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Analysis and Recognition of Stammering on "I Split It"

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***Abstract*—In this paper we propose a model which is useful for stutterers to communicate and also for the clinician to assess the stutterer. One percentage of total population is facing with the problem of stuttering/Stammering. The complete model consists of three blocks: Speech to Text Conversion (STC), Text Analyzer (TA) and Text to Speech Conversion (TSC). In these blocks we assume that the STC and TSC are available and we concentrate on TA. In this approach Repetition (R) and Prolongation (P) which is the characteristic of stuttered speech is identified along with number of R and P by the TA. The number of R and P helps the clinicians to check the severity of stuttering. The data used in present work is the text data, where all the four possibilities of speech data that can be produced by the stuttered with R and P is simulated and analyzed. This approach is analyzed on semi automative based with dictionary approach and the result obtained for simulated data is 100%.**

***Index Terms*—Stuttering, Stammering, Repetition, Prolongation, Dictionary;**

I. Introduction

Stuttering also known as stammering in the UK is a disorder of speech [1].

The different type of disfluencies that employed in stuttering are: 1. Interjections that is an extraneous words and sounds like "uh" and "well". 2. Revisions is the change in the content or grammatical structure of a phrase or pronunciation of a word as in "there was a young dog, no, a young rat named Arthur". 3. Word repetitions. 4. Part word repetitions. 5. Prolonged sounds are the sound judged to be unduly prolonged. [2]. Stuttering is often associated with the "Repetitions". As described above, part word or syllabic repetitions are the defining elements of an early stuttering. The dominant features of Normal Nonfluent (NNF) speech reported are: 1. Word Repetition, but not partword Repetition is a prevalent feature of early stuttering [3]. 2. In an early stuttering, there is a very high proportion of Repetition (R) in general, as opposed to the other types of disfluency similar to the prolongation (P) [4]. Stuttering sometimes referred to as stammering or diffluent speeches are the speech disorder. When the children start learning to speak they repeat the words which is different form normal repetition of words. The normal development of stuttering might occur when the child ages is between 18 months to 5 years. This includes the repeating words or phrases, the poor pronunciation of words, and leaving out words or sounds, speaking some words that are hard to recognize. There are many types of stammering, including the following: a) Developmental stammering, this is the most common type of stammering which occurs in the children's. As their speech and the language processes are developing [5]. b) Neurogenic stammering, neurogenic stammering is also a common disorder that occurs from signals problem between the brain, nerves and muscles [5]. c) Psychogenic stammering, psychogenic stammering is believed to originate in the area of brain that directs the thought and reasoning. This type of stammering may occur in people with mental illness, or those who have excessive mental stress or anguish. Although stammering may cause an emotional problem, it is not believed to be the result of an emotional problem [5]. In this paper we consider R and P as the major characteristics feature of stammering.

II. Methodology

A Semi automated Model is developed to identify and remove the Repeated words and Prolongation from the Stuttered speech. The approach developed was tested on a sentence, "I split it", which contains three words. The stutterer would have produced these words with the following four possibilities: a) no R and P: I split it, b) only R: I I I split it, c) only P: I ssssplit it, d) both R and P: I I I I sssplit it. Before the analyzer is tested for all the four possibilities, the dictionary is loaded with all the three fluent words I, split, it. If the input given contains the words which may or may not be repeated is identified by comparing the given text data with dictionary. Once the word is identified it is compared with the next adjacent word to identify the R and increment the comment towards it. With this the number of R is identified. If the input given is not fluent (prolonged data), that data will not be available in the dictionary, later character by character comparison takes place, to identify the P. Once the R and P is detected the similar approach is use to eliminate the R and P words. The similar approach is used to delete the repeat words and characters in the given simulated text data. The Complete Model is as shown in the Fig. 1. The semi-automated model is as shown in the Fig. 2.

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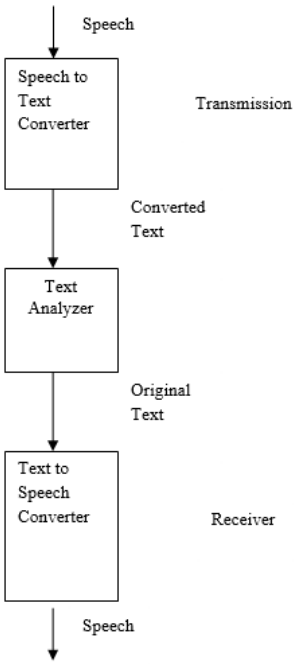

Fig. 1. Complete model for long distance communication

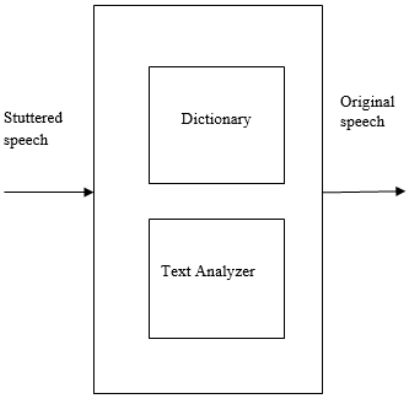

Fig. 2. Semi-automated model

By taking Stuttered speech, the Dictionary and Text Analyzer generates original speech in the file called log details by displaying number of source words, destination words, Repetition words and prolongation as shown in the Table-2.

III. Results

The recognition was carried out on test files to identify and remove the repeated words and prolonged words created. The results are as follows:

A. *Test Data-1*

TABLE I (A)
INDICATING TIME TAKEN BY EACH WORD

Words	I	Split	It
Duration in milliseconds	0.8-1.2 (0.4ms)	1.6-2.1 (0.5ms)	2.5-2.8 (0.3ms)

Input: I split it, Output: I split it

B. *Test Data-2*

TABLE I (B)
INDICATING TIME TAKEN AND DELAY WHICH MAY BE PRODUCED DURING LONG DISTANCE MOBILE COMMUNICATION

Words	I	I	I	Split	It
Duration in milli seconds	0.6-1.0 (0.4ms)	1.4-1.8 (0.4ms)	2.05-2.5 (0.45ms)	2.7-3.2 (0.5ms)	3.6-3.95 (0.35ms)

Input: I I I split it, Output: I split it

C. *Test Data-3*

TABLE I (C)
INDICATING TIME TAKEN AND DELAY WHICH MAY BE PRODUCED DURING LONG DISTANCE MOBILE COMMUNICATION

Words	I	sssplit	It
Duration in milliseconds	0.5-1.0 (0.5ms)	2.2-2.8 (0.6ms)	3.1-3.45 (0.35ms)

Input: I sssplit it, Output: I split it

D. *Test Data-4*

TABLE I (D)
INDICATING TIME TAKEN AND DELAY WHICH MAY BE PRODUCED DURING LONG DISTANCE MOBILE COMMUNICATION

Words	I	I	I	I	sssplit	it
Durati-on in msec	0.5-0.9 (0.4ms)	1.2-1.7 (0.5ms)	1.9-2.3 (0.4ms)	2.7-3.1 (0.4ms)	3.6-4.6 (1.0ms)	4.8-5.2 (0.4ms)

Input: I I I I sssplit it, Output: I split it

The waveform and spectrogram for all the four possible sentences are shown in figure4.

From Table-I (A) it is clear that due to absence of R and P there is no additional delay. Whereas from Table-I (B) R of I as occurred which introduces a delay of (0.4+0.45)ms plus silent interval of (0.25+0.20)ms with total additional delay of 1.30ms. Similarly from Table-I (C) and I (D) P and combination of P and R as occurred respectively which has introduce an additional delay of 0.9ms and 2.4ms. The Fig. 3, shows the bar chart of input and output of semi-automated model which can be used for analyzing a TA.

TABLE II
TEST DATAS

	Source Words	Destination Words	Repetition Words	Prolongation Words
Test Data-1	3	3	0	0
Test Data-2	5	3	2	0
Test Data-3	3	3	0	1
Test Data-4	6	3	3	1

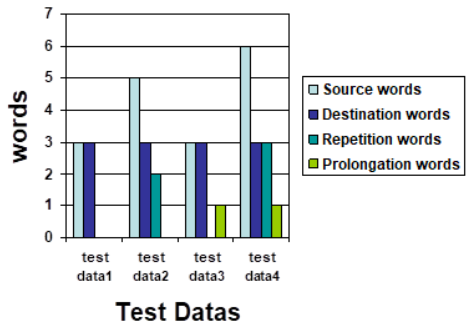

Fig. 3. Showing bar chart of input and output of semi-automated model

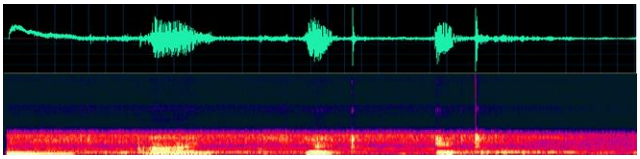

Fig. 4 (a). Waveform and spectrogram for test data-1

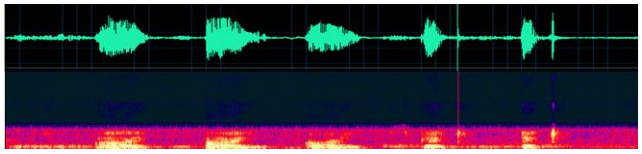

Fig. 4 (b). Waveform and spectrogram for test data-2

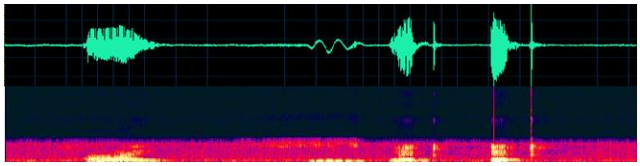

Fig. 4 (c). Waveform and spectrogram for test data-3

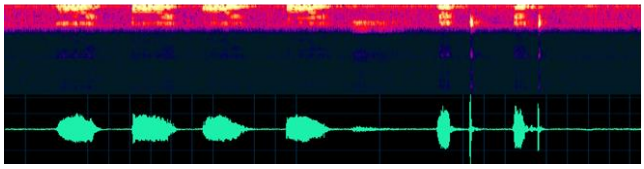

Fig. 4 (d). Waveform and spectrogram for test data-4

IV. Future Work

The model may be tested for standard passage like all phoneme passage and Rainbow passage and its accuracy may be verified as future work.

This Model can be enhanced to fully automated model by interfacing speech to text and text to speech convertor.

V. Conclusion

In this paper a semi-automated model for eliminating repeated words and prolongation from the stutter speech has been implemented and the results are shown in the table 1and 2 for different text inputs. The delay introduce during recognition of R and P and also by eliminating them from the stuttered text introduces a very few msec delay, which is in acceptable range. The results can be verified with large number of data/passage by using a dictionary with all the possible word. Present work is implemented by using object oriented concept, as the object oriented model help us to enhance without affecting the current model.

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