



**University
of Victoria**

Graduate Studies

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

of

AIMIN GUAN

BSc (University of Victoria, 2006)

**“Forest Aboveground Biomass and Carbon Mapping
with Computational Cloud”**

Department of Computer Science

Wednesday, March 29, 2017

2:00 P.M.

Engineering and Computer Science Building
Room 467

Supervisory Committee:

Dr. David Goodenough, Department of Computer Science, University of Victoria (Co-Supervisor)

Dr. Wendy Myrvold, Department of Computer Science, UVic (Co-Supervisor)

Dr. Olaf Niemann, Department of Geography, UVic (Outside Member)

External Examiner:

Dr. Randy Scharien, Department of Geography, UVic

Chair of Oral Examination:

Dr. Wanda Boyer, Department of Education Psychology & Leadership Studies, UVic

Dr. David Capson, Dean, Faculty of Graduate Studies

Abstract

In the last decade, advances in sensor and computing technology are revolutionary. The latest-generation of hyperspectral and synthetic aperture SAR instruments have increased their spectral, spatial, and temporal resolution. Consequently, the data sets collected are increasing rapidly in size and frequency of acquisition. Remote sensing applications are requiring more computing resources for data analysis. High performance computing (HPC) infrastructure such as clusters, distributed networks, grids, clouds[2] and specialized hardware components, have been used to disseminate large volumes of remote sensing data and to accelerate the computational speed in processing raw images and extracting information from remote sensing data. In previous research we have shown that we can improve computational efficiency of a hyperspectral image denoising algorithm by parallelizing the algorithm utilizing a distributed computing grid[3]. In recent years, computational cloud technology is emerging, bringing more flexibility and simplicity for data processing. Hadoop MapReduce is a software framework for distributed commodity computing clusters[4], allowing parallel processing of massive datasets. In this project, we implement a software application to map forest aboveground biomass (AGB) with normalized difference vegetation indices (NDVI) using Landsat Thematic Mapper's bands 4 and 5 (ND45). We present observations and experimental results on the performance and the algorithmic complexity of the implementation. There are three research questions answered in this thesis, as follows. 1) How do we implement remote sensing algorithms, such as forest AGB mapping, in a computer cloud environment? 2) What are the requirements to implement distributed processing of remote sensing images using the cloud programming model? 3) What is the performance increase for large area remote sensing image processing in a cloud environment?