Notice of the Final Oral Examination
for the Degree of Master of Science

of

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BSc (University of Victoria, 2012)

"Robust Multivariate Analysis Methods for Single Cell Raman Spectroscopy"

Department of Physics and Astronomy

Tuesday, August 30, 2016
9:00 A.M.
David Turpin Building
Room A144

<u>Supervisory Committee:</u>
Dr. Andrew Jirasek, Department of Physics and Astronomy, University of Victoria (Supervisor)
Dr. Alexandre Brolo, Department of Chemistry, UVic (Outside Member)

<u>External Examiner:</u>
Dr. Parminder Basran, Department of Physics and Astronomy, UVic

<u>Chair of Oral Examination:</u>
Dr. Pascal Courty, Department of Economics, UVic

Dr. David Capson, Dean, Faculty of Graduate Studies

Abstract

Usefulness of a particular clinical assay is directly correlated with its ability to extract highest possible signal from available data. This is particularly relevant for personalized radiation therapy since earlier plan modifications confer greater benefits to treatment outcome. Recent studies have demonstrated capability of single-cell Raman microscopy to detect cellular radiation response at clinical (below 10Gy) doses, but only in certain strongly responding cell lines and after at least two day incubation. One of possible causes is rather unoptimized signal processing used. This work investigates application of several advanced multivariate methods - weighted principal component analysis (WPCA), robust PCA, probabilistic PCA, and nonlinear PCA to improve radiation response detection threshold and signal strength. Representative datasets from strongly (H460 - human lung) and weakly (LNCaP - human prostate) responding cell lines were analysed in 0-50Gy and 0-10Gy dose ranges and results quantified to determine relative and absolute algorithm performance. It was found that with careful tuning, significant improvements in sensitivity and better signal separation could be achieved as compared to conventional PCA.