3. PRELIMINARY

Chronic Kidney Disease (CKD) refers only to the biological disease of the kidney, which can no longer filter human blood in the way it should. The chief issues for developing kidney disease are heart disease, diabetes, high blood pressure and family history of kidney failure.

FIG 1. A FUNDAMENTAL PERCEPTRON

The perceptron is the basic unit of a neural network. It represents a network. It accepts inputs (x1, x2, x3, …, xn) as shown in Figure 1, and uses the weight of each input (wl, w2, w3, …, wn) to perform some processing, and then give a decision or forecast. It is the simplest neural network, with only one node, called a neuron. It can only solve linearly separable problems. A neural network composed of multiple neurons, which implies that a function uses it to classify or predict data, is called a multi-perceptron model, as shown in Figure 2. A neural network is a network that simulates the human brain network. The Multilayer Perceptron model used in this research was provided by the PyTorch library for deep learning in Python and it was constructed using the same library.

Fig 2. A Single layer Neural Network

4. METHODOLOGY

The model is trained using the principles of Supervised Machine Learning [9] where for given value of X i.e., input values (x1, x2, x3, …, xn) there is a corresponding Y value i.e., target or output value. As shown in figure 3, the data is fed into the model where X comprises various features such as blood features such as blood pressure, age, sugar, etc. and Y is the target class that consists of binaries values i.e., affected by CKD or not.

FIG 3. SUPERVISED LEARNING

The model uses batch learning or offline learning mechanism [10] for training, in which the training data is provided to the ANN model in batches, and then validated and tested.

The dataset used In the proposed model is collected from Apollo Hospitals in Managiri and Karaikudi, Tamil Nadu, India. It contains some 25 attributes or features and a site, which is a branch of Google LLC, and this site is an Online machine learning community experts and data scientists, allowing users to publish and find data sets of various problems called Kaggle. Figure 4 describes the broad phases that were followed during the construction of the ANN model for CKD diagnosis.

FIG 4. PHASES FOR CONSTRUCTING THE CKD CLASSIFIER

4.1 Data Pre-processing

The character and binary values were mapped to numeric values for example, last attribute ‘Class’ was mapped as 0 for not having chronic kidney disease and I for having the same.

This data set contains all the attributes of the 400 Indian patients in Table 1.

There was a need to convert the data in a Numeral format as the Machine learning algorithms work with Numeral data. The data set collected from Managiri, Karaikudi, and Apollo Hospitals in Tamil Nadu, India contains 25 attributes [11], as shown below:

TABLE 1. FEATURE ATTRIBUTES FOR CKD

4.2 Constructing and Training the model

The model itself is a fully connected Deep Neural Network. It is constructed using the ANN provided by PyTorch library supported by Python programming language. After constructing the model, the pre-processed data was divided into two parts randomly where 75% of the data was used for training and the other 25% was consumed in testing the model. The training data was then fed to the model using the batch learning approach or offline learning mechanism. The model was trained for 250 epochs and then tested on unseen data.

4.3 Testing and Hyperparameters Tuning

The trained model was then tested on 25% of the unseen data to analyze its performance. Based on the testing results, the model’s hyperparameters are tuned to achieve maximum testing accuracy.

TABLE 2. TUNNED HYPERPARAMETERS FOR THE CLASSIFIER

Hyperparameters Configuration

Number of Hidden Layers 4

Number of Nodes per Layers {64, 64, 64, 64}

Activation Function Rectified Linear Unit (ReLU)

Learning Rate 0.001

Optimizer Adam

Criterion Categorical Cross-Entropy

Batch Size 16

Number of Training Epochs 250

Hyperparameters tunning is repeatedly done followed by testing to find out the optimal configuration of the model. Table 2 shows the set of tuning parameters for which the testing accuracy of the model was the highest.