Online Proceedings

POSTER SESSION 2

Commons East, Easel 76

1:00 PM to 2:30 PM

Acoustic Simulation of Cochlear Implants

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Mentor: Kaibao Nie, School of STEM, UW Bothell

For more than three decades, the innovation of cochlear implants (CI) has improved the lives of patients who have trouble hearing sounds. Using the technology of signal processing, the device can provide electric sound to patients at various frequencies. One thing cochlear implant patients have trouble with is the ability to perceive music. Cochlear implants can provide good speech performance but lack the ability to encode music in a better way. Our research is designed to provide the ability for patients to enjoy music through its three facets: rhythm, pitch, and timbre. The purpose of our study is to investigate pitch coding in cochlear implants which is important for music and speech and the quality of life for CI patients. The ultimate goal of our research is to improve sound-processing in deaf or hard-hearing patients all over the world. We will have determined how to deliver the best acoustic simulations of cochlear implants to study pitch coding and identify the ideal combination of carrier type frequency, channel and envelope that will deliver optimal music perception of any sound entering the cochlear implant. Features will be extracted from the simulated sounds to investigate spectral and temporal coding in cochlear implants. This will help in finding new ways of processing music and speech in cochlear implants for the benefit of its users.

POSTER SESSION 4

Commons East, Easel 63

4:00 PM to 6:00 PM

Superiorized Algorithm for Reconstruction of CT Images from Sparse-View and Limited-Angle Polyenergetic Data

Jason Matthew (Jason) Winn, Recent Graduate, Mathematics (Bothell Campus)
Mentor: Thomas Humphries, School of STEM, Division of E&M, UW Bothell

Within computed tomography (CT), increased image quality comes at the expense of amplified radiation exposure to patients. To reduce radiation exposure, techniques have emerged which use iterative methods to reconstruct images from limited-angle or sparse-view CT data. Superiorization is a recently proposed framework which "superiorizes" an existing reconstruction algorithm with respect to some secondary objective function. As a result, superiorization can reduce artifacts in the reconstructed image caused by sparse-view and/or limited-angle data. Within certain constraints, the superiorization method guarantees a reconstruction which fits the data equally well as the original reconstruction. More importantly, superiorization is expected to produce an image with higher quality. Existing research within superiorization has been confined to reconstructing images given data generated from monoenergetic X-ray beams. Despite the promise of this existing research, polyenergetic X-ray beams are common in clinical settings and existing methods need to be extended to handle polyenergetic data. To this end, our research goal was to extend the superiorization method to reconstruct images from polyenergetic data, using total variation (TV) and anistropic total variation (ATV) as the secondary objectives to be superiorized. In addition to successfully reconstructing images from polyenergetic data, we also demonstrate our method is capable of reconstructing images with "missing" data which is a result of sparse-view and limited-angle scans. This research further extends the potential of utilizing iterative methods in CT and thus reducing radiation exposure to patients.