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Thyroid Disease Detection using Soft Computing Techniques

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Abstract - *Thyroid disease affects individuals of all age groups at an alarming rate, so diagnosing this disease and giving proper treatment to the patient is of utmost importance.. A major problem in medical science is attaining correct diagnosis of treatment .*

In this thesis , multilayer perceptron classifier is employed for classifying thyroid diseases into euthyroid , hyperthyroid and hypothyroid which gave an accuracy of 97.5% and further classification of hypothyroid diseases into primary ,secondary and tertiary hypothyroid gave accuracy of 91.7%. Thus , In this research work thyroid diseases are classified with high accuracy and speed.

Key Words: Multilayer perceptron classifier, euthyroid , Hyperthyroid , hypothyroid , Back propagation algorithm, and Gradient descent.

1. INTRODUCTION

Thyroid gland is one of the most important glands in our body, it controls most of the body functions like growth. Any defect with the thyroid gland will interfere with the individuals normal processes. Therefore it is important to detect and treat any disease associated with the thyroid gland. In this research work we classify thyroid diseases into three types which is euthyroid (Normal functioning of the thyroid gland) ,Hyperthyroid (Overactive thyroid gland) and hypothyroid(underactive thyroid gland).If a person suffers from hypothyroid disease ,it gets further classified into three stages of hypothyroid which is primary hypothyroid, secondary hypothyroid and complementary hypothyroid.

2 Project Methodology

The block diagram of the research project is shown in figure 1.

The flow of project is as follows

Step 1:Thyroid dataset collection from UCI repository

Step 2:Partitioning the dataset into training, testing and validation set.

Step 3: Multilayer perceptron Classifier used for training and classification.

Step 4: Predicting the stages

Step 5: classifying the disease of the patient into 3 stages which are euthyroid , hyperthyroid and hypothyroid.

Step7: If patient is suffering from Hypothyroid then it is further classified into primary, secondary and complementary hypothyroid.

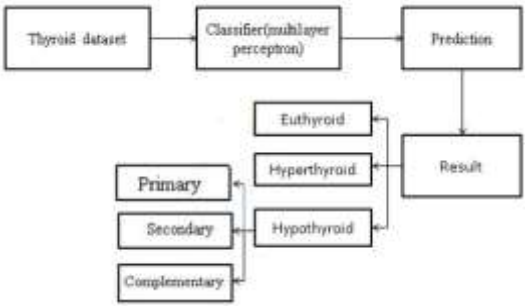

Fig 1: Block diagram

2.1 Thyroid dataset collection

Data set is obtained from UCI repository. This project involves 2 classifications. For the first classification the dataset consists of 1004 observations which are classified into 3 outputs and they are 1=Euthyroid,2=Hyperthyroid and 3=Hypothyroid. The attributes are TSH, T3, TT4, FTI, T4U .These are continuous attributes. If in the first classification the patient is suffering from hypothyroid, then second classification is done using the same attributes given in the first classification to classify hypothyroid diseases into 3 stages which are primary , secondary and complementary hypothyroid.

2. 2 Dataset Partitioning

In this research work thyroid dataset is partitioned into three subsets which are training , testing and validation subsets. Training set calculates gradient , bias and weights .The second subset is validation set. The error in the validation set is monitored during the training process. The validation error and training set error decreases in the initial phase of training. The test set error is not used during training, but it is used to compare different models.

2.3 Classifier

Multilayer perceptron classifier is used to train and classify thyroid diseases into euthyroid, hypothyroid and Hyperthyroid and to further classify hypothyroid diseases

into primary, secondary and complementary hypothyroid diseases. It trains using back propagation algorithm that learns the relationship between input and output data ensuring that error between the predicted and actual values are minimum by updating the weights repeatedly during training till it gets the desired accuracy. It generates some values based on which we can classify thyroid disease. It than saves a net file which is used for predictions. A saved and trained net file is shown in the below figure

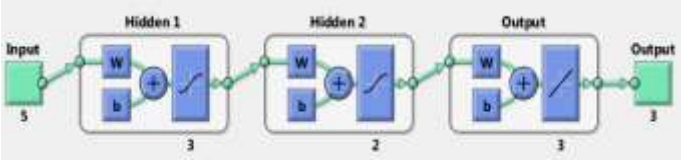

Fig 2: Trained and saved net file which is used for prediction

2.4 Prediction

The trained and saved net file obtained during the training process is used to make predictions. We save the patients data of tsh, t3, t4U, fti and tt4 in an excel sheet along with the serial number. That serial number is then given to the net file which predicts the disease of the patient. In this project we saved a net file which gave us 97.5 % accuracy for the first classification and 91% accuracy for the second classification. Since the accuracy is not 100% there are chances that the disease types of some patients will be misclassified.

2.5 Results

The predicted thyroid disease types of some patients is given in the figure below**.**

```
Case 1:Patient is suffering from Euthyroid
    1.9942

 patient is  suffering from Euthyroid
Case 2: Patient is suffering from Hyperthyroid
    1.3089

patient is  suffering from hyperthyroid
Case 3: Patient is actually suffering from euthyroid but  the system detects hyperthyroid
    1.3130

 patient is  suffering from hyperthyroid
Case 4: Patient suffers from complementary Hypothyroid
    2.7527

patient is  suffering from hypothyroid
 type compensated hypothyroid
Case5: Patient is suffering from primary hypothyroid
    2.7845

patient is  suffering from hypothyroid
type primary hypothyroid
```

The values 1.9942 , 1.3089, 1.3130 etc are the values obtained from the the classifier learnt during the training process which it is applying n now for prediction . We set ranges accordingly which gives us high accuracy. But as seen in the 5 cases 1 disease type is predicted wrongly out of 5 cases that is because our system is not 100 % accurate.

3. Conclusions

A multilayer perceptron classifier is proposed for classifying thyroid diseases into three classes as euthyroid , hyperthyroid and hypothyroid and to further classify hypothyroid disease into primary, secondary and tertiary hypothyroid to obtain maximum accuracy in minimum time.

In this research work two multilayer perceptron classifiers were designed. One classifier is for basic classification which is to classify whether the patient is suffering from hypothyroid, euthyroid and hyperthyroid. The classifier has an accuracy of 97.4% and hence it is very reliable. If the patient is suffering from hypothyroid, the 5 features are then given to the second classifier which classifies whether the patient is suffering from primary, secondary and complementary hypothyroid. This classifier gave around 91.7 % accuracy.

Thus, we conclude that employing this system can lead to enhanced quality and increased efficiency of the health service.

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