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Synthesis of Diabetic Patients Dataset Using AINN Model

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Abstract

A person is diabetic patient it means his body is not able to respond to insulin regularly. The diabetes disease may lead to other complications like Neuro problem, heart problem, blindness and kidney problem. The proper synthesis of data set of diabetic patients is required to solve the problem which further leads to be helpful in the treatment of the disease. In this article a mechanism is designed and introduced using Artificially Intelligent Neural Network (AINN). The AINN model is analyzing the activity of neurons and an algorithm called Quasi Newton algorithm to train the system. Finally a chart is produced to represent the cumulative score to justify the effectiveness of the model.

Keywords- Artificially Intelligent Neural Network (AINN), Quasi Newton algorithm, Cumulative Score

I. INTRODUCTION

While a person is not able to produce the insulin regularly or not able to generate the needed quantity of insulin to mitigate the glucose requirements that means that the human is Diabetic patient. Diabetes leads the risk of adding some other diseases like blindness, damage to blood vessels, nerve damage, kidney disease and most probably heart disease [1], [2]. As per the report of survey called National Diabetes and Diabetic Retinopathy published by Health and Family welfare department under ministry of govt. of India. In the last ten years, the increment of diabetes stood at 11.95 % in our country India. The survey was done by the institute called R. Prasad Centre for Ophthalmic Science in 2015-2025 [1]. All India Institute of Medical Sciences (AIIMS), released a report, that the diagnosis of known patient of diabetes was 8.2%, and further other new patient of diabetes 3.85%. Female patient 11.7% are lower than Males had a more diabetes illness which is 12 percent [1].

In 2014, the global presence of diabetes among person aged 18 and more was 8.49 percent, as per the WHO (World Health Organization). It is calculated that almost 73 million adults are suffering from diabetes in India. The presence in city areas ranges from 10.9 percent to 14.18 percent, whereas in rural India, it varies from 3.0 percent to 7.8 percent %, based on the data aged twenty years and older. Notably, the presence is meaningfully higher among persons over the age of fifty, as highlighted by the INDIAB Study [1]. The paper is completed with following parts: Introduction, Review of Literature, Dataset Taken, ANN Diabetes Diagnosis Model, Mechanism, Mathematical Model and Conclusion.

II. Review of Literature

The proper diagnosis and analysis of diabetes data is crucial in addressing this growing health concern. Classification techniques play a pivotal role in the analysis and decision-making process, particularly in the medical field. In recent years, classification methods, especially those based on artificial neural networks (ANN), have emerged as promising alternatives for improving decision-making in diabetes care. This paper explores the use of artificial neural networks to predict the onset of diabetes mellitus (DM) in Pima Indian women, highlighting the significance of early detection and intervention [3]. The use of artificial neural networks (ANNs) for data classification is increasingly prevalent [16] [17] [18].

In this research project, we implemented an ANN-based prediction model to predict the onset of Diabetes Mellitus (DM) in Indian women. This application leverages a 2 layered and visualized through graphs and charts. Classification rates showed considerable artificial neural network and the Pima Indians Diabetes Database, which is sourced from the National Institute of Diabetes and Digestive and Kidney Diseases. The dataset is limited to female patients of Pima Indian heritage, all of whom are at least 22 years old. For training the model, the quasi-Newton method was employed. Initially, the Training Loss was measured at 1.10080, and after 151 epochs, the final value was found to be 0.481862. The preliminary Selection Loss (SL) was 1.11061, and after 152 epochs, it decreased to 1.03611.

Directional outputs, which illustrate how the outputs change when one input is varied while keeping others constant, were generated variation depending on the initial weights of the network's architecture. Our analysis indicates that ANNs are a promising tool for predicting the onset of diabetes. The model's classification accuracy is approximately 56% for both training and test datasets. This research demonstrates the practical potential of neural networks as a modeling tool. However, due to the current limitations, further research is necessary to refine the model and explore enhanced models.

The use of artificial neural networks (ANNs) for data classification is increasingly prevalent [16] [17] [18]. In this research project, we implemented an ANN-based prediction model to predict the onset of Diabetes Mellitus (DM) in Indian women. This application leverages a 2 layered artificial neural network and the Pima Indians Diabetes Database, which is sourced from the National Institute of Diabetes and Digestive and Kidney Diseases. The dataset is limited to female patients of Pima Indian heritage, all of whom are at least 22 years old. For training the model, the quasi-Newton method was employed. Initially, the Training Loss was measured at 1.10080, and after 151 epochs, the final value was found to be 0.481862. The preliminary Selection Loss (SL) was 1.11061, and after 152 epochs, it decreased to 1.03611.Directional outputs, which illustrate how the outputs change when one input is varied while keeping others constant, were generated and visualized through graphs and charts. Classification rates showed considerable variation depending on the initial weights of the network's architecture. Our analysis indicates that ANNs are a promising tool for predicting the onset of diabetes. The model's classification accuracy is approximately 56% for both training and test datasets. This research demonstrates the practical potential of neural networks as a modeling tool. However, due to the current limitations, further research is necessary to refine the model and explore enhanced models.

III. DATASET TAKEN

The dataset used in this study is sourced from the National Institute of Diabetes and Digestive and Kidney Diseases. Its primary objective is to determine whether a patient has diabetes, based on a set of diagnostic measures. Several constraints were applied when selecting instances from a broader database. Specifically, the dataset focuses on female patients of Pima Indian descent, all of whom are at least 20 years old. The dataset includes multiple independent medical predictor variables, such as BMI, the number of pregnancies, insulin levels, and age, with the dependent variable being the outcome (whether the patient has diabetes or not) [3,5].

TABLE 1 – Details of Data

Parameters	Details
Gl	Concentration of Plasma Glucose: 2 hours oral Glucose Tolerance test 2.
ST	TST[mm] Triceps Skin fold Thickness
BMI	Body Mass Index (weight in Kg]/(height In M2)
Ag	Human Age in years
Pg	Pregnancy Frequency
BP	Pressure of Blood
Ins	2 Hours Insulin Serum Insulin in muU/ml
DPF	A Pedigree function for Diabetes
OC	Outcome: variable 1 for positive and 0 for negative

IV. MECHANISM

Classification plays an important role in segregating the data. A computer-based classification model can be used to produce a more accurate and quick result. In the recent era, artificial intelligent and neural network are getting popular due to their learning capabilities and accuracy for data classification and prediction. In this paper, an ANN inspired diabetes prediction model has been proposed. The flow chart of the proposed model has been shown in Figure 1 and explained in subsequent sections.

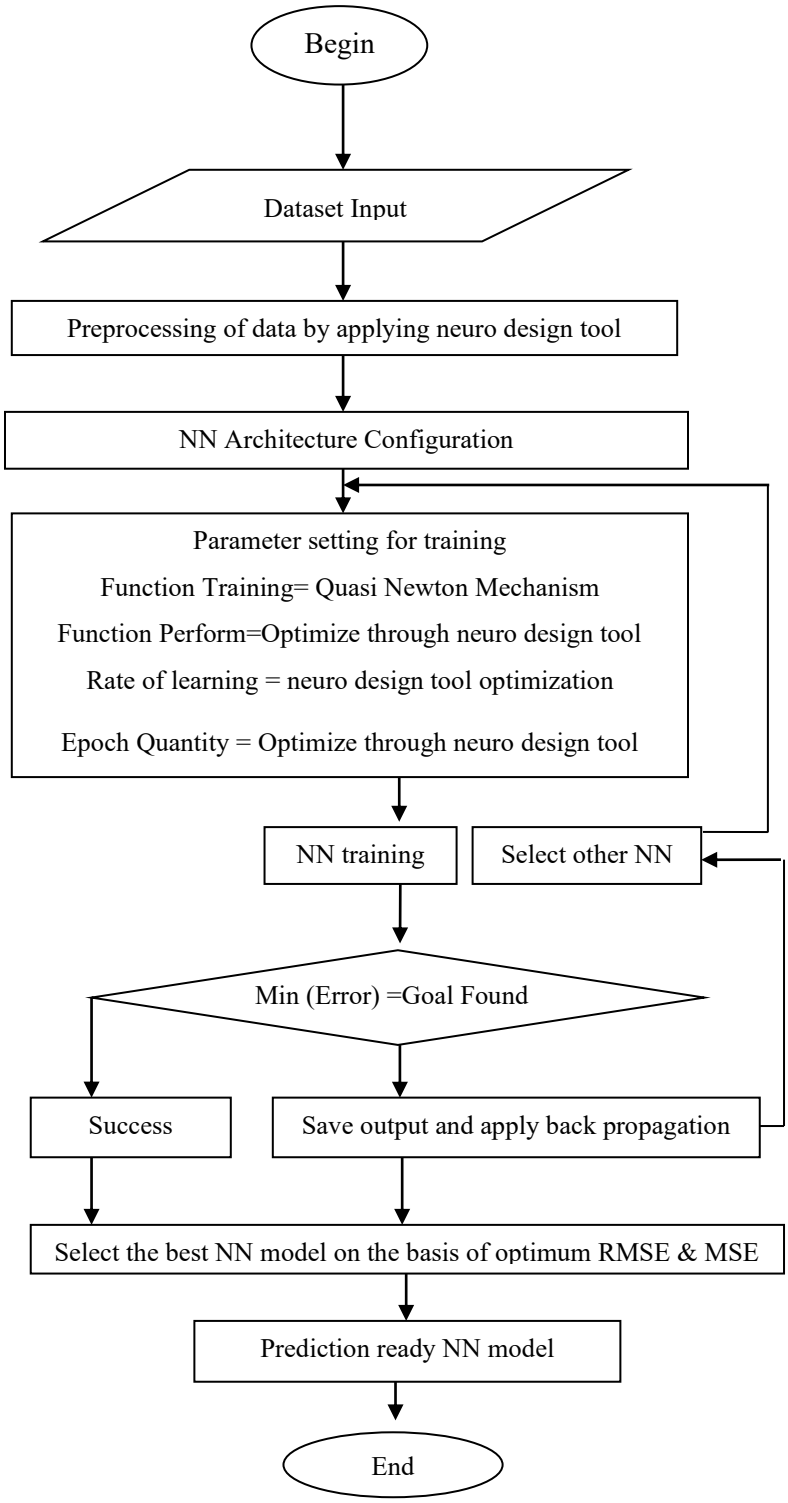

Figure 1 : Proposed Model Flow Chart

V. Mathematical Model

The neural networks characterize the predictive model. To implement this research work, a Neural Designer tool is used to design an artificial neural network. The total number of input variables used in the model is 8. Table-2 shown below describes some basic information about these inputs, including the units, then name, and the explanation. This layer having a size similar to the size of input i.e. 8. For this layer, an Automatic method is used for scaling. Table 2 displays the values used to scale inputs, which include maximum, minimum, standard deviation and mean.

TABLE 2- Data Applied as Input

	Minimum	Maximum	Mean	Std. deviation
Pregnancies	0	18	0	1
Glucose	0	198	0	1
Thickness of Skin	0	98	0	1
Insulin	0	845	0	1
BMI	0	67.23	0	1
Function of Diabetes Pedigree	0.077	2.43	0	1
Age	20	82	0	1

VI. CONCLUSION

For data classification, the use of the artificial neural network is growing these days [16] [17] [18]. In this research project, an artificial neural network based prediction model has been implemented. This particular application is created to guess the commencement of (DM) Diabetes Mellitus in Indian Women. For this purpose a two-layered artificial neural network and Pima Indians Diabetes Database is used, this dataset is originally from the National Institute of Diabetes and Digestive and Kidney Diseases. Several limitations have been placed on selecting those instances from a larger database. In particular, all patients here are females of Pima Indian heritage who are at least 21 years old. As a training algorithm, a quasi-Newton-method is used in this system. Primarily value 1.10079 of Training Loss has been measured, and after 151 epoch the closing value found 0.481862. The preliminary assessment of the SL (Selection Loss) is 1.11061, the closing assessment after 152 repetitions found 1.03511. Besides this, Directional outputs are generated, which is very useful to see how the outputs differ when all the other inputs are set as a function of a single input. Directional outputs are shown through the graphs and charts. Rates of classification can vary greatly depending on the weights of the first use of arc. Our analysis shows that ANN (Artificial Neural Network) is reasonable for foreseeing the beginning of diabetes. The likelihood of arrangement in preparing and test tests is around 56 percent. This research also indicates a realistic approach to the use of neural networks as a modeling instrument. At this point in time, measurable testing isn't suitable. Toward that path, further exploration is required, and this research work could be extended to create and compare enhanced models.

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demonstrates the practical potential of neural networks as a modeling tool. However, due to the current limitations, further research is necessary to refine the model and explore enhanced models.

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