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Mobile App Based Feature Extraction of a Speech Signal

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Abstract – Mobile phones are very much prevalent in today's generation. They can be utilized in the diagnosis and treatment of many diseases. The traditional methods which are used for the diagnosis of the vocal cord disorder are usually invasive, expensive and slow. Sometimes, they are also annoying. So the purpose of this paper is to design a non-invasive technique for the feature extraction of speech signal which can later be used for the vocal cord disorder diagnosis which would be cheaper, faster and repeatable. This paper summarizes a study of the mobile app based technique used to extract features of a speech signal with an ultimate aim to discriminate and detect vocal cord disorder. The study is concentrated in the analysis of relevance of a set of features obtained from the analysis of phonated speech, specifically an open vowel as \a\. The features which are extracted for the mobile app are frequency, pitch, amplitude and jitter.

Keywords *- frequency; pitch; jitter; vocal disease*

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I. Introduction

Due to importance of speech in community relations establishment and the effect of larynx in speech, correct and timely diagnosis of vocal cord disorders is very necessary. The interest of the researchers in medicine science and processing signal has been focused to non-invasive methods for the detection of various diseases such as vocal cord disorders. The main reason of this shift to non-invasive methods from invasive methods are tolerance and speed i.e. more tolerable to the patients and the result is quickly achieved. The other reasons for the use of such methods include easy implementation and less costs. Therefore, techniques that are capable of drawing conclusions from a sample of recorded voice are of particular interest for the diagnosis as compared to other invasive ones such as exploration by laryngoscopes, fiber scopes or video endoscopes, which are less comfortable for the patients. Some of the diseases affect the human voice. Therefore, sound signal processing methods could prove to be quite effective in detecting many diseases especially vocal cord disorders. The early detection of different types of disorders through non-invasive methods can help in faster and accurate treatment of patients. In general, the benefits of using signal processing methods in non-invasive method is that it does not require expensive equipments to record a signal recording can be done only using a microphone. Therefore, these methods allow us to determine the possibility of such diseases in the initial stage while in the next stage it is possible to define the type of disease for their proper treatment.

In this paper, an effective feature extraction method using Android app based on JAVA has been discussed to investigate voice signals of patients suffering from laryngitis and dysphonia. Voice analysis is a very popular tool for assessing the information about the voice disorders. It might help in getting relevant idea about the defects in apeech production system which will further help in diagnosis of the related disorders. Early diagnosis can help in proper treatment of certain disorders.

Tablets and mobile phones, which are very much prevalent in today's generation, can be utilized with the patients to diagnose the voice disorders and help them treated with music therapy. Students have already developed a mobile application for tablets to help older adults with disabilities more readily use the technology. They have produced apps and tested it with the dementia patients and provided facilities to meet the patients, family and caregiver needs & expectations. For example, a student produced an application named Candoo that uses Google's voice recognition and synthesis engine to navigate the web, provide the weather and give medicine reminder alerts. Another example included an application that allows families to electronically send photographs, video clips and music from anywhere to loved ones for enjoyment.

II. Collection of Data

For this study, the voice samples were taken from "Saarbrucken Voice Database" which is freely available on its website. The voice samples of healthy persons as well as patients suffering from voice disorders i.e. laryngitis and dysphonia were collected. Data collected includes a

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phonetic vowel \a\ spoken by the person in normal speech. Along with the data, the details which were recorded are:

(a) Sex (b)
Age group (c)
Health condition (type of disease if any)

Total numbers of speakers were 35 each from three groups.

III. Material and Methods

Material: Android Studio 6.1 was used for the development of the android app for mobile. It is an IDE(Integrated Development Environment) for the android platform. The reasons for choosing android studio were following:

- ✓ A rich layout editor that allows users to drag-and-drop UI components, option for layout preview on multiple screen configurations
- ✓ Built-in support for Google Cloud Platform
- ✓ Emulator to run and debug apps etc.

Method: Following steps were involved in making the android based app –

- Installation of the Android Studio 2.1.2 on windows 8.1 with 4GB RAM and 25GB free space in C drive.
- Open a new project.
  Under the menu 'quick start', click on 'start a new android studio project'. On the Create new project window name the app as 'BioEngg'.

- On the 'Create new project window' select the target android devices.

- Write the JAVA code for the app.
- Edit the welcome message on the main screen.
- Add buttons to the main activity.
- Create more activities.
- Write the button's method.
- Test the application.
- The app is ready for the basic functionality.

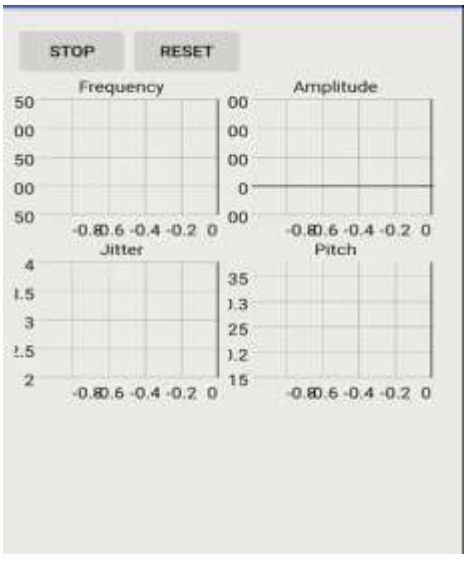
IV. Results and Discussion

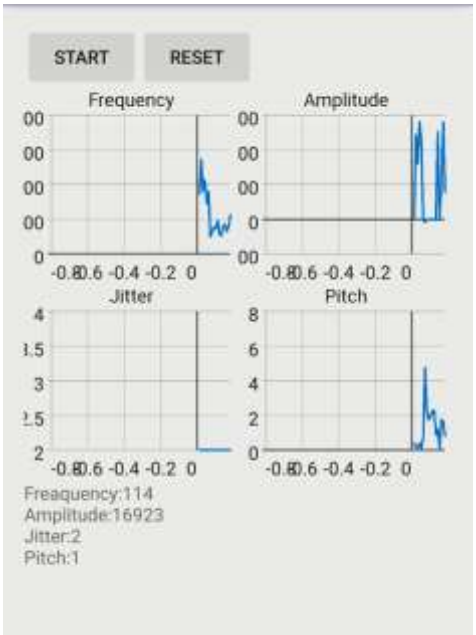
Frequency: The voice signal of a typical male adult person varies from 80 to 190Hz while that of a typical female adult person varies from 165 to 255Hz. Thus, the fundamental frequency of most speech signal falls below 300Hz. A term Formant frequency is also defined for speech signal as the spectral peaks of the sound spectrum.

Amplitude: A typical human voice is both amplitude modulated and frequency modulated. Amplitude may proved to be sufficient in speech recognition.

Jitter: Jitter is an acoustic characteristic of a speech signal. It is measured in terms of cycle to cycle variation of fundamental frequency. For a speech signal, a jitter value of less than 10Hz is considered to be negligible. It is an important feature in the detection of any kind of vocal cord disorders of a patient.

Pitch: Pitch in the speech signal is defined as the relative highness or relative lowness of the tone as perceived by the ear which is number of vibrations per second produced by the vocal cord. It is also the acoustic characteristic of a speech signal and is a very important feature in the diagnosis of vocal cord disorder of a patient.





V. Conclusion

The features like frequency, pitch, jitter and amplitude were successfully extracted using the android app. The results obtained were observed and analyzed. The results obtained from this method were found almost equal to the results obtained from the matlab method. Likewise, more features can be extracted using the same method.

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