can be established.

II. METHODOLOGY

We detect DM non-invasively through the analysis of human facial blocks. Noninvasive glucose refers to the measurement of blood glucose without drawing blood, puncturing the skin, or causing pain or trauma. Here we do this projects in different modules such as, 1] We use facial block color features with the Sparse Representation Classifier(SRC) to detect DM. They classified DM vs. Healthy based on a combination of four facial blocks with the SRC. The four facial blocks were located on the forehead, the nose, and below the right and left eyes, with each block represented by 6 colors.

We use four blocks (A, B, C, and D) of size 64 × 64 extracted to characterize a facial image. Fig.1 shows an example of a captured facial image with the marked four blocks. Block A is taken from the forehead. Blocks B and D are symmetrical and located below the right and left eyes respectively. Block C is found on the nose, B and D's midpoint. As Blocks B and D are similar, we do not use Block D in practice.

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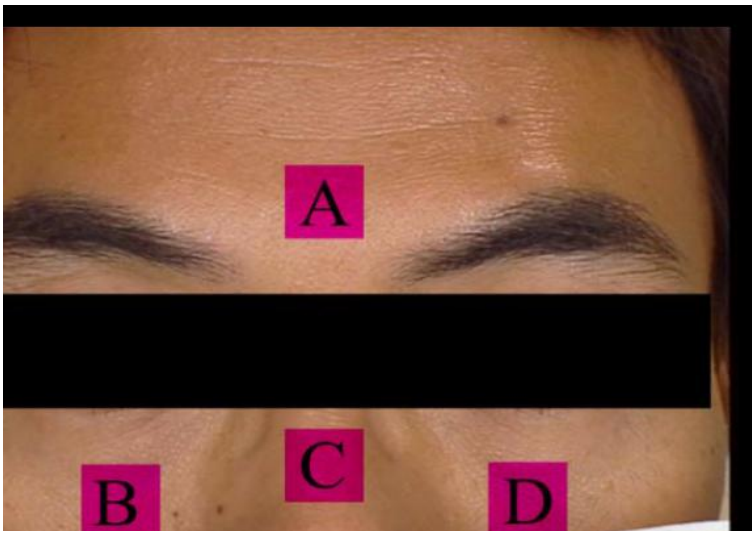

Fig. 1.An example of a facial image and its four blocks.

2.1 Block Diagram:

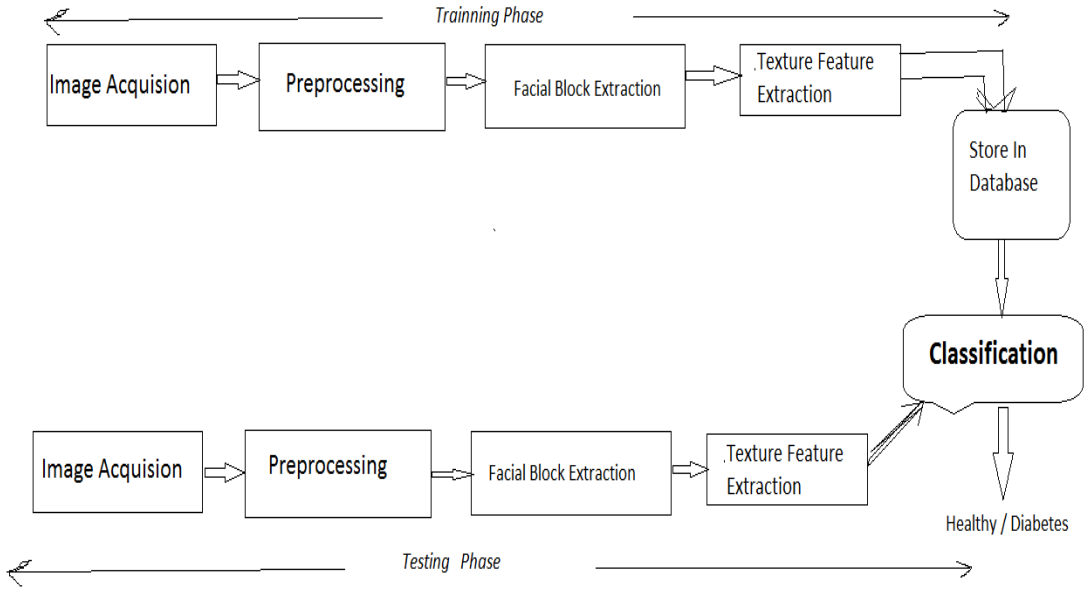

Fig.2. Block Diagram

2] we generate a custom-sized 2-D Gabor filter bank: It is straightforward to generalize the filter in (10) to two dimensions where the time variable t is replaced by the spatial coordinates (x, y) and the frequency variable u by the frequency variable pair (u, v) and this was presented in the late 70's. If similar studies in optics are not considered, the major effort to the development and use of 2- D Gabor filters has been made in image processing and especially in feature extraction. In 1978 Granlund proposed the form of a general picture processing operator which corresponds to a 2- D Gabor filter and was derived directly from requirements of image processing. It is noteworthy that Granlund addressed many properties, such as the octave spacing of the frequencies, that were reinvented later for Gabor filters.

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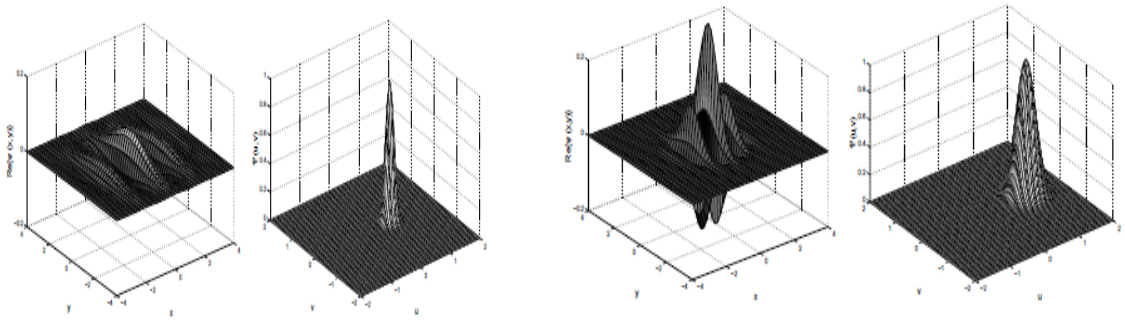
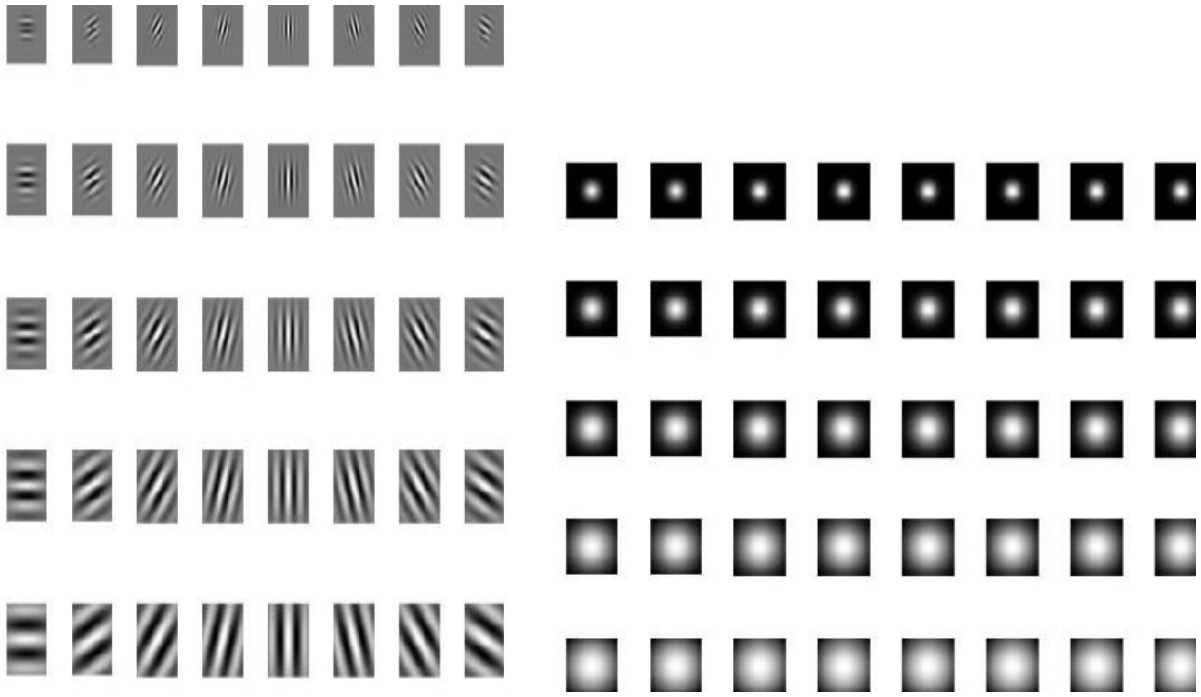


(a) (b)

Fig3.(a)(b) 2-D Gabor filters in spatial domain & frequency domain

3] By using this filter bank the texture features of a facial image are calculated, where the result is a column vector (one texture value for each filter). Fig. 2 displays the Gabor filter bank where each row represents one σ (5 in total) and each column is an orientation (8 in total).



(a) Real part of Gabor filter bank (b) Magnitude part of Gabor filter bank

4] Then we compute the mean of the vector and assigned the texture value of the facial block. After extracting the facial block texture features, *k*-NN and SVM are used to classify DM samples vs. Healthy samples.

III. ALGORITHM:

3.1. Gabor filter:

A Gabor filter, named after Dennis Gabor, Gabor filter is algorithm used for edge detection. Frequency and orientation representations of Gabor filters are similar to those of the human visual system, and they have been found to be particularly appropriate for texture representation and discrimination.

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It is straightforward to generalize the filter in to two dimensions where the time variable t is replaced by the spatial coordinates (x, y) and the frequency variable u by the frequency variable pair (u, v). If similar studies in optics are not considered, the major effort to the development and use of 2-D Gabor filters has been made in image processing and especially in feature extraction.

Facial block texture feature extraction is presented in this subsection. In order to compute the texture value of each block a 2-D Gabor filter is applied and defined as:

$$G(x,y) = \exp\frac{\left(x'^2 + y^2.y'^2\right)}{-2\sigma^2}\cos\left(2\pi\frac{x'}{y}\right) \quad \text{.....(1)}$$

where x'=x cosϴ+y sinϴ, y' = - x.sinϴ +y cosϴ

$\sigma$is the variance

λ is the wavelength

γ is the aspect ratio of the sinusoidal function

θ is the orientation.

Each filter in the bank with the same σ is convolved with a facial block to produce a response $R_x(x,y)$:

$$R_x(x,y) = G_y(x,y) * im(x,y) \quad \text{.....(2)}$$

Where,

im(x,y) =facial block, * represents 2-D convolution and k=1,2,…….40.

3.2. KNN(k-nearest neighbor)

In KNN, the training samples are stored in an n-dimensional space. When a test sample (unknown class label) is given, k-nearest neighbor classifier starts searching the 'k' training samples which are closest to the unknown sample or test sample.

Closeness is mainly defined in terms of Euclidean distance. The Euclidean distance between two points P and Q i.e. P (p1,p2, …. Pn) and Q (q1, q2,..qn) is defined by the following equation:-

$$d(P,Q) = \sum_{i}^{n}(Pi - Qi)^2 \quad \text{.....(3)}$$

If the values are same, then the patient is diabetic, otherwise not. After this, the accuracy rate and the error rate of the data set is being calculated.

3.3 Support vector machine classifier:

Support vector machine is a machine learning method that is widely used for data analyzing and pattern recognizing.A support vector machine constructs a hyperplane or set of hyperplanes in a high- or infinite-dimensional space, which can be used for classification, regression, or other tasks. Intuitively, a good separation is achieved by the hyperplane that has the largest distance to the nearest training-data point of any class (so-called functional margin), since in general the larger the margin the lower the generalization error of the classifier.

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IV. CONCLUSION

In this paper Gabor filter based DM detector is implemented which is based on facial block feature extraction and the method gives accurate results. High accuracy is obtained as compared to previous work. According to The International Diabetes Federation 5 million people worldwide died from DM(2003) ,which means 6 deaths in every second. To overcome all this limitation we are implementing the project to save patient time, to get accurate and fast result, to make patient free from pain and 12 hours of Fasting Plasma Glucose test.

V. ACKNOWLEDGMENT:

To put an effort like this requires the determination and help of many people around us and we would not be doing justice to their efforts by not mentioning each helping hand in person.We feel privileged to acknowledge with deep sense of gratitude to our guide **Prof.Urvashi Bhat,** for her valuable suggestion and guidance throughout our course of studies and help render to us for the completion of the paper.

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