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Speech Recognition Technology: Improving Speed and Accuracy of Emergency Medical Services Documentation to Protect Patients

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Introduction

Emergency medical services (EMS) is responsible for taking care of civilians in the United States when a health-related emergency problem occurs. The personnel who carry out operations to assist the civilians in need of medical care are called first responders. In the EMS, first responders in ambulances respond to a variety of health emergencies, such as strokes, heart attacks, skeletal injury, burns, etc. From every emergency, the first responders must keep a record of what occurred, and this is done using health records. Today, many EMS personnel use the electronic health records system, because the electronic records are easily integrated into the hospital system that the first responders bring patients to, and are not as unorganized as the handwritten method, preventing the need for paper (Rubin, 2016).

However, with all documentation methods that require the recording of information, mistakes are prone to be made, especially in the hyper stressed environment that a first responder must operate in. Hospital errors such as mistakes in documentation are predicted to cause one sixth of the deaths each year in the United States (James, 2013).

Methods

Journal articles focusing on current speech recognition technology, and natural language processing techniques being applied to varying speech recognition algorithms and differing healthcare settings were studies for this research.

A Standardized Measurement System for Accuracy Testing is Necessary

A standard system for determining accuracy or error types needs to be set for all researchers to compare to. In addition, the implementation of a SR system must be field tested for longer in order to ensure that this technology will improve and not create errors in the patients' electronic health record.

Analyzing different error categorizing methods from various researchers showed that they used many different systems and definitions, making it difficult to compare the data to see how variables affected each SR system. There must be a standard set of error documentation in order for SR systems to be utilized confidently in the field.

Speech Disambiguation of Similar Phrases Can Improve Accuracy

SR software is unable to differentiate between phrases that are similar phonetically, and thus this is a source of error that changes the meaning of a sentence in a patient's electronic health record. Improving SR software through algorithms to detect subtle variations in speech will negate this source of error and make SR software accessible to EMS first responders to document health records.

Specific error examples of SR software included "couple ability" instead of the intended phrase "culpability," "more Raleigh" instead of "morally," "permission" instead of "omission" (Cheshire, 2013). Other researchers found similar errors in their studies of SR technologies.

SR is not sophisticated enough to differentiate between similar sounding phrases, and this could be compounded by the accents and speech variations of each voice. One way to differentiate between similar phrases is by using speech disambiguation through post processing algorithms.

The Bag-of-Words Technique

One such algorithm that will improve differentiation between similar words is the bag-of-words post processing method. The bag-of-words post processing technique groups similar phrases defined manually by users together as matches. This method is better suited for large amounts data compared to other natural language processing algorithms that use machine learning, such as support vector machine. Machine learning algorithms often require a text corpus, or group of words in order to train and base their processing methods off of.

The bag-or-words post processing technique is better suited for use in the EMS prehospital settings because it is simple, making it require less computational power than the other machine learning techniques. If applied to SR software, the bag-of-words algorithm has the potential to solve the problem of similar phrases by disambiguating the speech.

Filtering Background Noise

SR technologies must interpret the sounds and filter out background noise. Many methods are currently being developed to digitally filter out background noise, primarily through analysis and rearrangement of the spectral components of the speech patterns. The processing of the spectral components of the speech patterns have improved the understanding of background noise, so when the modified speech inputs are run through the SR software, that software will have an easier time deciphering the words (Mcaulay & Malpass, 1980).

Fewer Interruptions

Using SR software and natural language processing to input data into the health record will prevent first responders from being interrupted as much as using an interface such a computer with keyboard or pen. This will decrease medical intervention error and improve patient outcomes.

SR by itself will cause less interruptions in work flow than keyboard input because with the keyboard, the user is frequently scanning the block of text for any mistakes that might have been included in the report (Dela Cruz et al., 2014).

Conclusion

SR software can be integrated into current EMS documentation in order to help create more accurate electronic health records at a faster pace. SR software has already been used in everyday life, from the software on your mobile device, to an automated telephone system used by some companies. Yet, current studies have shown that SR software is not at 99% accuracy as claimed by some manufacturers. Therefore, SR software is not robust enough for immediate use in EMS settings.

However, because SR software can be improved by algorithms to increase accuracy through speech disambiguation with the bag-of-words algorithm and filtering out background noise through spectral preprocessing techniques, and because SR software decreases interruptions in work flow for first responders in emergency situations, this software is a good candidate to use in the future as a tool to fill out electronic medical records in order to improve on the efficiency, accuracy, and safety for patients of the EMS services.

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