Biomedical Discussion Group

Deep Learning for Objective Assessment and Diagnosis of Neuromuscular Diseases

Thursday September 26, 2019
10:30 am - 11:30 am, East Campus 4 Boardroom (EC4-2101a)

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Abstract: Many neuromuscular diseases, including stroke, Parkinson's disease, amyotrophic lateral sclerosis (ALS), and Bell's palsy, affect the orofacial musculature, inducing devastating functional, communication, and aesthetical impairments. Afflicted patients may have difficulty blinking, manipulating food and liquids in the mouth, and expressing themselves verbally and nonverbally. A timely and objective assessment of the orofacial impairment can contribute to the overall disease diagnosis, lead to early interventions, and provide objective means to quantify the effect of therapeutic, pharmaceutical, or surgical interventions. Currently, orofacial assessment relies on clinical evaluations performed by experts, or on the use of reflective markers and motion capture sensors. However, these approaches are expensive, time-consuming, and their reliability depends on the expertise of a trained practitioner. Computer vision and machine learning have the potential of transforming the assessment, diagnosis, and treatment of diseases affecting the orofacial musculature. These techniques have provided new approaches to evaluate orofacial function that are objective, automatic, easy to use, inexpensive, and mobile. In this talk, I will discuss how machine learning is disrupting the assessment and diagnosis of neuromuscular diseases, the challenges that must be overcome before successfully translating this research into clinical practice, and what are some interesting future directions.

Bio: Diego L. Guarin completed his Ph.D. degree in Biomedical Engineering at McGill University, then moved to Harvard Medical School for a Postdoctoral Research Fellowship, and he is currently a fellow of the Michael J. Fox Foundation for Parkinson's Research working at the Toronto Rehabilitation Institute and the University of Toronto.
Dr. Guarin's research focuses on the development and application of engineering, data science, and neuroscience approaches to improve our understanding of the human neuromuscular system, to improve the diagnosis of neuromuscular diseases, and to support the development of new rehabilitation options. During his graduate studies, Dr. Guarin developed new experimental and analytical techniques to quantify the neuromuscular properties of human joints. These techniques are used to quantify the joint rigidity of spastic patients and identify the mechanisms responsible for the abnormal joint stiffness, facilitating the diagnosis and treatment selection. Dr. Guarin's postdoctoral research has focused on the fundamental problem of objectively measuring human movement, and on translating these measurements into objective and clinically useful metrics that can help in the diagnosis, assessment, and treatment of neuromuscular diseases. In particular, Dr. Guarin is working on novel non-contact technologies that utilize commercial grade cameras and machine learning algorithms to measure orofacial movements and improving the diagnosis of patients suffering from neuromuscular diseases such as stroke, ALS, Parkinson's disease, and Bell's palsy.

Keywords: Parkinson's disease, ALS, Bell's palsy, neuromuscular diseases, data science, neuroscience

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