Speech recognition in speech and language therapy

**Background:** Aphasia is the loss or impairment of language functions that occurs due to brain damage. This disorder affects the four linguistic modalities (speaking, understanding, writing and reading) in different combinations and levels of severity. More than 5000 people are affected by aphasia in Switzerland each year. Affected patients undergo face-to-face speech and language therapy (SLT). A key factor for a successful SLT is dose (length of the therapy session) and frequency. However, providing high dose frequency SLT is dependent on therapist’s availability and insurance coverage. Tablet-based aphasia tele-rehabilitation applications increase access to high frequency SLT while reducing costs. Together with the speech and language therapists of the University Hospital Inselspital, the Gerontechnology and Rehabilitation group has implemented a novel solution called Bern Aphasia Solution, which is composed of:
- a tablet-based application for aphasic patients that allows them to solve exercises of different types that target the affected language modality independently at home,
- a web-application for the speech and language therapists that allows them to assign exercises, track the patients’ progress and adjust the difficulty level based on the reported statistics.

A specific type of exercise focuses on the speech modality, where the patient has to repeat a word that is presented in a video depicting the speech therapist speaking the word. So far, the current system reports statistics regarding completion of the exercises but nothing about the quality of the speech uttered by the patient. This is currently assessed during the face-to-face meeting with the patient.

**Aim:** The aim of this project is to develop an algorithm to detect how correct the patient has repeated the word spoken by a speech and language therapist with the ultimate goal:
- to report in real time a feedback to the patient regarding how well he pronounced the word,
- to produce statistics for the therapist to optimize further therapy.

**Materials and Methods:**
Our database for this exercise type currently implements several thousands of audio-visually recorded spoken words by speech and language therapists. This data will serve as the baseline against which to test the words spoken by the patient. In order to develop the algorithm, first step will consist of completing the dataset with recordings of patients exercising the words. Recordings will be performed with conditions as close as possible to the targeted use in the Bern Aphasia Solution (i.e. different acoustic environments mimicking a use at home). Second step will consist of developing the algorithm to rate the quality of the repeated word by using machine learning techniques. This may also include adapting existing speech analysis technologies to this specific use case. In a third step, the algorithm will be transferred and included into the existing Bern Aphasia Solution and tested in a clinical study with patients.

**Nature of the Thesis:**
Development of the algorithm: 60%
Implementation of the algorithm in the App: 20%
Evaluation of the new exercise type: 20%

**Requirements:**
Basic knowledge in data analysis
Good programming skills
Interest to work with therapists and patients

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