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Development of Cyber Sign Language Interpreting App Program for Deaf

Sung-Hun Kim[1], Jin-Tak Choi[1] and Kil-Hong Joo[2*]

[1]Inchon National University, Inchon, Korea
e-mail : {pcmania, choi }@inu.ac.kr
[2]Gyeongin National University of Education
e-mail : khjoo@ginue.ac.kr

Abstract. As smart devices become more popular in the world, a lot of data is being shared. Since deaf people are not provided with sign language information, they are having a lot of trouble communicating correctly. In this paper, we implement a sign language analysis and emotional profile expression method using speech recognition and data mining according to the necessity of development of a sign language interpreter program for the deaf, through which the sign language interpretation service is provided through the app program, We also want to provide an environment where information can be acquired like the general public.

In addition, by providing a sign language interpreter app program, it is possible to create a moment of change that enables understanding and awareness of deafness.

Keywords: Deaf, Sign Language, Speech Recognition, Data Mining, Emotion Profiling, Sing Language App

1 Design and Implementation of Voice Recognition Based Real Time Online Sign Language Apps

In the present study, a voice recognition based real time online sign language app was developed to enable emotion recognition based real time sign language translation. To this end, in the present study, the work was performed with largely four modules: real time stream mining, emotion recognition profiling, sign language dictionary development, and sign language modeling. The real time stream mining module was designed to analyze vocabularies for homonym and emotion expression through stream mining techniques to provide accurate sign language interpretation results. The emotion recognition profiling module was designed to divide the expression of emotions into nine steps so that the deaf can recognize emotions quickly and accurately through emotion expression. The sign language dictionary app development module was designed to make vocabularies necessary for sign languages into a mini database called SQL Lite and insert it into the app to provide quick results. Finally, the sign language modeling was designed to enable easy expression of

* Corresponding Author

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complicated sign languages using easily recognizable characters. As for the entire flow of the voice recognition based real time online sign language app in the present study is as follows. First, when voice recognition has been performed, sentences are pre-processed in real time to identify vocabularies so that sign language expression can be performed. Thereafter, grid based stream mining is performed to process homonyms by comparing them with the word dictionary DB. Then, sign language words are extracted and compared with the sign language DB to express the words as sign languages through the voice recognition based real time online sign language app.

2 Real time datamining module

The voice recognition based real time online sign language app uses Google and the following voice recognition engine to extract sentences from voices or video inputs. The Google voice recognition engine for voice recognition uses the Android engine via online, and has become available offline after Jelly Bean. The Nuance SREC native engine used by Google is an open source voice recognition engine. However, it cannot be applied to the voice recognition based real-time online sign language app developed in the present study because it supports only English. In addition, the voice recognition activity developed by Daum can implement the voice recognition based real time online sign language app developed in the present study. However, it was excluded because it has a shortcoming of very low voice recognition rates. In the voice recognition based real time online sign language app, the voice data that came through Google's voice recognition module are stored as arrays and the voices are translated before being mapped on the sign language dictionary.

3 Emotion Recognition Profiling Module

People have diverse emotional changes. Much research is underway to recognize diverse human emotions. Diverse methods using bio-signals are used such as the central nervous system, the autonomic nervous system, face recognition, voice recognition, gestures, and texts. Many studies have been conducted to quantitatively measure emotions through these methods (McCheo, Whang, G. Y, Chang, S., Kim, 2004). As studies on quantitative measurement of emotions have been actively conducted, many emotion recognition systems have been developed. These systems infer emotions from the resultant data obtained from the user using diverse data mining techniques. Since the deaf deliver minute meanings through not only sign languages but also expressions and gestures during conversations, to express the emotions through the voice recognition based real time online sign language app, standards to analyze human voices to judge the stages of emotions and apply the results are absolutely necessary. When educational institutions or medical institutions translate voices into sign languages to express emotions, the meanings cannot be accurately expressed if there is no stage of emotions. Currently, diverse voice emotion recognition methods have been developed and the Gaussian Mixture Model (GMM),

Hidden Markov Model (HMM), Support Vector Machine (SVM), and Artificial Neural Network (ANN) are well known voice emotion recognition methods. Among them, based on the study results indicating that the GMM method is suitable for short section characteristics parameters, the GMM method is the most commonly used in voice emotion recognition systems [Kim, Ji-Eun (2012), GMM based voice/mixed signal classification using MFCC]. The GMM method employs a minimum classification error (MCE) technique based on a multi-modal system and performs optimized emotion recognition using discriminative weight training through the MCE technique.

4 Sign Language Dictionary Development Module

The development of a voice recognition based real time online sign language app can be largely divided into two parts. The first is to develop a sign language dictionary, which is the part to express sign languages for relevant words, and make the sign language dictionary into a database, and the second is to develop an app for the smart devices where the sign language dictionary is implemented. In fact, the sign languages used in sign language implementation are divided into grammar sign languages and natural sign languages according to sign language components and expression methods. The grammar sign languages involve changes in grammatical signs or words necessary according to the word order of letter languages, and the natural sign languages are spontaneous sign languages formed according to the ideas that arose from the minds of the deaf. In the case of the voice recognition based real time online sign language app, the sign language dictionary was made into a mini database and embedded into the app. When mapping sentences expressed through voice recognition on the sign language dictionary, using an online server has advantages in scalability and operational efficiency, but it has a drawback of low speeds. The DB was scaled down to construct the mini DB considering the characteristics of the app program that must express the sign language in real time. Once a sign language dictionary has been built, it is made into a mini-database in the app and is actually developed to enable rapid translation by storing it in the SQL Lite DBMS.

5 Development of the Voice Recognition based Real Time Online Sign Language App

The voice recognition based real time online sign language app is serviced in the form of app through smart devices. Recent smart device environments can be largely divided into Android device based environments and IOS device based environments. Although smart devices can be divided according to the screen sizes, since such divisions are again divided into detailed items according to whether they are Android based or IOS based considering the characteristics (screen size, etc.) of the devices, the operation systems, based on which smartphones are produced, are more important. Since Android smartphones are used by most people in South Korea to the extent that

the rate of use of them exceeds 85%, the voice recognition based real time online sign language app is developed based on Android devices. The voice recognition based real time online sign language app was programmed based on Java, which is a development tool that is the most commonly used now, and SQL Lite, which is the most commonly used on smart devices, was used as a database. The voice recognition based real time online sign language app consists of the following classes and the internal construction comprises the following; the CompareHangle class, which converts the initial, middle, and final consonants of Hangeul into filenames, or changes filenames into the initial, middle, and final consonants, the DBHelper class to help users use the database easily, the DBManager class that manages the database, the MainActivity class that contains major functions of the app, the ResultListener, which is an interface for delivering data to Google servers and processing the results, the SplashActivity class that defines the screen executed first, the SWfInfo class for obtaining information of swf files, the TempDataManager class that stores data for the re-replay button and previous content replay button used in the voice recognition based real time online sign language app, and the Unzipper class for decompressing of compressed files.

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