SMART-PHONE BASED INTERFACE FOR COCHLEAR IMPLANTS

By Hussnain Ali

Cochlear Implants (CIs) serve as a benchmark technology in neural prosthesis for their high success rate in restoring hearing to the deaf and their growing and widespread use. According to the U.S. Food and Drug Administration (FDA), as of December 2010, approximately 219,000 people worldwide have received CIs. Comparison of these statistics to the year 2005 when there were about 110,000 implant recipients and the year 1995 when there were only 12,000 implant recipients, indicates the growing demand and satisfaction with the implant performance. Improvements in sound processor technology, such as size, power consumption, ease of use and reliability have played a significant role in the growth of CI uptake in the community.

Cochlear Implant Laboratory at The University of Texas at Dallas (UTD) is at the forefronts of CI research. Researchers at UTD have been trying to improve the hearing quality of the implant users by developing innovative sound processing algorithms and technologies. One of the breakthrough technologies they have developed is an interface to the implant using commercial smart phone devices. This pioneering work of Dr. Philip Loizou and his team at UTD is one of the first main-stream efforts to bridge consumer electronics with medical devices. This project is funded by a $2.5 million grant from the National Institutes of Health. The project enables researchers, clinicians and CI users to interact with the implant using ubiquitous smart phones and user-friendly applications.

The smart-phone based research platform allows the CI users to optimize their listening experience according to the environment. For example, in noisy environments with many sounds from different directions, cochlear implant users struggle to tease the words apart as all desired and unwanted sounds are heard at once. Speech intelligibility in such an environment requires a combination of advanced signal processing and user's customization of their processors. Now, imagine an app which implant users can use to provide their feedback and fine tune their listening experience in real-time. This gives CI users more control of their processors and hence allows them to communicate better in challenging environments. It may also save regular costly visits to the audiologists. In addition to this, smart phone apps particularly designed for training purposes help the implant users to improve their listening performance over time in targeted listening environments.
The smart phone based technology is also helping the researchers working in this area to design and conduct experiments with CIs with great ease and flexibility. The portable platform allows investigation of new ideas and long-term assessment of algorithms, e.g. by using it for take-home field trials. This has lead to quick development and evaluation of novel research ideas and algorithms for noise suppression, music perception and speech enhancement resulting in better listening experience for implant users. This is generating new research and findings on underlying hearing mechanism in cochlear implants which will have practical implications on future generation of implants. The platform is currently being tested by a dozen labs in the United States and it could be potentially used by thousands of people worldwide in the future.

**References**


2 National Institute on Deafness and Other Communication Disorders, “Cochlear Implants”, National Institutes of Health, Bethesda, MD, 2005


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