

Phonological Disorder Identification in Children Using Artificial Neural Network Techniques

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Abstract - Education is the important tool for everyone's life. India as a developing nation requires citizens who are capable of converting it to a superpower nation, but as a hindrance to this phenomenon, most of the children are facing a disorder called PHONOLOGICAL DISORDER or Speech Sound Disorder (SSD) that affects the education, self-confidence, career, and health of a child. In the current world circumstances the shortage of Speech-Language Pathologists (SLP), is a major drawback. Computer-based speech therapy is needed to provide new and innovative means of treatment to the children with SSD. This paper presents some literature survey based on phonological disorder characteristics and computer-related technologies for the identification of this disorder. Data mining concepts and machine learning techniques are the technologies used for the identification of the disorder. This survey also includes some artificial neural network technologies that we are going to incorporate in our future works.

Keywords: Phonological disorder, artificial neural networks, Speech Sound Disorder, Speech-Language Pathologists (SLP)

I. INTRODUCTION

Phonological disorder results when a child lacks the ability to produce sounds that are necessary for speech that is commonly used in his /her age. Phonological disorder is also known as articulation disorder, developmental articulation disorder, or speech sound production disorder. The cause of the phonological disorder is mostly unknown, but if the cause is a neurological origin [4], the names dysarthria or dyspraxia are used. There are many systems that use manual statistical methods for the identification of this disorder [5]. Basic artificial neural network algorithms to train the neural network will leads to a quick classification of dataset values. Nowadays ANN techniques and machine learning algorithms becomes very popular in the field of disease prediction [2] [3].

Data mining is the subjective procedure of categorization through huge datasets to recognize designs and set up connections to tackle issues through information explanatory reasoning. Data mining domain uses an effective concept called Artificial Neural Networks for classifying the data. The basic ANN structure has been shown in fig.1

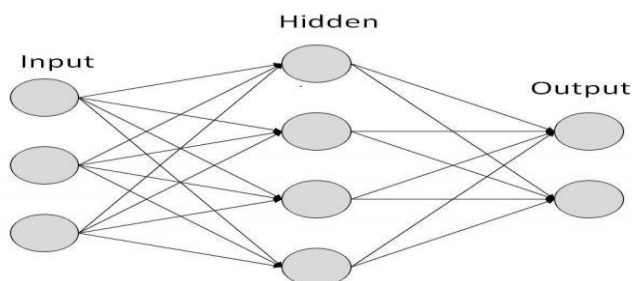


Fig.1 Basic ANN structure

II. LITERATURE SURVEY

There are several literatures that surveyed preschool children [6] [14] & [15] for predicting the Speech Sound Disorder. The researchers in the field of speech language disorders described speech inconsistency management methods [5]. A famous tool for the phonological disorder identification called ASHA [13] was also developed in the year 2016. The following Table1 compared several literatures that used artificial neural network techniques for the disease predictions, and some of the references will explain the characteristics needed to predict the phonological disorder. The table compared the methods of all the literatures and provides details about the software used in those systems.

III. PROPOSED SYSTEM

The system proposed here will collect the details from the students. Then the students will be asked to pronounce some selected words and their pronunciation audio will be recorded. The recorded audio will be preprocessed by removing noise from signal using ZCR(Zero crossing Rate) mat lab code. The value of PCC [9] (Percentage of Consonant Correct) and several other characteristics will be determined from the preprocessed audio signal. A dataset will be build using the acquired characteristics. This dataset will be used to train the artificial neural network; to classify the values after the classification of the dataset the accuracy of the algorithm will be determined using several error rates such as Mean Square Error (MSE). Overall system architecture will be as follows,

Table1 Literatures Comparison

TITLE	DESCRIPTION	METHODS & SOFTWARES USED
Design of Rheumatoid Arthritis Predictor Model Using Machine Learning Algorithms. In: Cognitive Science and Artificial Intelligence. SpringerBriefs in Applied Sciences and Technology. Springer, Singapore [7] Author Shanmugam S.et.al. Year: 2018	This paper examines the machine learning techniques and data mining in the prediction of a disease called rheumatoid arthritis. Several factors obtained from the physicians about the patients were used for the prediction methodology. The results obtains from this study was considered very useful in the prediction of rheumatoid arthritis	Matlab and Artificial neural networks
CLASSIFICATION OF EMOTION FROM EEG USING HYBRID RADIAL BASIS FUNCTION NETWORKS WITH ELITIST PSO [12] Authors: Sreeshakthy. M, et.al. Year: 2015	Feeling assumes an essential part of a few exercises in the present world. Human basic leadership, intellectual process, and collaboration between human and machine all these exercises rely upon human feelings. Outward appearance, melodic exercises, and a few methodologies are used to locate the human feelings. In this paper, EEG is utilized to locate the exact feeling. The arrangement of the human feeling is a procedure that unions the element determination and gives the class names to the information. The proposed work has four phases which incorporate preprocessing, highlight extraction, include choice and characterization. This paper utilizes a Radial Basis Function Network prepared by Evolution calculation and Swarm Optimization is utilized to choose the specific highlights in the element determination process. The consequence of the system will characterize the human feelings into excitement and valence feeling. In view of the characterization, diverse feeling level exactness must be approved.	Matlab and Artificial neural networks
PATTERN RECOGNITION USING SPIKING NEURAL NETWORKS WITH TEMPORAL ENCODING AND LEARNING [11] Authors: Dhilipan. et.al. Year : 2015	Pattern Recognition assumes a critical part in a few exercises like discourse confront, character recognition. Patterns are perceived utilizing Spiking Neural Networks. Regularly neural systems are utilized as a part of scientific basic leadership process and psychological process. Spiking neural system with cracked incorporate fire neurons is utilized to perceive the examples. Spiking neural systems process diverse sources of info and deliver the exact and quick acknowledgment of the specific pattern. In this paper iris informational collection must be taken to arrange those patterns.	Matlab and Artificial neural networks
THE USE OF SEVERITY MEASURES AND SPEECH INCONSISTENCY IN CHILDREN WITH SPEECH SOUND DISORDERS [1] Authors HaydéeFiszbeinWertzner, et.al. Year : 2013	This study classifies preschool children with the phonological disorder and without the phonological disorder. The authors used several phonological indices for the identification of this disorder. The infantile language test has been used to calculate the phonological processes and the indices PDI, PCC-R, IRS, IRO, and IRD. These indices have their own formulae and the values were determined. The speech inconsistency index has been determined using the Speech inconsistency test. Finally, the data were evaluated statistically. The researchers have gathered several preschool children for gathering the details required for the study. Here they referred this disorder as speech sound disorder (SSD). Among several indices, the percentage of consonants correct is considered to be efficient indices for the identification of this disorder. In order to define these indices, they have used picture naming test and the imitation test.	Manual statistical methods no software is used

<p>COMPUTERIZED ASSESSMENT OF PHONOLOGICAL PROCESSES IN MALAYALAM (CAPP-M) [8]</p> <p>Author: N. Sreedevi, et.al.</p> <p>Year: 2013</p>	<p>This paper presents such an instrument named Computerized Assessment of Phonological Processes in Malayalam (CAPP-M). In view of the articulatory procurement standards acquired from 120 Malayalam talking kids in the age scope of 2-3 years, the word jolts were chosen for the System. The tool was observed to be touchy to the discourse creations of youngsters with this correspondence issue moreover. Hence, CAPP-M can be a snappy screening device for programmed and simple examination of the discourse sound mistake designs in kids with Malayalam as their local dialect. The present examination created indigenous programming for the appraisal of phonological procedures.</p>	<p>Adobe AIR to run this CAPP-M software</p>
<p>WORKING MEMORY IN CHILDREN WITH READING DISABILITIES [16]</p> <p>Authors Susan Elizabeth Gathercole, et.al.</p> <p>Year: 2005</p>	<p>This examination researched relationship between working memory (estimated by complex memory errands) and both perusing and science capacities, and in addition the conceivable interceding variables of liquid knowledge, verbal capacities, here and now a memory (STM), and phonological mindfulness, in an example of 46 6-to 11-year-olds with perusing inabilities. The seriousness of perusing troubles inside the example was altogether connected with complex memory, dialect, and phonological mindfulness capacities, while poor science capacities were connected with complex memory, phonological STM, and phonological mindfulness scores. These discoveries recommend that working memory abilities listed by complex memory assignments speak to a vital imperative on the procurement of expertise and learning in perusing and arithmetic. Conceivable components for the commitment of working memory to learning, and the suggestions for instructive practice, are considered. The motivation behind this examination was to research the degree to which hindrances of working memory adds to the seriousness of the learning challenges experienced by kids with perusing handicaps. Albeit close connections between memory work and numerous parts of learning and scholastic accomplishment in unselected examples of kids are entrenched, how much working memory work compels learning progress in youngsters with learning inabilities is less surely knew.</p>	<p>Manual statistical methods no software is used</p>

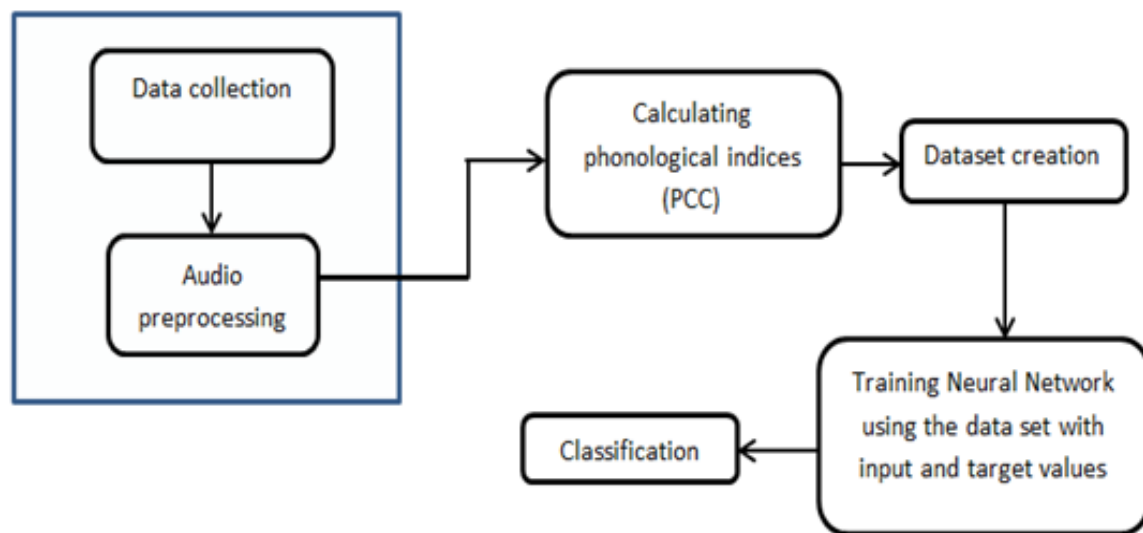


Fig.2 Architecture of the proposed system

Fig.2 shows the architecture diagram of the system, in which the data required for the classification process will be collected from the students and it will be preprocessed. The audio signal which has been preprocessed is used for the identification of the phonological characteristics and the calculated values are converted into a dataset. By using several artificial neural network algorithms the dataset will be classified and the children with the phonological disorder will

be identified. At last, the efficiency of each neural network algorithms will be evaluated and the best one will be chosen for the project.

IV. CONCLUSION

The system proposed here will make use of the artificial neural network to classify the dataset thus overcoming the disadvantage of the statistical methods in case of larger

datasets. Incorporating the computer technologies into the communication domain will certainly lead to a productive learning process. Artificial neural networks can be effectively used for the classification of dataset instead of statistical methods. From the collected survey the existing systems for the phonological disorder identification uses manual statistical methods. The old methods are very tedious and difficult to handle huge dataset values. Hence the Artificial Neural Network technology of Data mining domain will be used for the proposed system

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