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5G SMART DIABETES TOWARDS PERSONALISED DIABETES

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ABSTRACT:

A Convolutional Neural Networks (CNNs) approach is proposed to automate the method of Diabetic Retinopathy(DR) screening using color fundus retinal photography as input. Our network uses CNN along with denoising to identify features like micro-aneurysms and haemorrhages on the retina. Our models were developed leveraging Theano, an open source numerical computation library for Python. We trained this network using a high-end GPU on the publicly available Kaggle dataset. On the data set of over 30,000 images our proposed model achieves around 95% accuracy for the two class classification and around 85% accuracy for the five class classification on around 3,000 validation images

Keywords: CNN, Haemorrhages, kaggle dataset, python.

1. INTRODUCTION:

Diabetic Retinopathy (DR) is an eye disease that damages the retina of patients with long-standing diabetes. This is an ocular complication of the eye that affects 75% of diabetic patients leading to blindness in the age group of 20-64 [1]. There are different ways to diagnose DR. The World Health Organization reports that about 347 million people in the world are affected by DR. About 366 million adults with diabetes is estimated by International Diabetes Federation. This figure is expected to rise to 552 million by 2030. Estimated occurrence of type 2 diabetes mellitus and diabetic retinopathy is quite high in India, according to the studies that have been conducted so far. Based on a survey in 2000, the top three countries with highest number of diabetes mellitus are India (31.7 million), China (20.8 million) and USA (17.7 million) [2]. Trained clinicians are required to examine the color fundus photographs of retina and detect DR. The process of identifying DR involves detection of lesions with vascular abnormalities. This is an effective way of detection but requires the service of experienced clinicians for analysis of the photographs manually, which is time-consuming. Rural areas, where the rate of diabetes is usually high, lack the expertise of well-trained clinicians and sophisticated equipment that are necessary for detection of DR. Better infrastructure with automated detection techniques are now required to tackle the growing number of individuals with diabetes. An early detection can help to avert or decrease the spread of DR which otherwise might cause blindness [3]. Previous research work for identification of the stages of DR using automated techniques includes support vector machines [4] and k-NN classifiers [5]. Most of the methods treat this as a two-class classification problem for detection of DR.

2. EXISTING SYSTEM:

Numerous techniques are tested by researchers in the area for DR classification with encouraging results. Recent work for addressing blood vessel segmentation includes the application of CNN (LeNet-5 architecture) as feature extractor .Three heads are used in this model at different layers of the convnent which are then fed into three random forests. The final classifier achieved an accuracy of 0.97 and 0.98 on the DRIVE and STARE dataset. An automatic segmentation of blood vessels in color fundus images is implemented by M.Melinscak et al using deep max-pooling convnet to separate the blood vessels. The model contains a deep max-pooling convolutional neural networks to segment blood vessels. It deployed 10-layer architecture for achieving a maximum accuracy of around 0.94. It was carried around 4-convolutional and 4-max pooling layer with 2 additional fully connected layers for vessel segmentation. Automated analysis of DR using images processing techniques are introduced by Adarsh et al. In this approach, extraction of retinal blood vessels, exudate, micro-aneurysms, haemorrhages and texture features takes place, followed by construction of Multiclass SVM using area of lesions and texture features. Impressive results are reported using the publicly available datasets DIARETDB0 and DIARETDB1 with accuracy of 0.96 and 0.946 respectively.

PROPOSED SYSTEM:

A. Overview

Data is collected from the dataset provide by the Kaggle coding website and maintained by

EyePacs. The dataset consists of colour fundus photographs collected from various sources. The images are classified based on the severity of DR, where each image was assigned to a class by a trained clinician1. The figure below shows the various stages of diabetic retinopathy(DR)

B. Class Imbalance:

The class labels of the dataset are highly imbalanced i.e more than 73% of the class are negative, which makes our model difficult to train. Table I below shows the class proportion statistics, where PDR and NPDR refers to proliferative and Non-proliferative DR respectively.

Class	Number	Percentage
Negative	25810	73.5%
Mild NPDR	2443	6.90%
Moderate NPDR	5292	15.10%
Severe NPDR	873	2.50%
PDR	708	2.00%

TABLE I. CLASS IMBALANCE.

FEATURES SELECTION:

A. Pre-processing:

The dimension of images in the dataset is 3000x2000 pixels. For convenient use of the CNN using the resources at our disposal, the images are cropped and resized to squares of 512 pixels.

B. Data Augmentation:

Augmented images were created to increase the class size as there was limited number of training samples for some of the classes. Brightness of each of the images created after pre-processing were adjusted by converting the RGB image to float representation followed by converting into the original data type. This is done by adding a delta value to all the components of the image. The images are scaled appropriately and both the image and delta are converted to float prior to addition. As the addition to the image is performed in floating point representation, the delta must be in the range [0,1) whereas the pixel values are in [0,1). The original and the brightness adjusted images are then rotated by 90 and 180 degree which inherently increase the class size 6 times. This makes our mod del immune to different orientations and lighting conditions.

5G-Smart Diabetes: Toward Personalized Diabetes Diagnosis with Healthcare Big Data Clouds

In this paper author is using today's 5G technology to monitor condition of diabetic patients with low cost. Now-a-days many people's are suffering with diabetic disease due to work stress or unhealthy life styles and peoples will not know about the current health condition till symptoms appear or diagnosis through medical check-up and the condition of disease will be severe by that time and there is no possible way to get that intimation prior.

Diabetes will be of two type's diabetes 1 and diabetes 2. Diabetes 2 require hospitalization and in diabetes 1 condition we can monitor patient and alert him or doctors about his current condition using below techniques

1) cost: this technique requires no cost compare to hospitalization as users will be having wearable device which will read his condition and inform to patients and hospitals using his smart phone
2) Comfortable: as these wearable devices are small and patients can wear it and keep working on his daily activities.
3) Sustainability: Devices can be in contact with hospital servers which will have complex data mining algorithms running on it. After receiving patient data server will run those algorithms to predict patient condition and send report back to devices.
   In propose paper we are using Decision Tree, SVM, Artificial Neural Network algorithms from python to predict patient condition from his data. To train these algorithms we are using diabetes dataset. To predict data efficiently author is using Ensemble Algorithm which is combination of Decision Tree, SVM and ANN algorithm. Training model of all this three algorithms will be merging inside Ensemble Algorithm to get better accuracy and prediction.
4) Personalization: In this technique one patient can share his data with other patient based on distance between cloud servers they are using to store data. Here we are using dataset so sharing is not possible but i am making all predicted test data values to be open so all users can see or share it.
5) Smartness: this technique will be consider as smart as its require no human effort to inform patient about current condition.

Here i design two applications to implement above technique

1) Cloud Application: This application act like a cloud server and storage and train dataset model with various algorithms such as decision tree, SVM and ANN and Ensemble algorithms.
2) User Application: In this application we will upload some test data and

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will be consider as user sense data and this data will be send to cloud server and cloud server will apply decision and SVM and ANN model on test data to predict patient condition and send resultant data to this application. As we don't have sensors to sense data so we consider uploaded test data as sense data. Here we don't have user details to share data so i am keeping all predicted data to be open so all users can see and share.

Using diabetes data as dataset and below is dataset details

Pregnancies,Glucose,BloodPressure,SkinThickness,Insulin,BMI,DiabetesPedigreeFunction,Age,Outcome
6,148,72,35,0,33.6,0.627,50,1
1,85,66,29,0,26.6,0.351,31,0
8,183,64,0,0,23.3,0.672,32,1
1,89,66,23,94,28.1,0.167,21,0

In above dataset values first record contains dataset column names and other records are the dataset values. All dataset records in last column contains class values as 0 and 1. 1 values indicates patient values show diabetes 1 symptoms and 0 value indicates patient has normal values but indicates diabetes 1 symptoms. Above dataset is used for training and test data will have only patient data but no result values such as 0 or 1. This test data will be applied on train model to predict as 0 or 1.

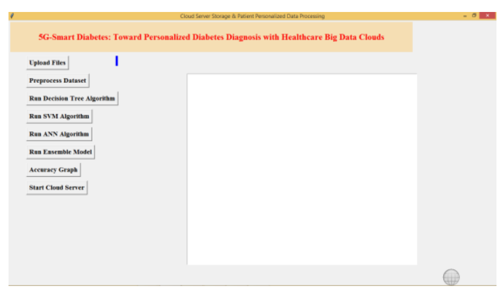
Below are test values and this values are inside 'users.txt' file inside User/data folder

6,148,72,35,0,33.6,0.627,50
1,85,66,29,0,26.6,0.351,31
8,183,64,0,0,23.3,0.672,32
1,89,66,23,94,28.1,0.167,21

In above test records we can see there is no 0 and 1 values and cloud server will receive and predict values for above test records

Screen shots

Double click on 'run.bat' file from 'Cloud' folder to start cloud server and to get below screen



In above screen click on 'Upload Files' button to upload diabetes dataset

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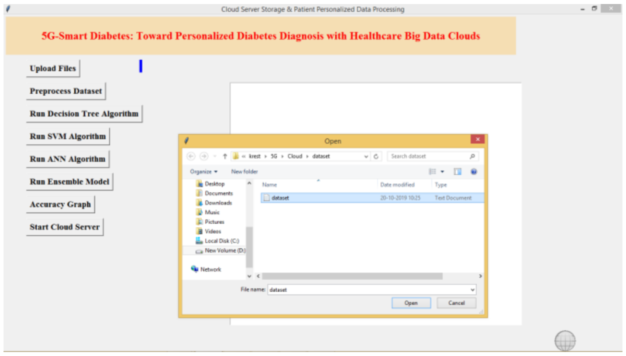
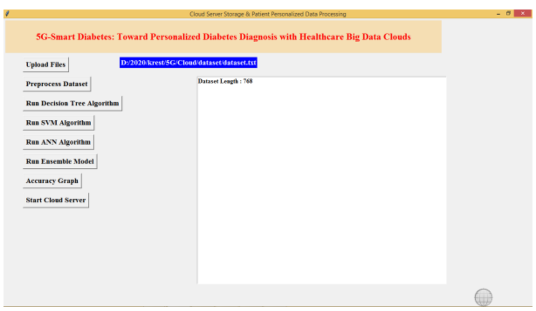
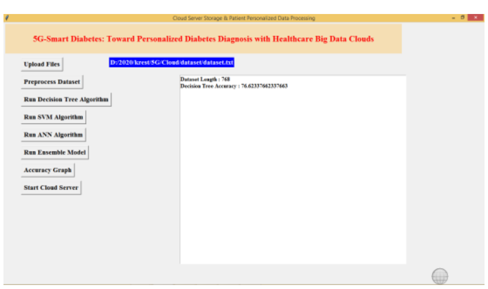


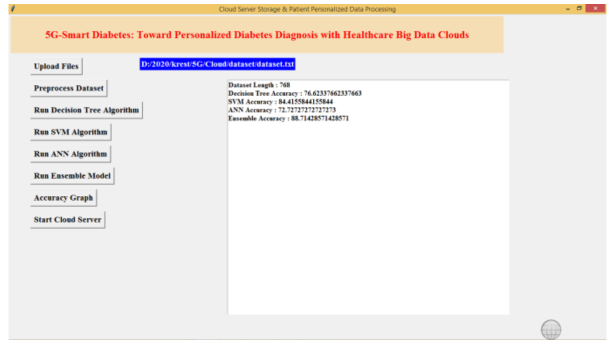
After uploading dataset click on 'Pre-process Dataset' button to clean dataset



In above screen after pre-process total dataset records are 768. Now click on 'Run Decision Tree Algorithm' to build decision tree model and below is its accuracy



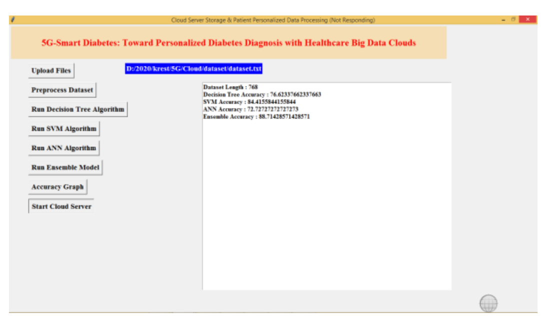
Similarly run other buttons to build models with algorithms



In above screen we got accuracy for all algorithms, now click on 'Accuracy Graph' button to get accuracy of all algorithms

In above screen graph x-axis represents algorithm name and y-axis represents accuracy values.

Now click on 'Start Cloud Server' button to start server and this server will receive data from user and predict disease details.



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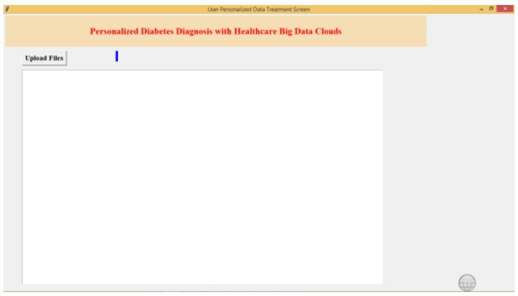
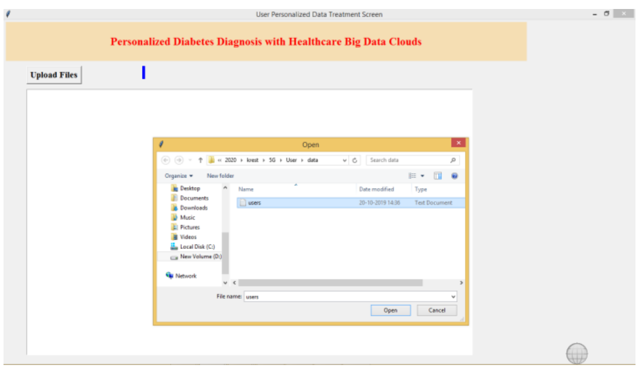
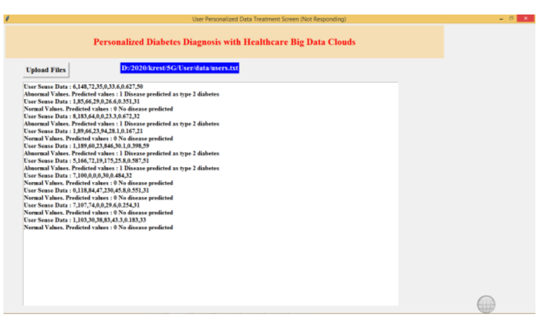
In above screen cloud server started and now double clicks on 'run.bat' file from User folder to start User sensing application and to get below screen



In above screen click on 'Upload Files' button to upload test file and to predict patient condition

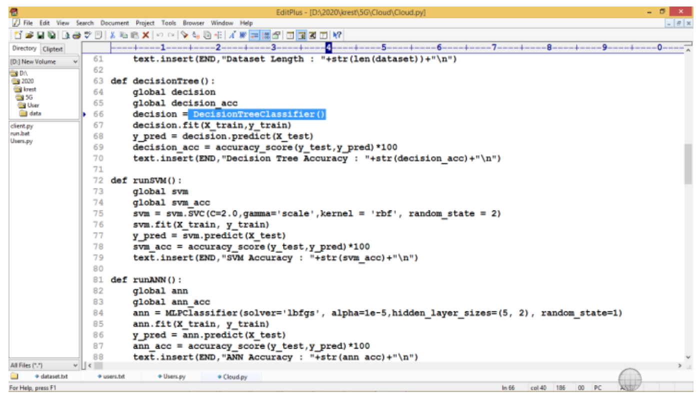


After uploading users data will get below prediction results

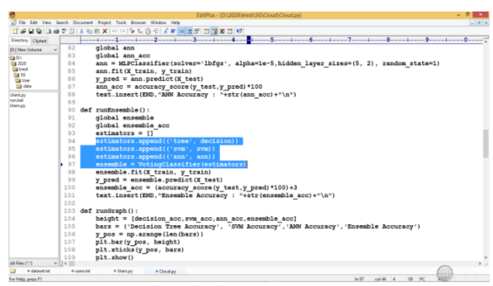


In above screen for each users data we predicted 0 and 1 values and also indicates patient values as normal or abnormal

All algorithms code you can see inside Cloud/Cloud.py file, in below screen we can all algorithms from python



In above screen we can see Decision Tree, SVM and ANN algorithms code



CONCLUSION

A model is presented for classification of DR stages based on the severity using color fundus images. The performance of the model is assessed using different metrics. Considering the heterogeneity of the dataset, the performance of the proposed model is satisfactory. The accuracy of the model can be increased by using other complex denoising techniques. Incorporating experimental errors during image capture will be helpful in developing more efficient normalization methods.

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