

# Study and Analysis of Stuttering Problems Using Artificial Intelligence Techniques

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## ABSTRACT

*Speech is a sequence of number of movement of the muscles that changes their shape to create a basic tone of voice, so that one could understand and easily communicate with others. Many people suffers with the problem in the fluency in the speech, such problems are called stuttering. Major progress is made in the field of biology and technology. There are many type of stuttering like involuntary repetition of the same words and prolongation of the sounds, syllables, words or phrases, and silent pauses in between of the sentences, each of the type is cured in different manner. There have been many researches already done on this problem previously. Usually it is very difficult and complex to classify and categories the speech disorders but, there are many categorisation techniques which could be used to categorize such speech and evaluate the problem like Artificial Neural Networks (ANN), Hidden Markov Model (HMM) and Support Vector Machine (SVM).*

## 1. Introduction

### 1.1 Speech in our daily life

Speech is the most habitually and widely used form of communication between human beings. There are number of languages in the world that are been spoken by us for the communication. Researchers are trying to develop the system which can analyse and classify the speech signals. The computers are been used in many sectors like agriculture, health care and government. Speech recognition refers to the capability to listen the spoken words identifies various sounds present in it, and recognizes them as words of some known language. It's been a dream goal of the researchers to make machine that could recognize the language automatically. Even though, we have many of the intelligent systems that can recognize and give the meaning of those languages and even after so many research works have been done it is far away from getting the goal of making an intelligent machine that could perform the voice processing so properly in every virtue like from different people and different languages.

### 1.2 Challenges in the stuttering problem:-

A huge portion of the world's population suffers from many speech disorders for example whispering, lisping, mumbling, cluttering, and stuttering and many other. One of the biggest challenges is to differentiate between the normal speech and disordered speech. The problem of the speech stuttering is dealt under the field of the speech pathology. It is observed that the symptoms of the stuttering are found in males four times more than the females. Stuttering is the subject of interest for the researches from different domains like speech pathology, psychology, speech physiology, acoustics and signal analysis.

Different types of stuttering:

The most common types of stuttering are:

1. Interjection
2. Revisions
3. Incomplete phrases
4. Repetition
5. Prolonged sounds
6. Broken words

### 1.3 Cause and cure for the stuttering

In the beginning the stuttering was the problem that was considered under the neurologic trait. The main reason due to which the stutter suffers from the dyfluency in the speech in biological term is when the larynx muscle which is responsible for the opening and closing of the vocal cords is not working properly. According to the studies because of the less blood flow there is considerable increment and decrement in the electrical signals in the brain which is responsible for the generation of the voice. Therefore the stuttering cannot be cured for the long time all the stutter can do is to practice to give shape to their voice so that it could sound like fluent speech.

## **2. Literature Review**

Stuttering is a disorder of speech communication. In last 2 decades, there are a lot of researches being done on stuttering recognition. There are 3 major classifiers used to classify types of dysfluencies and also between stutterers and non stutterers. Three classifiers are ANNs, HMMs and SVM. Each classifier provides different accuracies where HMM is proven to give highest accuracy 96%, then SVM yielded 94.35%, while ANNs achieved an accuracy of 94.9%. Accuracy of stuttering recognition may be improved by using other feature extraction algorithm like Linear Predictive Cepstral Coefficient (LPCC) or (Perceptual Linear Prediction) PLP or other classifier like  $k$ -nearest neighbor ( $k$ -NN) or determinant analysis which may improve the accuracy and overall performance of stuttering recognition system.[3]

During the study it was observed that technique has some limitation, sometimes reliability and performance of the system is affected. It was also observed that the maximum work in the area of Automatic Speech Recognition is for English language. Less work has been carried out for Indian languages. Even the recognition rate for the ASR is higher for English language than any other language. The recognition rate for the Indian language is very low due to the phonetic nature of Indian language. It was also observed that the researchers have tried single techniques for the recognition; there is a need to develop hybrid approach which may give better performance for the development of robust speech recognition area. This paper provides the comparative study of the commonly used feature extraction techniques for speech recognition. This paper will help the researchers willing to work in the area of speech recognition know the basic difference between the discussed feature extraction techniques [2]

From experimental results, it can be concluded that the designed speech recognition system can recognize the voice command well. The best recognition rate that can be achieved by the system is 100% and it is achieved by the system using 15 samples per command and 40-50 observation symbols of HMM. This achievement is reach with condition silent environment and consistent utterance. These conditions are drawback of the system. For further development, it is necessary to improve the system so that it can run well in the noisy environment. It must robust to the noisy environment.[4]

The objective approach has an advantage over the manual, which provides consistence measurement required for assessment of stuttered speech. The number of dimensions (multi dimension) plays a key role in objective assessment of stuttering. The purpose of this paper is to analyze the multidimensional MFCC features and identify which dimensional provides better accuracy. In our work 10 samples in the age group of 25 – 30 years were collected. In which 80% were used for training and remaining 20% for testing. The MFCC features of 12, 13, 26 and 39 dimensional MFCC are compared and it is found that 39 dimensional MFCC are better for assessment of stuttered speech objectively, with 84.58 % accuracy. The 39 MFCC separate the two classes of data more precisely than the other multidimensional MFCC. Therefore for objective assessment of stuttered disfluencies, the 39 dimension MFCC feature vector obtained for each syllable performs better than other multidimensional feature vectors. Compared to earlier methods which uses Artificial Neural Network (accuracy 78%) and Hidden Markov Model (accuracy 81%), the present work using 39 dimensional MFCC provides better results with 84.58%. Due to this improvement the work done to obtain result in may be improved further. As a future work to check for improvements other feature extraction methods like IMFCC (Inverse Mel Frequency Cepstral Coefficient) may be tried. [5]

Syllable repetition is one of the important parameter in assessing the stuttered speech objectively. The existing method which uses artificial neural network (ANN) and Hidden Markov Model (HMM) requires high levels of agreement as prerequisite before attempting to train and test to separate fluent and nonfluent. We propose automatic detection method for syllable repetition in read speech for objective assessment of stuttered disfluencies which uses a new approach and has four stages comprising of segmentation, feature extraction, score matching and decision logic: Segmentation is assisted manually which is tedious but straightforward. Feature extraction is implemented using well known Mel frequency Cepstra coefficient (MFCC). Score matching is done using Dynamic Time Warping (DTW) between the syllables. The Decision logic is implemented by Support Vector Machine (SVM) and compared with our previous work which uses Perceptron method. The proposed objective approach has an advantage over the manual (subjective), which provide consistent measurement required for assessment. The assessments by human judges on the read speech of 15 adults who stutter are described. 80% of data are used for training and 20% for testing. The average result was found to be 93.45%, which is better than our previous work [80.78%] using HMM.[6]

Stuttering is fluid impairment in verbal speech which will be determined based on the involuntary repetitions and prolongations, either vowel or voiceless. A variety of methods is Available to aid patients who suffer from stuttering. One of the treatment methods is using the DAF (Delayed Auditory Feedback) device, the patient hear his/her voice after few delays. DAF (Delayed Auditory Feedback) trains patients to speak fluently by playing back the patient's voice after some delays. DAF plays the person's own voice back to them, and they hear it with a slight delay, usually about one tenth of a second later. The aim of the paper is to design DAF in order to cure stuttering and relief patients from stresses that caused by stuttering. In this article, we have used AVR ATmega128 to design DAF in this aim. Microphone is also used to take the analog samples and A/D converter is used to convert analog to digital signals. Finally, the small "anti-stuttering" device that uses hearing aid technology to deliver Delayed Auditory Feedback (DAF) will be designed.[7]

### 3. Conclusion

Speech is one of the most used ways of communication for humans. When a person suffers from the disorder in the speech fluency that problem is called stuttering. In this paper a survey and analysis have been done. Through the survey it is observed that people suffer from different type of stuttering features like prolongations, blocking and interjections. This research helps in figuring out the features which could be used in differentiating and characterising the difference between simple voice and stuttered voice.

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