Trinity Centre for Bioengineering

PHD RESEARCH POSITION IN NEURAL ENGINEERING

EARLY PREDICTORS OF SPEECH PERCEPTION AND PERFORMANCE IN COCHLEAR IMPLANT USERS

A cochlear implant (CI) can partially restore hearing in patients with severe to profound sensorineural hearing loss. However, the large outcome variability in CI users prompts the need for more objective measures of speech perception performance.

For a cochlear implant (CI) users to obtain a high level of speech perception the electrical stimulation, controlled via the speech processing strategy, must be adjusted or ‘fitted’ for each individual user. It is the task of the audiologist to fit the CI so that the user obtains the maximum level of speech perception. However, a number of factors make this a difficult task, which may result in less optimal fitting for that individual user. Currently, the audiologist adjust the speech processing strategy and ask the users if it ‘sounds better’ or carries out a speech perception test. This subjective assessment of speech perception is less than optimal.

Based on the recent findings from our laboratory into electrophysiological (EEG) based analysis of the brain’s response to acoustic stimuli, a method to assess acoustic processing in Cochlear Implant Users has been developed based on neuroimaging (EEG).

This project aims to further develop neural objective measures of speech perception in CI users. Such measures may be employed to optimize or streamline the fitting process and would be particularly useful in a paediatric population. In addition, a neural metric which predicts speech perception outcome before the CI user has fully adjusted to a new speech processing strategy (a process which can take months) would be extremely beneficial to the audiologist. It would allow the audiologist to optimize the speech processing strategy in a timely manner and identify users who may need extra rehabilitation at an early stage.

Measures of neural signals, such as evoked potentials, from structures such as the auditory nerve and brainstem are useful in estimating threshold levels but are unable to predict higher-level outcomes like speech perception. Evidence suggests that cortical evoked potentials may be more suited to estimate speech perception.

The specific objective of this project is to measure cortical response to complex stimuli, which probe a CI user’s spectral and temporal processing capabilities and thus develop a range of metrics, which correlate with speech perception.

The Neural Engineering Group within the Trinity Centre for Bioengineering invites applications for a PhD student position with specific signal processing skills and an interest in neural engineering. A scholarship is available. The PhD Researcher will be required to:

- Play a leading role in the development of novel theoretical ideas for analysis of biomedical signals, particularly EEG signals for the detection, analysis and classification of the brain’s ability to perceive sound.
- Participate in the specification, design and validation of new and improved linear and non-linear signal processing methods for EEG signals.
- Operate independently with weekly supervision.
- Write journal papers for publication on innovative methods for assessment of speech perception in Cochlear Implant users.
- Work with clinicians, audiologists, speech and language professionals to develop and evaluate new and improved signal processing of assessment of speech perception.
- Carry out experimentation in a clinical environment with Cochlear Implant users (children and adults)
- Prepare progress and technical reports on the research project.
- Work closely with internal Trinity Centre for Bioengineering research staff to develop and validate systems for the assessment of speech perception and to integrate these subsystems into a complete assessment of speech perception assessment system.

Key Requirements
The candidate must have an honours degree in Electronic Engineering (or cognate discipline) with extensive signal processing experience and be

- Familiar with signal processing tools and Languages (Matlab, C++, etc)
- Able to work autonomously, managing and reporting on their assigned project
- Work with clinicians, speech and language professionals to develop and evaluate new and improved signal processing of assessment of cognitive function.
- Experience in experimentation with patients desirable.

For an informal discussion, or to submit an application please contact Professor Richard Reilly (tcbe@tcd.ie). Applicants should submit a supporting statement, a CV, and the details of two recommenders. Application review begins August 2013.
Publications from our laboratory in this theme include

- M. Mc Laughlin, T. Lu, F.G. Zeng. Using a Cochlear Implant as a Recording Device to Measure Cortical Evoked Potentials. 35th Midwinter meeting of the Association for Otolaryngology, San Diego, February 2012.