

A Study on Learning and Intelligence Based Techniques In Thyroid Diagnosis

Sonia Rani, Apash Roy

School of Computer Science and Engineering

Lovely Professional University, Jalandhar, Punjab, India

ABSTRACT—Healthcare and information technological developments brought huge changes in human life. There are a number of area in medical are enriched with modern technological devices. I recent times, Intelligent systems are on demand. There is huge research going on intelligent system in the field of healthcare. This work is a study of researches on intelligent systems is been developed or used in this field. In this paper mainly represent about the thyroid disease which is most common disease in world now days. Mostly women are suffering from thyroid and they have undiagnosed thyroid, then it becomes the major disease thyroid cancer. So thyroid disease diagnosis with intelligent system and artificial neural networks is a major challenge . This problem can be solved by diagnosis of thyroid at early stages by using Various AI techniques and methods like BPN, SVM, ANN, DSS, MLP, CNN, deep learning and with some intelligent systems.

Keywords: Artificial Neural Networks, Thyroid, Diagnosis, Learning methods, Backpropagation, Multilayer Perceptrons, Deep Learning, Support vector machine, Intelligent system, Intelligent healthcare.

1. Introduction

Health of human being is in topmost concern for every human being. Most of the health related issues are not because of out of bad habits, it is also because of environmental difficulties. Water, air, etc are getting polluted and getting worst day by day. With the emerging application of different technological development, automation, and up gradation is also necessary for intelligent computer based systems for healthcare field also. There are researches going on in restless way. Here in this work a study is been done for the solution of thyroid related problems has been dealt with the help of intelligent systems.

If we see thyroid, it is just one gland near our neck, somehow shaped like a butterfly, ejaculate different hormone to control certain activity of human body. Thyroid makes 2hormones, “triiodothyronine (T3)” and “thyroxine(T4)” . These hormones are mainly included in the process. These two hormones are regulated by “Thyroid-Stimulating Hormone (TSH)”. If the ejaculation is not balanced, a problem happens. Once a person got thyroid problem, there is no cure. It can be balanced by use of medicine only. Thyroid can affect metabolism, strength of muscle, body weight, temperature of body, etc.

In computer science there are different expert systems are developed to prevent or at least predict at early stage so that proper treatment in time can be made to cure the problem. Intelligent systems including artificial Intelligence, Neural Network, machine learning etc. are getting popularity day by day in the field of healthcare with high accuracy and efficiency. The system allows on time cost effective and expert diagnosis for the patients.

2. Objectives

1. Understanding the diagnosis of thyroid disease by using different artificial intelligence techniques.
2. Searching a suitable opportunity to expand an existing work or identifying new development.
3. By making an efficient system using suitable technology to help people of the society for better health life.

3. Study of Intelligent Systems in Healthcare

In this paper the thyroid hormonal problems are diagnosed using an artificial neural network approach with backpropagation learning. Backpropagation is supervised learning method and it uses the Gradient descent learning algorithm applied in feed forward neural networks. The performance of neural network can be calculated by using two factors called specificity and sensitivity. This n/w has been trained and applied tested on 80 samples only. Limitation of this method is error can occur when data sample is large. (Dr. Santhakumaran & sarasvathi, 2011).

One efficient technique using three neural network technique is used here for diagnosis of thyroid related problem (Renupriya et.al., 2016). The three networks are trained with backpropagation, Radial basis function and Learning vector quantization. The images of different person in a data set are used to train and test the networks.

Making a simple perceptron network can be capable of diagnose thyroid. Here in the work a multilayer perceptron network of artificial neuron with the using of 3 layers hidden ,input and output layers diagnosis the stages of thyroid. (Mokri et.al., 2013).

Convolutional Neural Network can also be applied to diagnosis thyroid. An optimized system using SPECT images is prepared; where different other learning mechanisms are used to predict risk of having chances that a patient can suffer from thyroid problem (Wang et. al., 2019).

A recurring neural network is applied for decision making process in treatment of cancer. For controlling the model complexity principal statistical method is used to cross validate the data first and the overall transparency of the network prediction is second concern for the network. Variety of clinical trial along with some randomized trial is used for testing the system, and found efficient (Lisboa et.al., 2006).

AI would be most influence in healthcare diagnosis like 'patient monitoring', 'clinical decision support', 'patient administration' and 'healthcare interventions'. Patient condition can be accessed by using facial expressions through an AI system with current technique of deep learning, 3d images, decision support systems, computer vision and robotics. Use of those technologies brought cost effective and efficient treatment in recent years. Computer vision can be useful for assessing the condition of a patient using facial expression. Robots can be an effective tool for guiding a patient in unknown environment and can remind them in their regular activities. (Reddy et.al., 2018).

A method of feature selection and classification method with the pattern recognition is used for thyroid disease diagnosis. Pattern recognition is used in 2 stages for to select feature set, 1st stage is Sequential forward selection and backward selection. And another stage is for genetic algorithm selection, these are two well-known heuristic schemes, are working for feature selection. Support

vector machine is used as classifier to separate the thyroid disease into two datasets. The first dataset of thyroid is taken from UCI machine learning repository and the second one is taken from the real data (Seithi et.al., 2012).

Machine learning techniques useful to medical imaging data and also define some traditional machine learning techniques like principle component analysis and support vector machine. Presently most recent one is CNN used for medical imaging. Transfer learning is used in medical image data for training to deal with the issue of lacking sufficient (Zhang et.al., 2019).

It presented the general model for diagnosing any disease. An efficient neural network training model for thyroid disease diagnosis by using Back propagation network, Radial basis network, Learning Vector Quantization Algorithm is applied. MATLAB (“MATrix LABoratory”) tool is used for numerical computation and for visualization. Learning Vector Quantization used. An artificial neural network model used for classification and image segmentation problems (Sidhu et.al., 2014).

Thyroid diagnosing and skin temperature variation detected by A non invasive infrared thermopile non contact smart sensor. This sensor detects the thermal coefficient and the Adriano microcontroller helps to display the temperature value. In the second part A pulse rate sensor is used for detecting the pulse rate by a finger which is put on the sensor for thyroid detection. This technique of thyroid detection gives an accuracy 83.33% (Malathi et.al., 2019).

Thyroid diagnosis with dataset by using the algorithms C4.5, RBFN, MLP is carried out here in some work. The dataset used 3 classes, 5 features and 215 records (hypo=30, hyper=35, normal=150).A method of MLP has emerge with an outstanding performance of 98.15% (Nallamuth & Palanichamy, 2015).

Two techniques IoT and Edge computing also used in the field of healthcare. Some intelligence sensors like ECG, Temperature sensor included in front- end module. Deep learning, tensor flow, hadoop, coap used in the back- end server for health diagnosis (Dr. kumar &Majumder, 2018)

Thyroid diagnosis by ANN, BPN, Hybrid Back-Propagation Neural Network, DSS, MLP, MLM,

RBFN methods are suitable. But the ANN is most appropriate method it gives the 99.2% accuracy, and this system evaluated by using matlab software (Sriram et.al., 2019).

Some classification models SVM, ANN, naive Bayes, K-NN, decision tree used for disease prediction and analysis and that are being used in the thyroid andto predict the estimated risk on a patient’s chance of obtaining thyroid disease. The information of dataset of thyroid gathered from UCI machine learning repository (Mehra et.al., 2018).

AI techniques applied in structured data like Class support vector machine and neural network, and deep learning, and unstructured as natural language processing. For cancer, neurological,

cardiovascular diagnosis with convolution neural network, MATLAB, Random forest method for(CT scan), decision tree, PCA,IBM Watson devices (Jiang et.al.,2017).

Thyroid can also be monitored by basal body temperature. A combination of Thermal sensor, wireless technologies, IEEE 802.15.4, WiFi, and Bluetooth with low energy, software , bio-sensor, memory, ring oscillator along with counter, controller, calibration algorithm. Ring oscillator was implemented with circuit, and components in Simulink library, inverter, NAND gate and using a bottom up approach (sundaravadivel et.al.,2016).

Modern imaging techniques like ultra sound, computerized tomography and magnetic resource imaging revealed thyroid nodules. Image processing can be accessed over internet by android mobile devices. K-means based image processing algorithm clustering unsupervised learning algorithm, client application Eclipse IDE and Android SDK is used for server application, FTP, MSSQL database (Arslan et.al., 2015).

Hybrid Neuro-Fuzzy expert system used for find the parameters of a fuzzy system for thyroid diagnosis. Data collected from patient previous state of health, living conditions, and other medical devices. Data set showing the degree of membership of thyroid disorder. Like weight loss, Irritability, Eye changes, Heat sensitivity, Nervousness, brittle hair, warm skin, weak length muscle, insomnia for diagnosis of thyroid diseases (Azar et.al., 2012)

A data set of thyroid disease was applied in the performance analysis. 10-fold CV method, This result ensured that IG-AIRS would be helpful in diagnosing thyroid function based on laboratory tests. Artificial immune systems (AIS).The proposed system reached 95.90% classification accuracy. The human immune system has two complement array parts, the innate and adaptive immune systems. This result ensured that IG-AIRS would be helpful in diagnosing thyroid (Kodaz et.al., 2009)

Table 1: Notable Findings from the study along with limitations

Observed points	Findings
Covered areas	Almost all possible areas of healthcare, but here mostly thyroid related work is studied.
ANN/ ML Techniques or methodology Used	SVM, Radial Bias, Perceptron, Backpropagation, CNN
Implied practical implementation	Thyroid, Thyroid cancer, techniques use accuracy Approx 80-95%.
Claimed average efficiency	Approx 80-95%.
Identified limitation, where future work is needed	For large data systems may create error Still Not Sufficient accuracy achieved There are number of new works are needed to

	be done.
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4. Conclusion

Application of computerized system in the field of medical and healthcare is going on since long. With the emerging trends in technological development, intelligent systems are also coming day by day into the field. Thyroid hormonal problems can be diagnosis using an artificial neural network approach, thermal sensors. In this mainly represents the Artificial Intelligence techniques or methods and some intelligent systems are used for diagnosis the thyroid disease with less cost ,less time, without inconvenience and with accuracy level approx 80-95% . It will surely beneficial for whole society.

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