Diabetic Retinopathy Recognition Using NN and SVM Approach

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ABSTRACT:

The diabetes retinopathy is the application of medical image processing. The retinal images are evaluated to diagnose the DR. It is however, time consuming and resource demanding to manually grade the images such that the severity of DR can be defined. When the tiny blood vessels present within the retina are damaged, only then can one notice this problem. Blood will flow from this tiny blood vessel and features are formed from the fluid that exists on retina. The kinds of features involved here due to the leakage of fluid and blood from the blood vessels are considered to be the most important factors to study this problem. The diabetes retinopathy detection techniques has the three phase which pre-processing, segmentation and classification. In this work, NN approach is used for the classification of diabetes portion from the image. The proposed model is implemented in MATLAB and results are analyzed in terms of certain parameters.

Keywords: Diabetes retinopathy, NN, Optical Disk Segmentation

I. INTRODUCTION

World Health Organization (WHO) has assessed that during 2000 there had been 171 million human beings international with DM (DM), and consequently the range can increment to 366 million through 2030 growing the disappointed most of the maximum reassets of death, inabilities, and monetary complication at the earth. To precept sorts of DM exist, type one DM and sort a couple of DM. human beings with type one DM forget about to supply inner secretion, and all through this technique want infusions of it. kind a couple of DM is that the maximum famous kind and is probably ordered through inner secretion resistance. [1] As of now, is there`s no therapy for type one DM or type a couple of DM. In any case, type a couple of DM can be overseen through intake nice, understanding, and retaining a legitimate technique of life. A rapid plasma aldohexose (FPG) test is that the normal method rehearsed through numerous wholesome specialists to research DM. FPG test is carried out whilst the affected person has long gone no however twelve hours at the same time as now no longer nourishment, related desires taking an instance of the affected person's blood (through penetrating their finger) retaining in thoughts the end purpose to investigate its blood sugar levels. Despite the real reality that this machine is particular, it could be regarded as evident, and fairly agonising [2]. Diabetic Retinopathy (DR) can be a smaller scale tube exceptional of DM it really is answerable of four.8% of the thirty seven million times of incapacity at the earth, evaluated through UN agency [1]. In its maximum on time degree known as Non-proliferative Diabetic Retinopathy (NPDR), the fitness hassle if diagnosed can be dealt with to keep away from extra motion and sight misfortune.

 Totally unique imaging modalities, for instance, at the same time as now no longer red, X-ray images and shading reserve United States imaging rectangular degree utilised to research the human tissue layer retaining in thoughts the end purpose to distinguish DR and thence NPDR. [3] These methods depend on the recognition of relevant additives recognised with DR, in addition to however now no longer confined to hemorrhages, miniaturized scale aneurysms, completely unique exudates, and retinal veins. These imaging modalities themselves can be regarded as intrusive, imparting the eye to terrific flashes or having glow in infused right into a vein resulting from X-ray images. [4]Thusly, there is a demand to function to a non-evident however particular DM and NPDR identity method. Thus, this manages the stated issues and proposes a non-evident mechanized machine to renowned DM and NPDR through spotting Healthy/DM and NPDR/DM-sans NPDR (DM at the same time as now no longer NPDR) assessments utilising a range of tongue additives comprising of shading, composition, and natural arithmetic. [5]

The human tongue consists of severa components so one can wont to research fitness hassle, with shading, composition, natural arithmetic additives being the most clear. usually, wholesome specialists could examine those additives taking into account years of expertise. Be that as it might, unclearness and sound judgment rectangular degree invariably related with their symptomatic results. To uproot those subjective views, quantitative element extraction and exam from tongue pix can be engineered up. To the best of our insight, there is no opportunity dispensed paintings to identify DM or NPDR utilising tongue shading, composition, and natural arithmetic highlights. Tongue pix have been stuck utilising partner uncommonly deliberate as a locality of residence equipment attempting into shading redress. every picture became divided with a selected end purpose to hunt down its frontal cortex pixels. With the relevant pixels found, three gatherings of additives specially shading, composition, and natural arithmetic have been separated from the tongue closer read.[6]

II. DIABETIC RETINOPATHY

A Typical Retinal Image from the Left Eye Showing Retinal Vasculature, Optic Disk, Macula and Fovea Diabetic retinopathy is the prime reason for vision misfortune amongst the working age populace of the creating and the created nations. Diabetic patients are 25 times more plausible to wind up visually impaired than non-diabetic patients [1]. Diabetic retinopathy is a complexity of diabetes to the retina. Both the types of diabetes i.e. diabetes mellitus and diabetes insepidous, prompts diabetic retinopathy inevitably after some time.[22] It is an exceptionally asymptomatic malady in the early stages and it could prompt lasting vision misfortune if untreated for long time. The issue here is the patients may not think about it until it achieves propelled stages. When it achieves propelled stages vision misfortune gets to be inescapable. As diabetic retinopathy is the third significant reason for visual impairment especially in India, there is a quick necessity to create productive determination strategies for this issue. The time of onset and the length of time of the diabetes are the two most critical issues that decide the occurrence of diabetic retinopathy. Among the patients beneath the age of 30 years, when initially determined to have diabetes, the pervasiveness is 17% amid the initial 5 years. These expansions to 97% following 15 years of diabetes [2]. Amongst the patients over the age of 30 years at the onset of diabetes, 20% have hinted at retinopathy promptly after presentation and this expanded to 78% following 15 years of diabetes [3]. Diabetic retinopathy happens due to microangiopathy which thusly influences the retinal precapillary arterioles, vessels and venules.

It is created by micro vascular spillages from the breakdown of the inside blood-retinal boundary and micro vascular impediment. Because of the dynamic harm of the micro vascular framework, loss of vision and visual deficiency can happen as appeared in Fig. 1.3. Micro aneurysms are the primary clinically perceptible indications of diabetic retinopathy. They show up as little red spots of 10 to 100 microns distance across. As the illness advances, micro aneurysms will be burst. This outcome in retinal hemorrhages either externally or in more profound layers of the retina. Retinal hemorrhages look either as little red specks or smudges indistinguishable to micro aneurysms or as bigger fire molded hemorrhages. [11]

III. METHODOLOGY

Detecting Diabetes Mellitus and Non-Proliferative Diabetic Retinopathy with SVM and NN. This research work is based on the diabetes retinopathy detection. The diabetes retinopathy detection has the various phases which are the image pre-processing, segmentation, feature extraction and classification. It is based upon GUI (graphical user interface) in MATLAB. It is an effort to further grasp the fundamentals of MATLAB and validate it as a powerful application tool. There are basically different files. Each of them consists of m-file and figure file. The phase of the proposed work is described below:-

1. **Data Pre-Processing:-** In this phase, the diabetes retinopathy image is taken for the detection. The input image in the RGB format which need to convert into the gray scale format. The gray scale image is further processed for the detection Gray scale Image .

2. **Optical Disk Segmentation: -** The OD is seen as a bright yellowish or white area within the colored fundus images. For the optic disc, high and similar intensity values are available for exudates. Thus, the removal of optic disc from the retinal image is very important. The region properties and area identification are used for masking and removing this brighter optic disc. The optic disc and blood vessels are detected by applying edge detection algorithm after preprocessing. The counter detection is performed using canny edge detection algorithm. All the local maxima known as the gradient is preserved for improving the blurred edges by the canny edge detection algorithm.

3. **Blood Vassal Extraction:-** This is due to the fact that their concentration levels are similar. The high levels of contrasts vessels present in the blood are removed by applying dilation on the intensity image. Further, the dilation operation is used to fill the small holes present within the images along with the help of structuring element. There are different shapes in which structure elements (SE) exist. The optical disc and blood vessels are removed here using the flat disc shaped structure.

4. **Classification:-** The last phase is of classification which is applied with the NN (Neural networks). The NN approach is the unsupervised approach for the diabetes retinopathy detection. The training set is prepared based on the color features of the input image. The system can train itself until error gets minimized in the network. The stage at which error gets minimized at that stage system is considered as maximum trained. The test image is taken as input for the diabetes retinopathy detection.

ALGORITHM

In this proposed method, the following steps are studied below:

Step 1: To read the input image from dataset.

Step 2: To apply preprocessing step on input image.

Step 3: Apply the image localization and color model on the dataset images.

Step 4: Apply the feature extraction nearest neighbor technique to extract the features of the dataset images.

Step 5: Classify the extracted features with the help of Probabilistic NN and SVM classification technique to classify the trained and tested images.

Step 6: Calculate the results and diagnosis the results being obtained.

Step 7: Calculate the percentage of diabetes based on retina images.

Dataset Used

The diabetic retinopathy dataset is downloaded from the Kaggle website with different images. The link for data set is given below:

https://www.kaggle.com/c/diabetic-retinopathy-detection/data.

4.1 PICTURE ANALYSIS

The pictures that are caught are taken in a database and afterward broke down. The patients concerns are taken even before taking the pictures of the tongue in the database, for the investigation I have taken the pictures from a medicinal database. The pictures that are taken are broke down by division process where the forefront pixels of the tongue are isolated from the foundation pixels. The division is finished with the assistance of BEDT (bielliptical twisting layout) in mix with the BEDC (bielliptical distortion form).
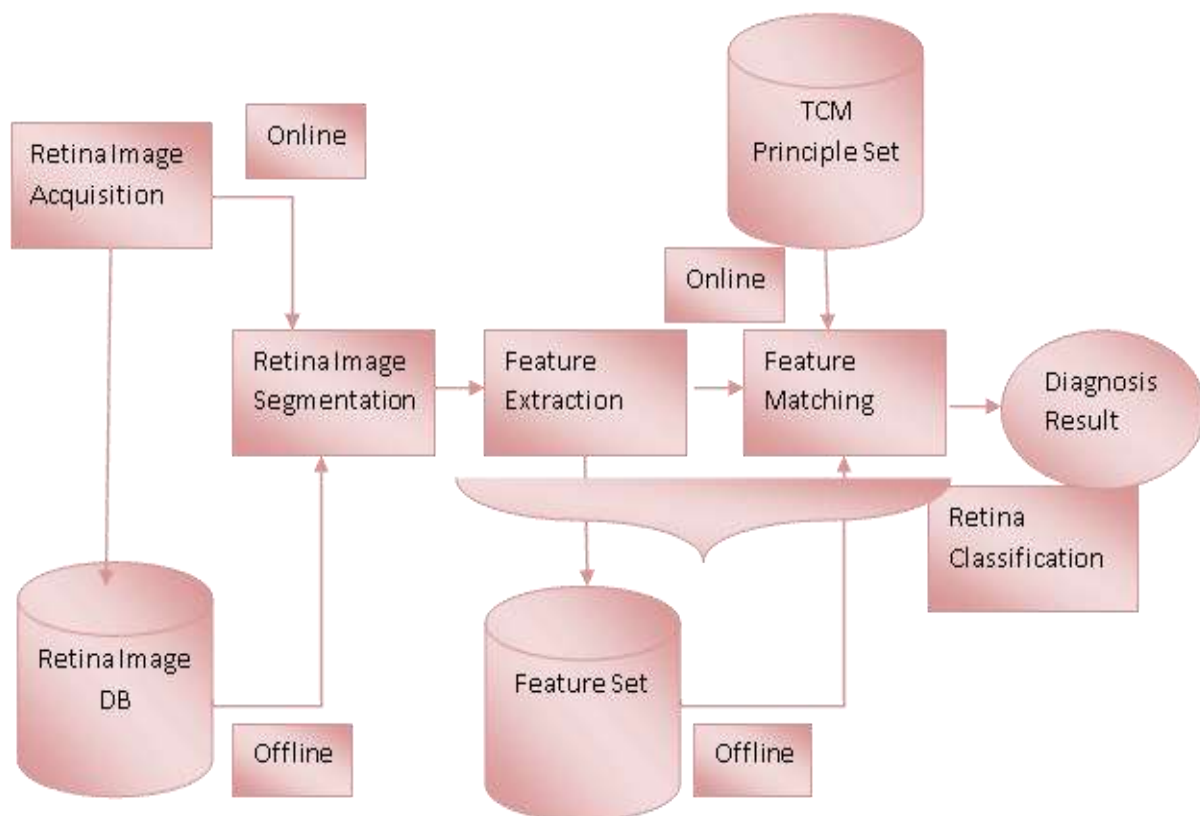
RETINA IMAGE DIAGNOSIS

Figure 1. Flowchart of Biometric based Automatic Retina Diagnosis System.

IV. RESULT AND DISCUSSION

The evaluation of work with different snap shorts and some parameters tables that are calculated with the help of MATLAB Tool. All these snap shorts are given with normal and abnormal persons. All these snap shorts are according to the age 40-50 and 50-60, because in these two ages range diabetes infection is more rather then other ages. These are given below:
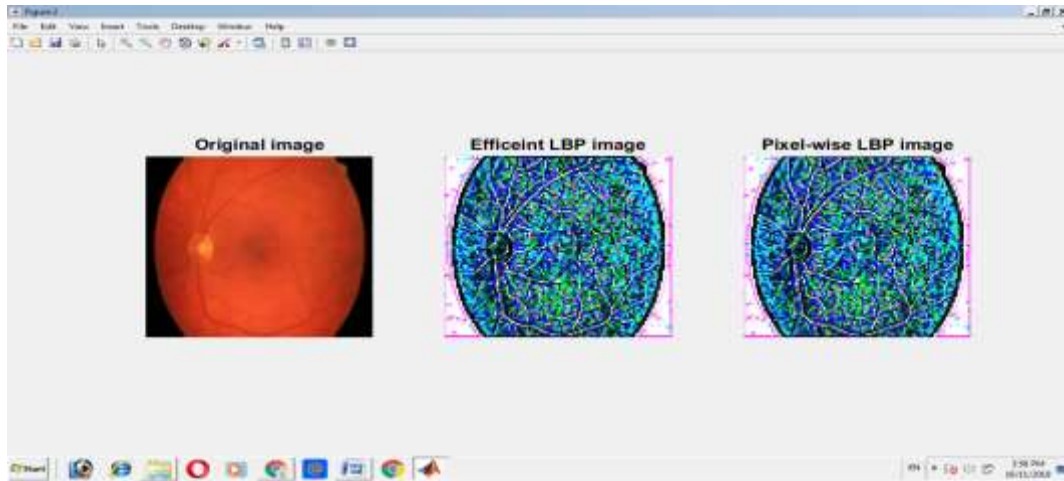
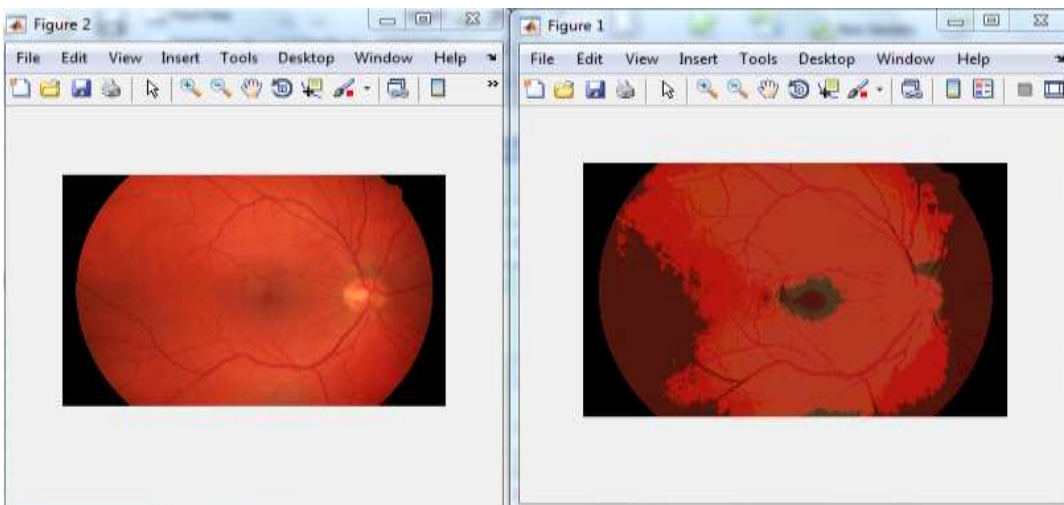Figure 1: Original image and LBP images

Figure 2: Input image and Output image processing with KNN

The figure 2 is the input and output image processing with KNN. In this figure output image is different form input image, because output displays some spots that is the diabetes symptoms.
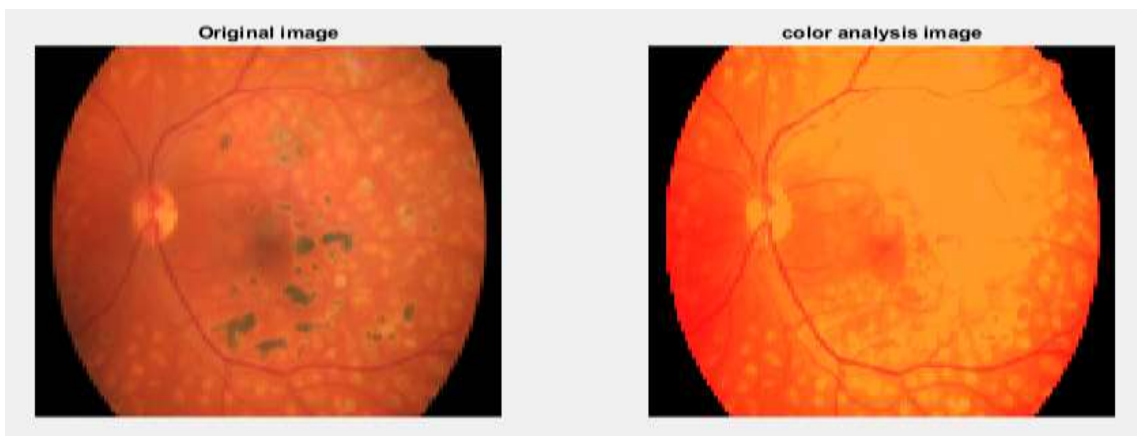

Figure 3: Color Analysis of diabetes image

The figure 3is the color analysis of diabetes images. The output diabetes image have color change due to color.
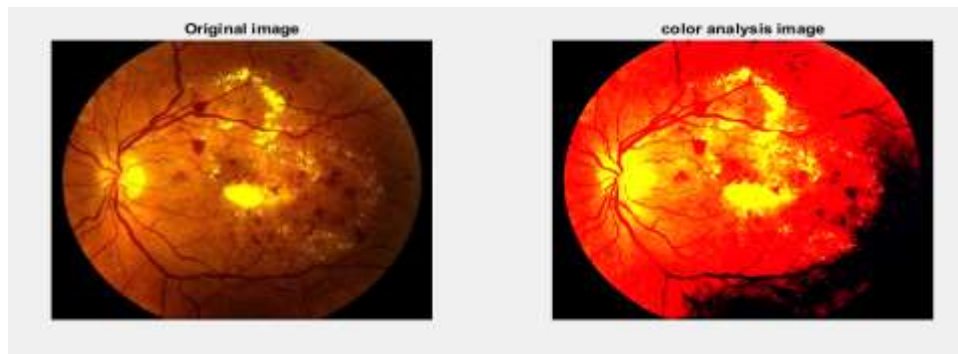
Figure 4 (a) Normal Person Diabetic image and (b) Abnormal Person Color Image

Table 1. 40-50 Age Normal and Abnormal diabetes effected Person retina processing parameters

Parameters/ age (40-50)	Retina (normal)	Retina (abnormal)
SSIM LSS(*Luminance Similarity Score*)	0.0083	0.0069
SSIM ESS (*Edge Similarity Score*)	-0.353×10^4	-0.3935×10^4
Mean	0.6027	0.4286
Standard Deviation	0.1063	0.1598
Entropy	6.7805	7.2787

Table 2. 40-50 Age Normal and Abnormal diabetes effected Person PSNR, MSE and etc. Parameters

Parameter / age (40-50)	Retina
Patch based contrast QI	0.2253
MSE (R)	231.99
MSE (G)	176.05
MSE (B)	97.87
PSNR (R) dB	24.5100
PSNR (G) dB	25.7083
PSNR (B) dB	28.2582

Table 3. Normal and Abnormal diabetes effected Person PSNR, MSE and etc. Parameters

Name of Images	PSNR	MSE	Entropy
567.jpg	6.7	1.38	62
1.jpg	12	3.7	70
2.jpg	12.1	3.9	64
3.jpg	9.7	6.8	59
4.jpg	12.5	3.6	51
6.jpg	9.7	6.8	67
7.jpg	13.3	2.9	65

V. CONCLUSION & FUTURE WORK

In this paper diverse analyst's examination work is assessed, it is presumed that the retinal pictures are assessed to analyze the DR. Diabetes is an illness which because of the blood glucose level is too high in the body. As we probably am aware, typical body acquired blood glucose level from the feast that human take day by day and the insulin hormone is vital in giving vitality to body. In any case, over the top or high glucose level in body can bring about numerous significant issues, for example, it can harm eyes, kidney, and nerves. The principle objective of this work is to detect the diabetes and their retinopathy to detect Diabetes Mellitus and Non-Proliferative Diabetic Retinopathy with Neighborhood based Modified Back propagation using Adaptive Learning Parameters (SVM) method on different Human Body Part Features and to detect diabetes based on tongue, foot and Palm images with SVM

and NN classification. Another is to detect the Contour of the Optic Disk - To evaluate the advancement of eye sickness and treatment results. To design a new algorithm with SVM and NN for tongue and foot and palm images to detect diabetes. The SVM and NN are implemented in this research work and maximum results are obtained based on the diabetes percentage that is detected and some other parameters are also analyzed in this research work. In this research study firstly existing work is implemented and after that new results are obtained that is 70%-80% improved. Although the results presented in this study have demonstrated the effectiveness of the proposed method, there are still rooms for improvement for the scheme to be used in automatic retinal image analysis systems. Segmentation of retinal vessels can further be used for a number of purposes. The retinal vascular toruosity is shown to become a predictive factor for cardiovascular diseases and diabetes.

References

[1]. Paudyal G, Shrestha MK, Meyer JJ, Thapa R, Gurung R and Ruit S (2008)studied on Prevalence of diabetic retinopathy following a community screening for diabetes in Nepal Med Coll J:pp.-160163.

[2]. Zhang B., Wu X., You J., Li Q., and Karray F. (2010) studied on Detect ion of microaneurysms using multi-scale correlation coefficient s in Pattern Recognition, vol. 43, pp. 2237-2248.

[3]. Zhang B., Wu X., You J., Li Q., and Karray F. (2010) studied on Retinal vessel extract ion by matched filter with first-order derivative of Gaussian in Comp. in Bio. and Med., vol. 40, pp. 438-445.

[4]. Lesmana Putu Dody I, Ketut Eddy Purnama , Mauridhi Hery Purnomo I (2011) studied on Abnormal Condition Detection of Pancreatic Beta-Cells as the Cause of Diabetes Mellitus Based on Iris Image in International Conference on Instrumentation, Communication, Information Technology and Biomedical Engineering:pp.1-6.

[5]. Wiley Matthew, Bunescu Razvan and Marling Cindy (2011) studied on Automatic Detection of Excessive Glycemic Variability for Diabetes Management in 10th International Conference on Machine Learning and Applications , IEEE pp.148-154

[6]. Wiley Matthew T. (2011) studied on Machine Learning for Diabetes Decision Support in Russ College of Engineering and Technology of Ohio University,:pp.1-159

[7]. Ramadhansyah, Ridha. (2011) studied on Analysis and Implementation of Random Forest Ensemble Method and C4.5 Algorithm for Spam Email Classification Data. inIT Telkom,pp-1-16.

[8]. Tama, Adhi, Rodiyatul Bayu, Hermansyah. (2011) studied on An Early Detection Method of Type-2 Diabetes Mellitus in Public Hospital in Telkomnika, Vol.9, No.2, pp. 287-284.

[9]. Sushruta, Sushruta Samhita – by Acharya Kaviraja Ambikadutta Shastri, Chaukamba Sanskrit Sansthan Varanasi, edition(2011) in Uttara tantra, 17th chapter, Verse-26-27, Pp-702,

[10]. Rasaratna Samuchchayah, by Prof. Siddhi Nandana Mishra, Chaukhambha Orientalia Varanasi, edition-2011, Pp-697

[11]. Ngugi M P, Njagi J M, Kibiti C M, Ngeranwa J J N, Njagi E N M (2012) studied on Diagnosis of Diabetes Mellitus in International Journal of Diabetes Research, 1(2): pp.24-27

[12]. Phyo San Phyo, Ho Ling Sai (2012) studied on Intelligent Detection of Hypoglycemic Episodes in Children with Type 1 Diabetes using Adaptive Neural-Fuzzy Inference System in 34th Annual International Conference of the IEEE EMBS San Diego, California USA,IEEE-pp.6325- 6328

[13]. Raja Mohammad Nagor Nisah Bt (2012) studied on Diabetes Detection System in faculty of computer system and software engineering: pp.-1-24

[14]. Zhang B., Karray F., Li Q., and Zhang L. (2012) studied on Sparse Representat ion Classifier for microaneurysm detect ion and retinal blood vessel extract ion in Inf. Sci., vol. 200, pp. 78-90.

[15]. Puteri, Nita A. (2013) studied on Heart Disease Prediction Algorithm Classification and Regression Tree (CART) in IT Telkom.pp-1-6

[16]. Zhu Zhechen, Nandiy Asoke K. and Waqar Aslam Muhammad (2013) studied on adapted geometric semantic genetic programming for diabetes and breast cancer classification in SOUTHAMPTON, UK IEEE.pp. 22-25

[17]. Zhang Bob and Kumar Vijaya B.V.K.(2013) studied on Detecting Diabetes Mellitus and Non-Proliferative Diabetic Retinopathy using Tongue Color, Texture, and Geometry Features in IEEE,pp.-1-16

[18]. Kirsali Priyanka, Sambasivarao K. and Badoni Pankaj (2014) studied on An Automatic System for the Detection of Optic Disc and Pathologies in Retinal Images in IEEE ,pp. 000228-00234

[19]. Kania Sabariah Mira and Hanifa Aini (2014) studied on Early Detection of Type II Diabetes Mellitus with Random Forest and Classification and Regression Tree (CART) in International Conference of Advanced Informatics: Concept, Theory and Application (ICAICTA) ,IEEE-pp.238-242

[20]. Zhao Chunhui (2014) studied on Sensor Abnormality Detection based on Global Prediction Model for Type I Diabetes in Proceeding of the 11th World Congress on Intelligent Control and Automation Shenyang, China, IEEE-pp.335-340.

[21]. Lekha .S and Suchetha .M (2015) studied on Non- Invasive Diabetes Detection and Classification Using Breath Analysis in ICCSP IEEE conference: pp.0955-0958

[22]. Nadimi-Shaharaki Mohammad H. and Ghahramani Mahnaz (2015) studied on Efficient Data Preparation Techniques for Diabetes Detection in IEEE:pp.1-6

[23]. Dastapure Mamata , Shekar Veena , KV Mamatha and K Sujathamma (2015) studied on diabetic retinopathy and its management in ayurveda-a Special case report in IAMJ: Volume 3; Issue 8; pp.1-6

[24]. J lidia tina and prof. Ahmed hussain (2015) studied on Tongue Image Analysis for Medical Diagnosis in ijsetr , Vol.04,Issue.12, pp:2263-2268

[25]. Shu Ting, Zhang Bob and Yan Tang Yuan (2015) studied on Simplified and Improved Patch Ordering for Diabetes Mellitus Detection in IEEE,pp.-1-6

[26]. Yuchen Wu , Ze Hu (2019) studied on Recognition of Diabetic Retinopathy Basedon Transfer Learning , 2019 4th International Conference on Cloud Computing and Big Data Analytics,IEEE-2019.

[27]. Prabhjot Kaur, Somsirsa Chatterjee, Dilbag Singh (2019), studied on "Neural Network Technique for Diabetic Retinopathy Detection" International Journal of Engineering and Advanced Technology (IJEAT), ISSN: 2249-8958, Volume-08 Issue-06, August 2019.