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AN EMPIRICAL APPROACH ON PROGNOSIS OF DIABETES USING IRIS SCAN

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ABSTRACT:

Diabetes can be provided with the best solution when it is known earlier. It may lead to several problems like kidney damage, heart disease, nerve damage, and eye diseases. Image processing is a procedure of using a digital computer to process digital images through various algorithms. Iridology is a medical science to study the iris tissues which can help to predict various problems in the human body, long before the symptoms occur. In this paper, we are using image processing to study the iris images with the help of iridology to predict the presence of diabetes mellitus in a human for classification of images, SVM algorithm is being used because it is more appealing theoretically than KNN and Navey Bayes algorithms and in practice, its strength is its power to address non-linear classification tasks and the 2-D wavelet tree extraction technique to extract data from image datasets of 100 people having normal eye(healthy) and diabetic eye. We are providing an interface to easily upload images and obtain results. Accuracy of 89.7% is observed which persuades the effectiveness of the system.

Index Terms - Diabetes, 2-D wavelet tree, Support Vector Machine, K-Nearest Neighbor

I. INTRODUCTION

Nowadays the main keyword around the world is “Health care”. Diabetes causes a worldwide Health Care crisis. A fast and quick look on it reduces the human’s fatal rate. It is a metabolic disease in which a person contains high blood sugar because of insufficient insulin in the body or cells in the body does not respond to the insulin produced [1].

Health care management and Medical science gives top priority to diabetes. A huge amount of data and records are maintained on diabetes patients. Clinical decision support may use results [2] obtained from predictive models that combine patient data and prognostic data to improve patient care [4]. Data mining extracts knowledge from large databases. It involves different fields of computer science with the computational process, statistical techniques, machine learning, clustering and discovering patterns [8]. Data mining provides effective prediction and accurate results to save lives and reduces the cost of treatment. The management of diabetes and its complications can be done by predictive models and several models are being proposed over decades.

User authentication can be done by using the biometric system based on features of finger, face, and voice. Iris has a strong area of research on authentication. Iris recognition system is used in various systems such as ATM machines, airports, etc are applications [9]. We are using some algorithms for iris recognition and along with iridology to know the status of the diabetic person [7]. In this paper, we are using the SVM algorithm for classification and 2-D wavelet tree for extraction.

II. RELATED WORK

According to IDF (international Diabetic Federation), India is the second-largest country. That is affected by diabetes after china. India got 2nd rank. From the survey of 2018-2019 approximately 500 people will be affected by diabetes throughout the world. This mark may rise to 10% by 2050.

For finding whether a person is diabetic or not there are various methods which include measuring glucose levels through urine, eye fluids, sweat, blood, and saliva [5].Some of these methods require sample preparation in advance. This invasive procedure can be overlapped with the help of Iridology. It is a science that connects patterns, shapes, tissue damage, etc. The existing system is not helping the majority of people get diagnosed due to which, their problems come out in not so early stages [10].

Detection of diabetes using Iris scanning can be done manually by an ophthalmologist or a doctor. When with this method, the old procedure of in- person examinations are not so sustainable for the huge size of the diabetic population. Diabetes is of three types namely, type I, type II and gestational diabetes.

- When the body produces a negligible amount of insulin it is the type I diabetes. This is mostly observed in children and teenagers. It is also called as IDDM (Insulin Dependent Diabetes Mellitus).
- When the body does not produce insulin efficiently it is the type II diabetes. This kind of diabetes is mostly observed in adults of 40 and above. However, due to high obesity rates, teenagers and young adults are also diagnosed with this problem.
- The third type which is gestational diabetes is observed in pregnant women. A few women with no record of diabetes will have high glucose levels in their blood, which leads to diabetes.

Table 1.Summerised Application of IRIS Analysis and Disease Detection

Application	Author	Feature Extraction Technique	Classification Technique
Diabetes	Bansal et al. [9]	2-D Discrete Wavelet Transform (DWT)	Support Vector Machine (SVM)
Diabetes	Samant et al. [10]	First-order statistics, Gray Level Co-Occurance Matrix, Discrete Wavelet Transform	Random Forest (RF), Support Vector Machine
Kidney disease	Hussein et al. [11]	Gabor Filter	Neural Network
Liver disease	Herlambang et al. [12]	Gray Level Co-Occurrence Matrix	Back-propagation Neural Network

III. BENEFITS OF PROPOSED SYSTEM

We are going to evaluate the eye retinal images from multiethnic cohorts of diabetes patients; the machine learning had high specificity and sensitivity for detecting eye diseases and diabetic retinopathy.

- Hence we improved more accuracy with using of the iris patterns.
- The internal organ of the eye is gets highly protected.
- We can easily update the details of the patient in the database.
- Interfering: Acquiring data is relatively very easy.
- A large database with a smaller template can be easily stored and checked.
- Iris Patterns which we are using are more Persistence.

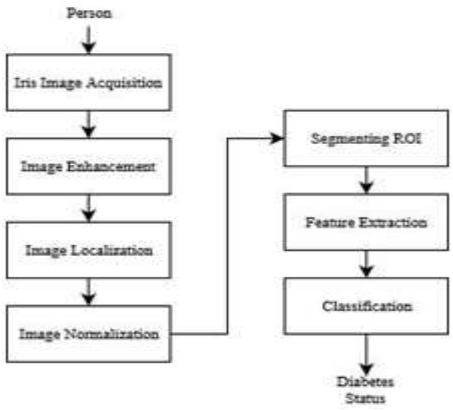

Fig. 1. Block diagram of Proposed Model of the diabetes prediction system

1. Iris Image Acquisition

Iris images are acquired from the people and from this images data blood glucose levels are measured. For measuring the blood glucose levels of the images acquired, we use Personal computer, software to acquire images, Camera Iris scope as shown in Figure 2.The value of blood sugar levels in the body based on the subjects ranged from 85 mg/dL for the lowest value and 210 mg/dL for the highest value.

Fig.2 Design of measurement system

2. Image Enhancement

This phase consist of improving the quality of images by reducing the noise. This can be achieved through gray scale and filtering. Fourier Transform algorithm is used in Filtering process. In this process, the RGB image is changed to grayscale so that the data of information on the image becomes simple to simplify the further process.

3. Localization Of image

Localization of Image is the process to determine outer and inner boundaries of the iris or boundaries of the pupil and boundaries of the sclera in the eye image [11]. The algorithm which is used in this study is the 2-D wavelet tree extraction technique and SVM classification technique.

4. Image Normalization

Image normalization is a process that changes the range of pixel intensity values in the image processing. Normalization is a process to eliminate the inconstant area which is occurs due to stretching the iris of the eye caused by pupils widening due to various distance images, tilted head positions, camera rotation, various lighting levels, and rotation of the eyes. Normalization is every often called as histogram stretching or as contrast stretching. In more regular fields of Processing data, such as digital signal processing, it is referred to as dynamic range expansion of the pixel intensity.

5. Segmenting Region of Interest

Segmentation of image main aim is to partition the sample to get the dimension that is more related knows. The segmentation process is to determine the accurate value for the desired significant area because this process will affect the data for further process. Rubber Sheet is used in the normalized iris image to cut into areas based on the boundaries values.

6. Feature Extraction

Extraction of Feature in the image processing goals to get the features of data. Iris of an eye has a single texture, and the uniqueness of the feature characterizes for every individual. The texture of the features commonly used to detects the objects in the image [11]. Gray Level Co-occurrence Matrix (GLCM) is to check the texture of the eye and considering spatial relations between pixels by using statistical methods.

7. Classification

In this stage, Classification is to group the data based on the datasets and based on the features of the image that have obtained. The processed Iris images will be classified into testing data and training data. Training data is used to make predictive models for predicting diseases in the form of non-diabetes and diabetes classes, and while testing data is used to know the performance or accuracy of the model. In this study, we are using the Support Vector Machine (SVM) for classification and 2-D Wavelet tree technique for feature extraction. SVM works more effectively than KNN (K Nearest Neighbor), It is going to works by looking for the typical hyperplane, and it is useful to divide the data into their respective classes [12].

IV. RESULTS AND DISCUSSION

The results are to use to sharpen the process by using Fast Fourier Transform are to turn off the original image of the iris and image of the kernel for sharpening process Figure.3 shows the difference between the original image of the iris and image after the sharpening process. It can be known that the sharpening image has more similarity lucid information and the texture of the iris look more clearly or pattern with more similarities.The results get from this research show that the textural feature of the iris image by using Gray Level Co-Occurrence Matrix has an effective ability to classify non-diabetic and diabetic classes based on iridology.

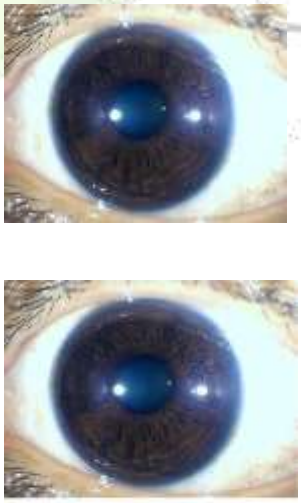

Fig 3. Image before sharpening and after sharpening

FPR esteem got from these two characterization techniques shows 23.95% as the most critical mistake got when the pixel separation is 3 with kNN strategy and 10.05% as the littlest blunder got when the pixel separation 20 with kNN strategy. For FNR esteem, it is 39.56% for the most unmistakable mistake got when the pixel separation is 3 with kNN strategy and 20.40% as the littlest blunder acquired when the pixel separations are 20 with kNN technique.

Table 2.Comparison of Accuracy with variations in pixel distance with SVM and KNN

Pixel Distance (Pixel)	Support Vector Machine (%)	k Nearest Neighbor (%)
3	73.33	71.45
5	74.80	71.88
7	73.15	75.18
10	76.03	79.37
15	80.62	83.15
20	79.35	85.6

Table 3. Comparison of FPR with variations in Pixel Distance for SVM and KNN

Pixel Distance (Pixel)	Support Vector Machine (%)	k Nearest Neighbor (%)
3	20.96	23.95
5	17.46	20.04
7	19.49	16.9
10	16.56	15.66
15	14.36	14.33
20	17.66	10.05

Table 4. Comparison of FNR with variations in pixel distance for SVM and KNN

Pixel Distance (Pixel)	Support Vector Machine (%)	k Nearest Neighbor (%)
3	36.23	39.56
5	38.32	41.79
7	39.56	38.30
10	30.95	29.44
15	28.31	21.52
20	26.1	20.40

Table 5. Comparison between Proposed Model and Existing Model

Authors	Disease	Classification accuracy(%)
Purnama et al. [18]	Pancreas disorder	85
Sivasankar et al. [19]	Pulmonary disease	84.38
Bansal et al. [9]	Diabetes	87.5
Proposed model	Diabetes	85.6

At last, in light of three parameters, specifically accuracy, FPR, and FNR, the best variety is when pixel separation is 20 with kNN strategy with precision is 85.6%, FPR is 10.05%, and FNR is 20.40%. Execution of the framework has been estimated as far as particularity (1 – bogus positive rate) and affectability (1–bogus negative rate) with the greatest explicitness is 0.889, and most extreme affectability is 0.796. Table 7 shows the correlation between the proposed model with existing iris conclusion models for recognizing sickness.

V. CONCLUSION

In this paper, we are using the Support Vector Machine (SVM) for the classification of iris images and 2-D wavelet tree extraction techniques are feature extraction. Iridology is the alternative approach used in this present study to determine the status of non-diabetes and diabetes using machine learning. Machine Learning goal to classify the identification process. This 2-D wavelet tree extraction technique is used to find iris of eye and pupil circle in an image and we are using the Rubber sheet model to normalized iris image [14]. The proposed model uses the Gray Level Co-Occurrence Matrix based on the feature extraction with Support Vector Machine (SVM) and K Nearest Neighbour (KNN) based classifiers. The maximum accuracy is 89.5% with FPR and FNR is 10.09% and 19.20%, respectively.

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