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# Intelligent systems for diagnosis of different types of diabetes

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ABSTRACT

Diabetes is a disease which often occurs when blood sugar of a person is high or more then the threshold value. There are many types of diabetes such as pre diabetes, type 1 and type 2 diabetes. Diabetes also have other adverse effects. It should be treated well on time. In developing areas, the doctor to patient ratio is very small. So medical diagnostic systems are helpful in these situations. Medical diagnostic systems also give the results similar to the expert or doctor. Symptoms are given as inputs to these medical diagnostic systems and they give the results. They can act as supporting tool for the patients and physicians as well. Further there are many techniques which can be applied to these medical diagnostic systems. These techniques are normally artificial intelligence techniques. These techniques contain mainly machine learning and deep learning techniques. A large number of authors have already worked on these kind of medical diagnostic systems for diabetes. Authors have used soft computing, machine learning and deep learning techniques for diagnosis of various different diseases such as diabetes. In this review paper, the contribution made by different authors in field of medical diagnostic system for diabetes is stated. This paper describes different techniques applied by different authors for the diagnosis of diabetes.

Keywords – System, diabetes, diagnosis

## Introduction

Diabetes arises because of the deficiency of insulin. A harmone which is helpful for the body in consumption of glucose, known as insulin. A diabetic person is not able to produce this harmone. It results in high blood sugar. Environmental as well as health factors are the main reasons for diabetes. There are many tests which can be performed in clinical laboratories to diagnose diabetes. These tests are RBS test, AIC test, PP test etc. There are many types of diabetes. The main types are pre-diabetes, type1 diabetes and type2 diabetes. Autoimmune disorders result in type1 diabetes. This type of diabetes is mostly found in children and adults. The percentage of population effected from type1 diabetes is almost 5 to 10 percent. The prime factors for type2 diabetes are poor diet, obesity, abnormal sleep, stress etc. Type2 diabetes is often found in patients having age in between forty-five and sixty-five years. The various factors for type2 diabetes are higher frequency of urination, exhaustion, low vision, irritability etc. Another type of diabetes is pre-diabetes, it means a person is on the way to diabetes. It is a warning to a patient that he or she may have diabetes. In prediabetes, blood glucose in the body is more than its normal value. This type of diabetes results in various heart diseases. In this situation, it is advisable to take actions to lower the risks of having heart diseases. Type2 diabetes is also the result of pre-diabetes.

## Literature Review

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Asma A. AlJarullah (2011) [1] used decision tree to diagnose patients with diabetes. Decision tree is applied on the dataset known as Pima Indians Diabetes Dataset. It contains the data of various patients with and without diabetes. There are two stages applied in this work. First is the pre-processing stage and second is the prediction model. In the first stage, missing data is identified and completed and in the second stage, decision tree is applied. This research work is implemented in Weka software.

Sonu Kumari and Archana Singh (2013) [2] developed an intelligent system for diagnosis of diabetes mellitus using neural network. The benefit stated in this research work is that the user can diagnose where he is having diabetes or not from his or her home. User must know some values for certain parameters. These values would be given as inputs for the proposed intelligent system. Matlab software is used for implementation of the whole research work.

Lin Li (2014) [3] developed an intelligent system for diagnosis of diabetes using three different classifiers such as ANN, naïve bayes and SVM. The dataset used in this research work is PIMA Indians diabetes dataset. Feature selection is done in this research work and a wrapper method is used for this purpose. Further the results obtained from this technique is compared with other voting techniques. Various parameters are calculated for the proposed systems and compared with the existing systems. It is found that the proposed system performs better in sensitivity as compared to other intelligent systems.

Neeru lalka and Sushma Jain (2015) [4] presented a fuzzy based expert system for diagnosis of type-1 diabetes. There are two attributes bmi and plasma glucose level which are taken as input and it will recommend the insulin dosage. Other input parameters used for diagnosis of type 1 diabetes are blood pressure and serum insulin level. The output is in the form of different classes such as very low, low, medium, high and very high.

Priya Shirley Muller and M. Nirmala (2016) [5] developed an intelligent system for diagnosis of gestational diabetes mellitus using radial basis function neural network. This system is used to classify gestational diabetes mellitus and non-gestational diabetes mellitus patients. Using this system, Pregnant women can detect gestational diabetes mellitus without visiting the hospital.

Madhuri Panwa et al. (2016) [6] developed an expert system for diagnosis of diabetes using pre-processing techniques and KNN. Generally, machine learning algorithms are applied for the same diagnosis, but obtained accuracy is low in case of applying machine learning algorithms. the reason behind this is the incomplete dataset. So pre-processing is done in this research work to complete the dataset and then KNN algorithm is applied. This research work has obtained 100% diagnostic accuracy.

Nilam Chandgude and Prof. Suvarna Pawar (2016) [7] developed an intelligent system for diagnosis of diabetes using fuzzy logic. This system diagnoses that either the patient is suffering from diabetes or not. It also suggests treatment on particular type of diabetes. Basically, it is a fuzzy inference system. The proposed method is quicker and more valuable as compared to other existing techniques.

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Aakanksha Mahajan et al. (2017) [8] proposed an intelligent system for diagnosis of diabetes. In this work, several different techniques are applied. These techniques are PCA, neural network and genetic algorithms. The aim of using PCA is to reduce the dimensionality of dataset. The role of genetic algorithms is to improve the performance of neural network classifier.

Dr. S. N. Singh and Komal Kathuria (2018) [9] used decision tree in data preparation for improvements in diagnostic accuracy for diabetes. In this paper, the drawbacks of using conventional techniques are described. It is reported that the data mining techniques have some problems in feature selection as well as in data preparation. These problems are resolved in the proposed work.

Sofia Benbelkacem and Baghdad Atmani (2019) [10] applied random forest for the treatment of diabetes diagnosis. A model is built for diagnosis of diabetes using random forest. Pima Indians diabetes dataset is used in this research work. Random forest with several number of different trees is developed to get the optimum size. The work is compared with different machine learning algorithms and it is observed that proposed work performs better then the machine learning algorithms.

A review of different studies for diagnosis of diabetes is shown in table1.

**Table 1: Comparison of intelligent systems for diagnosis of diabetes**

| S. No. | Authors | Year | Disease | Technique Used | Remarks |
|---|---|---|---|---|---|
| 1 | Asma A. AlJarullah [1] | 2011 | Diabetes | Decision tree | 78.18% of accuracy is achieved with this work. |
| 2 | Sonu Kumari and Archana Singh [2] | 2013 | Diabetes | Neural Network | Accuracy of 92.8% is achieved with this work. |
| 3 | Lin Li [3] | 2014 | Diabetes | Support vector machine, artificial neural network, and naïve bayes | 77% and 74.4% accuracy are obtained on two different datasets |
| 4 | Neeru lalka and Sushma Jain [4] | 2015 | Diabetes | Fuzzy expert system | The probability of having |

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|---|---|---|---|---|---|
| | | | | | diabetes is calculated which lie from 0 to 1. |
| 5 | Priya Shirley Muller and M. Nirmala [5] | 2016 | Diabetes | Radial Basis function neural network | This work is completed with 188 records of outgoing patients in 2013 |
| 6 | Madhuri Panwa [6] | 2016 | Diabetes | Pre-processing techniques and KNN | 100% accuracy is achieved in this research work |
| 7 | Nilam Chandgude and Prof. Suvarna Pawar [7] | 2016 | Diabetes | Fuzzy inference system | Highest precision obtained is 98% at 900 records |
| 8 | Aakanksha Mahajan et al. [8] | 2017 | Diabetes | PCA and Genetically Optimized Neural Network | 96.1 % accuracy is achieved with this technique. |
| 9 | Dr. S. N. Singh and Komal Kathuria [9] | 2018 | Diabetes | Decision Tree | J48 technique has better results as compared to other techniques |
| 10 | Sofia Benbelkacem and Baghdad Atmani [10] | 2019 | Diabetes | Random forest | Error rate of 0.21 at 40 trees is achieved |

Conclusion and Future Scope

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From the different studies considered in this review paper, it is concluded that pre-processing techniques with KNN give the highest accuracy that is 100%. While the results obtained from other techniques also show good values. Fuzzy inference system also performs outstanding results that is 98% accuracy. Neural networks show 92.8% diagnostic accuracy. It is also expected that the deep learning techniques may be applied in future for diagnosis of diabetes. Most of the work on diagnosis of diabetes is done using machine learning and soft computing techniques. So, there is scope to work with deep learning techniques for diagnosis of different types of diabetes.

References

[1]. Al Jarullah, Asma A. "Decision tree discovery for the diagnosis of type II diabetes." 2011 International conference on innovations in information technology. IEEE, 2011.

[2]. Kumari, Sonu, and Archana Singh. "A data mining approach for the diagnosis of diabetes mellitus." 2013 7th International Conference on Intelligent Systems and Control (ISCO). IEEE, 2013.

[3]. Li, Lin. "Diagnosis of diabetes using a weight-adjusted voting approach." 2014 IEEE International Conference on Bioinformatics and Bioengineering. IEEE, 2014.

[4]. Lalka, Neeru, and Sushma Jain. "Fuzzy based expert system for diabetes diagnosis and insulin dosage control." International Conference on Computing, Communication & Automation. IEEE, 2015.

[5]. Muller, Priya Shirley, and M. Nirmala. "Diagnosis of Gestational Diabetes Mellitus using Radial Basis function." 2016 Online International Conference on Green Engineering and Technologies (IC-GET). IEEE, 2016.

[6]. Panwar, Madhuri, et al. "K-nearest neighbor based methodology for accurate diagnosis of diabetes mellitus." 2016 Sixth International Symposium on Embedded Computing and System Design (ISED). IEEE, 2016.

[7]. Chandgude, Nilam, and Suvarna Pawar. "Diagnosis of diabetes using fuzzy inference system." 2016 International Conference on Computing Communication Control and Automation (ICCUBEA). IEEE, 2016.

[8]. Mahajan, Aakanksha, Sushil Kumar, and Rohit Bansal. "Diagnosis of diabetes mellitus using PCA and genetically optimized neural network." 2017 International Conference on Computing, Communication and Automation (ICCCA). IEEE, 2017.

[9]. Singh, S. N., and Komal Kathuria. "Diabetes Diagnosis using different Data Pre processing Techniques." 2018 4th International Conference on Computing Communication and Automation (ICCCA). IEEE, 2018.

[10]. Benbelkacem, Sofia, and Baghdad Atmani. "Random Forests for Diabetes Diagnosis." 2019 International Conference on Computer and Information Sciences (ICCIS). IEEE, 2019.