Mark Iskarous – Forster Family Foundation Scholar

1st year scholar, PhD Candidate, Biomedical Engineering

Johns Hopkins University

Research:

Mark's research develops computational models to enable naturalistic sensory feedback of tactile stimuli to amputees through electrical stimulation of their residual nerves. In particular, the computational models will mimic biological processing to encode tactile stimuli as robust and efficient neural representations. This work will improve functional outcomes in their daily lives when using neural prostheses.

Describe the expected benefit of your research to society:

This research project is motivated by the goal of improving the lives of amputees through naturalistic sensory feedback of tactile stimuli. Today, prostheses rely on decoding user intention through measurement of neural or electromyographic (EMG) signals. The full potential of these sophisticated robotic devices cannot be realized without the incorporation of sensors that evaluate the environment and a way to seamlessly communicate with the user. Neural prostheses can enable this seamless communication by interfacing directly with the nervous system of amputees and stimulating the nerves in order to elicit sensations corresponding to the interaction between the prosthesis and the environment. To do this naturalistically, the analog readings from sensors incorporated into the prosthesis must be encoded into the language of the nervous system: patterns of spiking activity. My goal is to improve sensory feedback for amputees by exploring how information from tactile sensors can be transformed into neuron-like (neuromorphic) spikes to be used for stimulation feedback. I will examine how tactile sensing is encoded in biology and then phenomenologically recreate the signal processing chain in a computational system. This research will develop computational models to enable naturalistic sensory feedback of tactile stimuli to amputees which will improve functional outcomes in their daily lives. In particular, the computational models will mimic biological processing to encode tactile stimuli as robust and efficient neural representations. The bio-inspired techniques created in this work also will more broadly apply to the development of neural prostheses for other sensory modalities.

Career objectives:

My goal is to help improve the lives of those with disabilities through the creation of biomedical technologies that will help them reach their desired level of functional restoration while also respecting their autonomy and dignity. In particular, I want to develop devices that interface with and speak the natural language of the nervous system: neuronal spiking activity. I want to work towards this goal as a professor at an academic research institution doing research in neuromorphic engineering.