International Journal of Research in Engineering, Science and Management
Volume-2, Issue-11, November-2019
www.ijresm.com | ISSN (Online): 2581-5792

Non-Invasive Method for Diabetes Detection using CNN and SVM Classifier

R. S. Parte[1], Ankit Patil[2], Adesh Patil[3], Apurva Kad[4], Swapnali Kharat[5]
[1]*Associate Professor, Department of Computer Engineering, JSPM's Jayawantrao Sawant College of Engineering, Pune, India*
[2,3,4,5]*Student, Dept. of Computer Engineering, JSPM's Jayawantrao Sawant College of Engineering, Pune, India*

***Abstract*: The diabetes is one of the common disease that many people suffer. Diabetes can be described as a group of metabolic disease where the blood glucose level in the body is higher than the normal prescribed parameters. Traditional way to detect the blood glucose level is by drawing blood samples which is painful and inconvenient. Investigation shows that urine, sweat, saliva, tears and breath contain traces of glucose and these traces vary with the levels of the glucose in the blood. Research shows that breath is a good alternative to monitor and diagnose glucose levels as acetone in the breath shown good correlation to Blood Glucose Level (BGL).**

The Basic purpose of the work is to convert the method of diabetes detection from Invasive to non-Invasive method by using breath samples which emerges as a promising option with acetone levels in breath. In Present there are certain techniques which provides the analysis of breath for acetone detection. Gas chromatography mass spectroscopy, selected ion flow tube mass spectroscopy and cavity ringdown. These methods have measure drawbacks of each and it faces many constraints, such as high computational cost and less accuracy. To overcome this issue, we are using Deep Learning Approaches, such as the convolutional neural network. By using this approach calculation of automated features from raw signal and classifying the derived features. Motive of this project is to develop a modified deep learning convolution neural network algorithm integrated with support vector machines to follow up the drawbacks of current methods and algorithm. The system is coordinated on real-time breath signals for non-invasive detection of diabetes. Multiple Metal Oxide Gas Sensors in array form are used to detect the acetone level. Sensors shows change in conductivity when exposed to acetone concentration. This property is useful for overcome the presently costly methods.

***Keywords*: Acetone level, Non-Invasive, CNN.**

1. Introduction

Diabetes can be described as a group of metabolic diseases where the blood glucose level in the body is higher than the normal prescribed parameter .When a person suffers from diabetes, it is seen that their body is either unable to secrete enough insulin or their body is not able to use the insulin produced by the liver .This causes sugar to buildup in the blood thus leading to diabetes.

There are two major types of diabetes which include type1 and type2. Type1 diabetes is the result of the body's failure to produce enough insulin. While type2 is a condition in which cells fail to respond to the insulin produced in the body properly. It is seen that the prescribed parameter of blood glucose levels (BGL) in healthy subjects before meals is around 70 to 80 mg/dL. Sugar less than 100mg/dL while fasting is considered normal by today's standards and after meals 140mg/dL. Any BGL higher than normal is considered unhealthy.

2. Literature survey

1. *Lekha. S, in (2015) ascertains that a support vector machine classifier is used to classify the data samples into three classes:*

This paper investigates the concentration of acetone levels for classification of breath samples in monitoring diabetes. Acetone concentrations were collected and classified for predicting diabetes. The samples were classified using the SVM classifier and were divided into three groups labeled as healthy, type 1 and type 2 diabetes. In this paper an attempt has been made to refine the existing classification approach (healthy and diabetic) further for a more accurate evaluation (healthy, type 1 and type 2 diabetic). The future work will include designing and developing the sensory array for examination of acetone concentrations in real time breath samples.

2. *Suchetha .M in (2017) stated the use of MOS Sensor array with 1D modified convolutional neural network (CNN) algorithm which combines feature extraction and classification algorithms:*

A non-invasive method of detecting diabetes has been discussed and analyzed in this paper. The analysis involves the implementation of a one-dimension convolution neural network to classify raw signals obtained from an array of MOS sensors. The CNN algorithm convolutes the raw data signal with a kernel based filter to produce a set of feature maps. The dimension of these feature maps are reduced by using a maximization operation over the data samples and thereby down-sampling the features. These reduced feature maps are then applied to a fully connected classifier which follows a similar mechanism as the multilayer perceptron based neural network. It is observed that this algorithm reduces the

computational cost and the need for optimal feature section techniques. In this paper, the raw breath signals have been successfully classified using the proposed 1D CNN algorithm and the mean square error as well as other performance measurement parameters have been computed.

3. *Lekha. S, in (2018) built an model using single acquisition system for Non-Invasive diabetes detection:*

This analysis involved developing a modified deep learning convolution neural network by integrating support vector machines. Traditional CNN use MLP algorithms for classifying derived features from raw input signals. Although these algorithms have shown promising results, the MLP algorithms have various drawbacks when classifying nonlinear data sets. To overcome these drawbacks, the proposed architecture integrates the concept of CNN feature extraction technique with the SVM classifier. The feature sets from raw signals are calculated by mathematically convoluting these signals with Gaussian kernel weights. The dimension of these feature maps are down-sampled by using a maximization operation over the extracted feature sets. These optimized feature maps are further classified with the help of the SVM with kernel functions for non-linear data classification. The developed system is tested on the acquired breath signals to quantitatively measure acetone gas concentrations present in them and hence to detect diabetes. In order to validate the system, the performance measures and overall computational time was compared with the already existing technique. It was observed that the modified algorithm substantially optimizes the overall performance of the detection system and effectively reduces the computational complexity of the classifier.

3. Problem definition

This project explains the prospects of analyzing breathe samples and some factors of human body such as BMI, age, serum etc. The approach used here is machine learning techniques. The data for training model is collected from pima Indians dataset. The maximum and minimum diabetes is calculated using band from 0-7 with low or starting level, moderate or intermediate level and high level. This data is given to SVM for classification and results are analyzed using CNN algorithms.

4. Machine Learning and its algorithms

A. *Breath Analysis Procedure*

The proposed analysis system here distinguishes the concentration of acetone levels in the breath as healthy or diabetic. The basic model of the proposed system is described by the following flow chart given in Fig l. The operation of the system happens in five stages. Initially the subject's breath samples are used for the acetone concentration prediction. The acetone concentration data from various samples are taken individually as input in the next stage. The SVM classification model then classifies the acetone concentration levels based on the thresholds described in the next section. In the [mal stage the output is displayed under any one of the three classifiers considered for this system. Thus the diabetic and the healthy breath samples are separated in this analysis model.

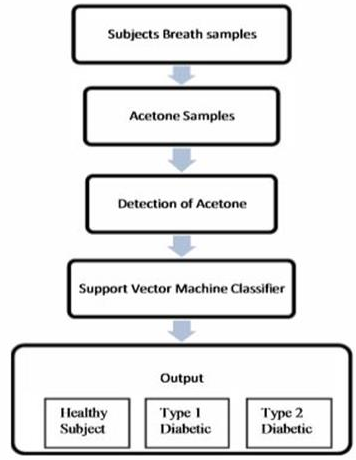


Fig. 1. Breathe analysis steps

B. *Proposed method*

The proposed system fully connected MLP classifier works to minimize empirical risk and maximize misclassified points of the training data. In reality, convolutional neural networks develop multiple feature detectors and use them to develop several feature maps which are referred to as convolutional layers. Through training, the network determines what features it finds important in order for it to be able to scan inputs and categorize them more accurately.

Based on that, it develops its feature detectors. In many cases, the features considered by the network will be unnoticeable to the human eye, which is exactly why convolutional neural networks are so amazingly useful.

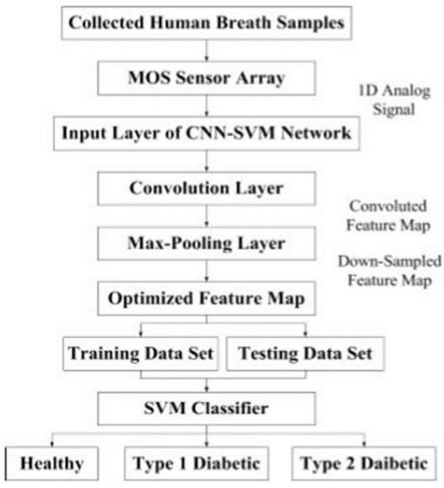
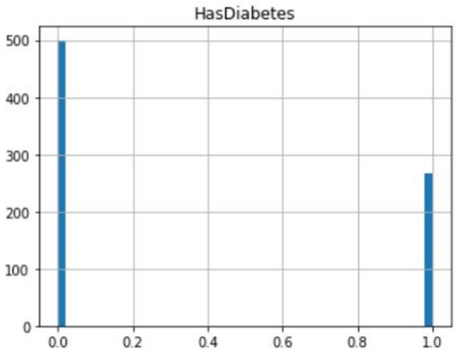
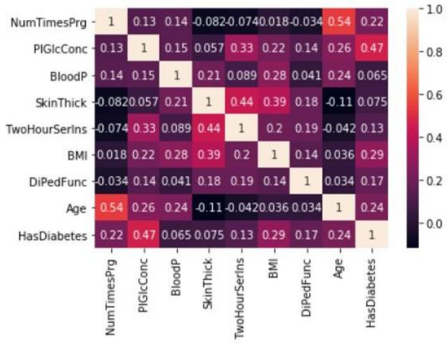


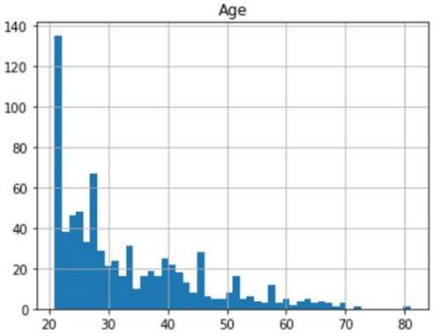
Fig. 2. Proposed system

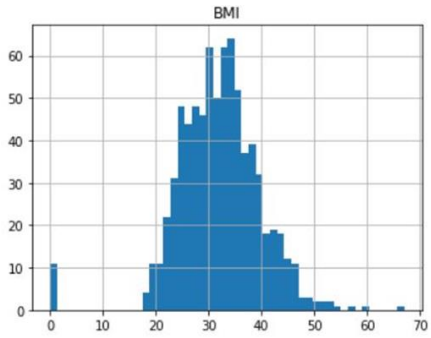
International Journal of Research in Engineering, Science and Management
Volume-2, Issue-11, November-2019
www.ijresm.com | ISSN (Online): 2581-5792

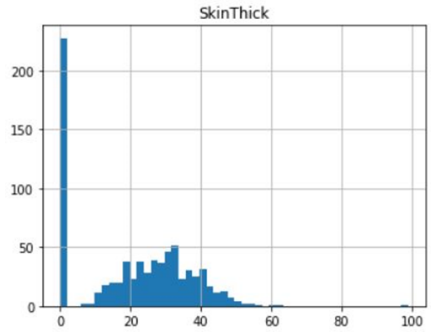
5. Classified visualized dataset











6. Conclusion

After implementing CNN-SVM algorithm for first stage classification of pima India dataset, it is concluded that this proposed system can be used for training and develop model. This analysis will involve developing a modified deep learning convolution neural network by integrating support vector machines. In order to validate the system, the performance measures and overall computational time will be compared with the already existing technique. The proposed system with modified algorithm substantially optimizes the overall performance of the detection system and effectively reduces the computational complexity of the classifier. Since, this will pertain to be the best application system to detect acetone level in breath for type 1 and type 2 diabetes prediction by gaining best accuracy.

References

[1] Lekha S. and Suchetha M., "Non- invasive diabetes detection and classification using breath analysis," *2015 International Conference on Communications and Signal Processing (ICCSP)*, Melmaruvathur, 2015, pp. 0955-0958.

[2] S. Lekha and S. M, "Real-Time Non-Invasive Detection and Classification of Diabetes Using Modified Convolution Neural Network," in *IEEE Journal of Biomedical and Health Informatics*, vol. 22, no. 5, pp. 1630-1636, Sept. 2018.

[3] S. Lekha and M. Suchetha, "A Novel 1-D Convolution Neural Network with SVM Architecture for Real-Time Detection Applications," in *IEEE Sensors Journal*, vol. 18, no. 2, pp. 724-731, 15 Jan.15, 2018.

[4] S. Wei, X. Zhao and C. Miao, "A comprehensive exploration to the machine learning techniques for diabetes identification," *2018 IEEE 4th World Forum on Internet of Things (WF-IoT)*, Singapore, 2018, pp. 291-295.