EMBC Workshop Proposal

Workshop Type (select one):

- [ ] Full Day Workshop
- [x] Half Day Workshop

Workshop Title:

Hardware-Embedded Neural Signal Processing Dedicated to High-Density Brain Implants

Workshop Organizer Name & Affiliation:

Amir M. Sodagar, York University, Toronto, Canada

Workshop Organizer/Speaker Name & Affiliation 1:

Amir M. Sodagar, York University, Toronto, Canada

Workshop Organizer/Speaker Name & Affiliation 2:

Mohammad A. Shaeri, York University, Toronto, Canada

Workshop Organizer/Speaker Name & Affiliation 3:

Workshop Organizer/Speaker Name & Affiliation 4:

Workshop Organizer/Speaker Name & Affiliation 5:

Workshop Organizer/Speaker Name & Affiliation 6:

Theme (Select one):

- (●) 01. Biomedical Signal Processing
- ( ) 02. Biomedical Imaging and Image Processing
- ( ) 03. Micro/ Nano-bioengineering; Cellular/ Tissue Engineering & Biomaterials
- ( ) 04. Computational Systems & Synthetic Biology; Multiscale modeling
- ( ) 05. Cardiovascular and Respiratory Systems Engineering
- ( ) 06. Neural and Rehabilitation Engineering
- ( ) 07. Biomedical Sensors and Wearable Systems
- ( ) 08. Biorobotics and Biomechanics
- ( ) 09. Therapeutic & Diagnostic Systems and Technologies
- ( ) 10. Biomedical & Health Informatics
- ( ) 11. Biomedical Engineering Education and Society
- ( ) 12. Translational Engineering for Healthcare Innovation and Commercialization

Workshop Synopsis— Max 2000 Characters

Brain-implantable microsystems for intra-cortical interfacing to the brain are nowadays of increasing interest in applications such as brain mapping, brain-machine interfacing, and prosthetic devices. When aiming at high-density neural recording and live streaming of the recorded information through a wireless link, the limited bandwidth of the wireless link becomes a bottleneck. To overcome the challenge, reduction and compression of the data being telemetered off the implant appears to be an effective solution.
This tutorial starts with an overview of brain-implantable neural recording microsystems. Then, design requirements and challenges of such devices is briefly reviewed. The tutorial subsequently focuses on the data reduction and compression techniques that enable a brain implant to concurrently telemeter intra-cortically sensed neural signals on tens to hundreds of channels to the outside world in the real time. In addition to their signal processing side, efficient hardware implementation of such techniques is discussed, which is of crucial importance when it comes to realize them on compact, low-power brain implants. Effective employment of compressive mathematical functions, temporal and spatial compression techniques based on discrete wavelet transform and other types of mathematical transformations, and spike detection, extraction, and sorting are among the major techniques that will be discussed.