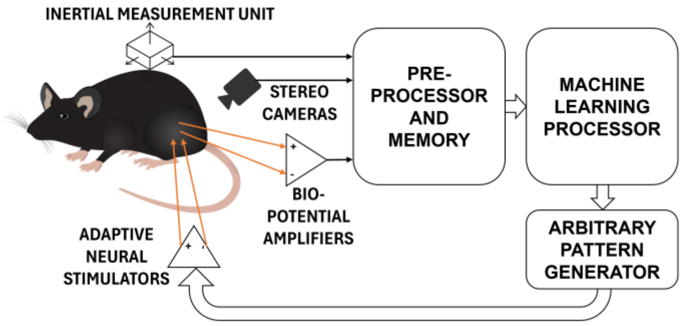
Project Title	**Machine Learning-Enabled Adaptive Neurostimulation for Patient-Optimized Biomedical Prostheses**
Supervisor	Prof. Roman Genov Department of Electrical and Computer Engineering (ECE)
Laboratory	Integrated Sensory Microsystems Laboratory (ISML), ECE, UofT
Project Description	 Figure: Envisioned adaptive neurostimulation system. We are designing the world's smartest and smallest neural prosthesis for bio-medical applications. The project aims to address unmet needs of intelligent closed-loop stimulation of a nerve for artificially controlling a paralyzed body. The above figure shows a system diagram. The collaborative team is developing a novel chip and associated methods for detection of muscle movement through an adaptive nerve stimulation, while automatically learning the best possible combinations of excitation and inhibition paradigms. The method will immensely contribute to the area of neural prostheses and other related applications. Students will participate machine learning algorithm development, testing, system integration and some integrated circuit (IC) design. Publications in high standard journals and conferences are inevitable. The project will be beneficial for cutting-edge skill and knowledge enhancement for the associated students.
Pre-requisite	Background/ affiliations in ECE/Eng.Sci./CS with experience/ interests in any two or more points: • Machine learning related coding (Python, Verilog, etc.) • PCB-level circuit design and hardware testing • IC layout • Analog, digital, or radio frequency (RF) designs • (Very important) Enthusiastic, independent learner, and strong soft skills.
Number of positions	3 (three) students
Contact	Sudip Nag (sudip.nag@mail.utoronto.ca) [and copy to Prof. Roman Genov (roman@eecg.utoronto.ca)]
References	[1] Xu, Jianxiong, et al. "Fascicle-selective bidirectional peripheral nerve interface IC with 173dB FOM noise-shaping SAR ADCs and 1.38 pJ/b frequency-multiplying current-ripple radio transmitter." 2023 IEEE International Solid-State Circuits Conference (ISSCC). IEEE, 2023. [2] T.D. Albarran, "Optimization of Temporal Interference Stimulation for Invasive Neuromodulation of Motor Neurons Using an In-Silico Sciatic Nerve Model," *M.S. thesis*, ECE, UCLA, USA, 2023. [3] R.B. Budde, M.T. Williams, and P.P. Irazoqui, "Temporal interference current stimulation in peripheral nerves is not driven by envelope extraction," *IOP J. Neural Engg.*, vol. 20, no. 2, Apr. 2023.