UNIVERSITY OF CALGARY
Biomedical Engineering Graduate Program

SEMINAR

Aron Sahand Talai, M.Sc. Biomedical Engineering Graduate Program will give a seminar as follows:

THESIS TITLE: Automatic classification of idiopathic Parkinsonian disease and progressive supranuclear palsy using multi-spectral MRI datasets: A machine learning approach

SUPERVISOR: Dr.Nils D. Forkert

DATE: Tuesday, August 21th 2018

TIME: **Public:** 12pm **Oral Exam:** 12:45pm

PLACE: HSC Building, HBA Conference Room #2903

ABSTRACT

BACKGROUND: The differential diagnosis of Parkinson's disease (PD) and progressive supranuclear palsy (PSP) is often challenged by similarity of early symptoms and lack of adequate bedside tests, effectively resulting in considerable misclassification rates. The aim of this study is to assess the benefits of using multi-modal MRI biomarkers in a computerized classification of PD vs. PSP to assist clinical diagnosis.

METHODS: Multi-spectral features were extracted from T1, T2, and diffusion-weighted (DWI) MRIs of 38 healthy controls (HC), 45 PD, and 20 PSP subjects. In detail, morphological features were obtained from T1-weighted (category 1), regional brain iron levels from T2-weighted MRI (category 2), and diffusion features were obtained from DWI MRI (category 3), whereas the last category consisted of a combination of all the features (combinational). A wide variety of feature selection and classification algorithms were employed in order to identify the top performing machine learning approach in the three level classification of HC vs. PD vs. PSP in each category. Nested leave-one-out-cross validation was utilized to evaluate classification performance followed by a 1000 permutation test to account for classification significance.

RESULTS: The DWI based classifier tied with the combinational approach in terms of overall accuracy. However, in the former, specificity was lower by 10%. In detail, 4 PSP and 1 PD subjects are incorrectly classified as PD and PSP in the combinational approach resulting in a sensitivity and specificity of 91.67% and 94.12%, respectively. The obtained results indicate that T1 and T2 weighted based features perform the worst based on overall accuracy (combinational >= DWI > T2 > T1). All classification categories were statistically significant ($p<0.001$).

CONCLUSION: Combination of features from different MRI modalities such as T1-, T2-, and diffusion-weighted datasets improves the multi-level classification performance of HC vs. PD vs. PSP compared to single modality features. The results and concepts discussed in this research study have wide ranging implication in the future developments of computer aided diagnosis in PD sub-syndrome diagnosis.