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

of

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BSc (University of Ottawa, 2013)

“Investigations of Calorimeter Clustering in
Atlas Using Machine Learning”

Department of Physics and Astronomy

Tuesday, December 19, 2017
10:00 A.M.
Elliott Building
Room 160

Supervisory Committee:
Dr. Robert Kowalewski, Department of Physics and Astronomy, University of Victoria (Supervisor)
Dr. J. Michael Roney, Department of Physics and Astronomy, UVic (Member)

External Examiner:
Dr. George Tzanetakis, Department of Computer Science, UVic

Chair of Oral Examination:
Dr. Ralf St. Clair, Department of Curriculum and Instruction, UVic

Dr. David Capson, Dean, Faculty of Graduate Studies
Abstract
The Large Hadron Collider (LHC) at CERN is designed to search for new physics by colliding protons with a center-of-mass energy of 13 TeV. The ATLAS detector is a multipurpose particle detector built to record these proton-proton collisions. In order to improve sensitivity to new physics at the LHC, luminosity increases are planned for 2018 and beyond. With this greater luminosity comes an increase in the number of simultaneous proton-proton collisions per bunch crossing (pile-up). This extra pileup has adverse effects on clustering algorithms for clustering the ATLAS detector's calorimeter cells. These adverse effects stem from overlapping energy deposits originating from distinct particles and could lead to difficulties in accurately reconstructing events. Machine learning algorithms provide a new tool that may improve clustering performance. Recent developments in computer science have given rise to new set of machine learning algorithms that, in many circumstances, outperform more conventional algorithms. One of these algorithms, convolutional neural networks, has been shown to have impressive performance when identifying objects in 2d or 3d arrays. This thesis will develop a convolutional neural network model for calorimeter cell clustering and compare it to the standard ATLAS clustering algorithm.