Review of Algorithms for Detecting Hearing Disorders

Meenakshi1, Amit Jain2
1,2Department of Computer Science and Engineering, PEC, Mouli, INDIA

ABSTRACT
In this paper, hearing disorders are classified into various categories according to the anatomy of the ear that explains various parts of ears. Hearing disorders are categorized according to part in which hearing problem comes. This paper helps in classifying hearing disorders with the help of various algorithms that are based on wavelet packets and support vector machine, artificial neural network, modified back propagation network, NNCT. Besides of many algorithms available, it’s still very challenging to detect type of hearing disorder.

Keywords: Conductive Hearing Disorder, Sensorineural Hearing Disorder, Transient Evoked Otoacoustic Emissions (TEOAE), modified back propagation network, NNCT.

I. INTRODUCTION
In today’s context, hearing disorders are common in diverse population as there is noise pollution, accidental incidence and genetic reasons for such development therefore there is an urgent need to use algorithms which can come aid to medical practitioner for helping them in diagnose of hearing disorder and classify its types, since identifying what type of hearing disorder is challenging task and specially for fresh medical practitioner in this access paper we conduct survey of hearing disorders, challenges involved in identifying the different class of hearing disorder and the role of classification of algorithm for diagnosis of hearing disorder and classification of their types.

1.1 Analysis of the Ear
The ears are paired sensory organs comprising the auditory system involved in the detection of sound, and the vestibular system, involved with maintaining body balance/ equilibrium. The ear divides anatomically and functionally into three regions: the external ear, the middle ear, and the inner ear. All three regions are involved in hearing. Only the inner ear functions in the vestibular-system[6].

II. TYPES OF HEARING DISORDERS
There are three types of hearing disorder, as follows:

2.1 Conductive hearing disorders[6] is related to damage within the ear canal, the tympanic membrane (eardrum), or the middle ear and is considered highly treatable. This occurs when sound is not able to pass correctly through the outer ear, or the tiny bones within the middle ear (ossicles) and thus cannot be registered as sound by the brain. Some of the factors that can affect conductive hearing disorder include:
1. Fluid build-up in the middle ear due to the flu, allergies, or infection, which prevents the ossicles from properly transmitting ear drum vibrations to the inner ear.
2. Any type of obstruction in the ear canal, such as wax build up or a foreign object.
3. Any infection of the ear canal that causes the canal to swell and partially or fully close.
4. Poor eustachian tube functioning so that pressure cannot equalize between the middle ear and outside air.
5. Congenital birth defects such as poor formation of the middle or outer ear.
2.2 Sensorineural hearing disorders: When hearing impairment stems from problems within the inner ear, this is considered Sensorineural Hearing disorder and is often due to nerve-related damage. Treatment options for Sensorineural Hearing disorder depend on the cause and can vary in success rate. Injuries resulting from noise-related trauma, an explosion for example, have shown to be responsive to medical therapy like corticosteroids which help to relieve swelling and inflammation of the cochlea hair cells. Success rates vary, however, when attempting surgical treatment for more extreme cases caused by trauma to the head, or abrupt pressure changes which may cause the inner ear to rupture. Common factors that can cause sensorineural hearing disorder include:

- Drugs that poison the auditory nervous system or auditory area of the brain.
- Excessive and prolonged exposure to loud sounds.
- Congenital birth defects where the inner ear, auditory nerve, or auditory area of the brain are malformed.
- Direct damage caused by head trauma or tumors.

2.3 Mixed hearing disorder: Mixed hearing disorder occurs when there is damage to both the inner and outer ear and an individual experiences symptoms of both Conductive and Sensorineural impairment. Since symptoms can span the full spectrum, causes vary to the same degree. When seeking treatment, medical professionals recommend attending to the Conductive Hearing Disorder first as and attempts to repair inner ear damage may be moot if damage to the outer ear prevents sound from passing through successfully.

III. PURPOSE OF ALGORITHM IN CLASSIFYING HEARING DISORDERS

3.1 Neural network model for optimizing vowel recognition by cochlear implant listeners:

In this, artificial neural network has been used for recognizing vowels for those patients who are using hearing aid in this research, they are suggesting usage of neural network for enhancing the reorganization of this machine which is called cochlear implant[1]. A neural network consists of an interconnected group of artificial neurons, and it processes information using a connectionist approach to computation. In most cases an ANN is an adaptive system that changes its structure based on external or internal information that flows through the network during the learning phase. Modern neural networks are non-linear statistical data modeling tools.

3.2 Wavelet packets and support vector machines:

In this, an application of wavelet packet transformation and support vector machine is used for detection of persons having different degree of hearing disorder which include normal hearing, high frequency hearing disorder, pantonal hearing disorder, the result of this paper have been promising and the test are in this paper is Transient Evoked Otoacoustic Emissions(TEOAE)[2] that is done on cochlea's outer...
hair cells when a normal middle ear is present. A series of transient stimuli (wideband clicks or chirps) are sent into the ear canal. The resulting TEOAE, coming from the inner ear through the middle ear, is measured in the ear canal between stimulus presentations. In less than a minute, a wideband assessment is achieved.

3.3 Schuknecht's typology:

In this, Researcher has reviewed Age-related hearing disorder (ARHL) with an emphasis on their relation to the framework advocated by Schuknecht. More than a classification scheme, Schuknecht's typology incorporates testable hypotheses about the bases of ARHL. Since there is presently no widely accepted competing framework, research in this area should be aimed at supporting, modifying, or replacing Schuknecht scheme. Only recently has our understanding of cellular changes and gene/environment interactions in ARHL achieved the level needed for hypothesis-driven experiments in this area[3].

3.4 Modified back propagation neural network:

In this, Researcher has been done for subjects who have been exposed to noise pollution to such extent that they disorder hearing capacity. In this research paper, they are trying to predict at which point the person will have permanent disorder of hearing if he continues to be expose to noise pollution. This is done by using modified back propagation network algorithms. BPNN learns by calculating the errors of the output layer to find the errors in hidden layers. Due to this ability of back propagating, it is highly suitable for problems in which no relationship is found between input and outputs. The gradient descent method is utilize to calculate the weights and adjustments are made to the network to minimize the output error[4].

3.5 Neural Network Classification Tree:

In this, Researcher has used integrated neural network, classification tree and intelligent search strategy to develop a novel neural network model, called neural network classification tree (NNCT), to reduce the computational complexity without sacrificing classification accuracy. NNCT has a tree structure, and each node contains a special neural network, called hint perceptron, to provide information for efficient search algorithm. In NNCT, we propose a definition of admissibility and a rule of maximizing dissimilarity to train the hint perceptrons with training samples. Simulation results show that NNCT, without degrading classification accuracy, has much less computational complexity than the regular neural networks[5].

IV. CONCLUSION AND FUTURE SCOPE

For doctors it is a challenge to find which hearing disorder class is the person suffering from even if the knows empirically by conducting various test that the person is suffering from a auditory problem. Therefore, to detect hearing disorder, it is necessary to develop a survey to understand what hearing disorder is and to develop a representative data set of hearing disorders. Then, to detect class of hearing disorder with high accuracy, it is required to create a classifier according to the results that helps the doctors to detect right class of disorder correctly.

REFERENCES

[1.] Chung-hwa chang, gary t.anderson and philipos c.loizou “A neural network model for optimizing vowel recognition by cochlear implant listeners.”
[2.] Hubert diet, Stephan weiss “Detection of cochlear hearing disorder applying wavelet packets and support vector machines”.
[3.] Ohlemiller, Kevin K, Age-related hearing disorder: the status of Schuknecht's typology.2004