WINTER 2019

ECE 7650 – Deep Learning with Convolutional Neural Networks

COURSE DESCRIPTION:

This course will cover convolutional neural networks (CNNs) starting with the foundations of deep learning, optimization, implementing deep CNNs, applications for visual recognition, medical imaging, existing CNN architectures, defining new CNN architectures, and advanced topics from recent literature in the field.

COURSE OBJECTIVE:

Starting 2012, deep learning has seen tremendous success in multiple application domains. In particular, convolutional neural networks (CNNs) have rapidly evolved as the work horse of modern deep learning. Much of the developments in CNNs have been motivated by problems in computer vision (image/scene understanding, object recognition), and more recently in biomedical imaging as well as other application areas such as remote sensing. Moreover, recent work has adapted them for non-visual inputs. With the rapid progress in the area, graduate students in electrical engineering and computer science need to be trained in the theory and practice of the current state-of-the-art in the field and also need to develop the skills to critically evaluate the literature required for taking the field forward. The course will prepare the students both for industrial and research settings.

PRE-REQUISITES:

1. A first course in Machine Learning such as ECE 4850 or COMP 4360
2. Linear Algebra
3. Probability and Statistics
4. Programming experience in Python/C++/Matlab

CONTACT HOURS:

3-hours per week

COURSE CONTENT:

The following topics will be discussed:

- Introduction to Machine Learning;
- Introduction to Computer Vision;
- Mathematical Optimization;
- Automatic Differentiation/Backpropagation;
- Shallow Neural Networks;
- Deep Neural Networks.
- Convolutional Neural Networks (CNNs)
- CNN architectures
- Custom Deep Architectures
- Recurrent Neural Networks
- Residual Neural Networks
- Generative Adversarial Networks (GANs)
- Deep Reinforcement Learning

Additional advanced research topics as determined by the instructor.

HOMEWORK:

Homework will consist of assignments with programming and theoretical problems.

TEXTBOOK:

Textbook is optional. Pointers to reading material and papers would be provided during the course of the term. Reference book: Deep Learning, MIT Press, (Goodfellow, Bengio, Courville)

EVALUATION:

Your final course grade is determined by your performance in assignments, an in-class midterm, a course project with a project report and poster presentation. The weighting of each of these components is as follows:

COMPONENT	NO	VALUE %	TOTAL VALUE	DETAILS / ADDITIONAL INFO
Assignments	4	7.5%	30	
Midterm	1	20%	20	
Final	1	30%	30	
Project proposal	1	2%	2	
Project Report	1	10%	10	
Poster or In-Class Presentation (TBD)	1	8%	8	The decision for a poster or an in class presentation would be made based on the enrollment. If the enrollment is significant such that multiple class sessions are required to accommodate the presentations, a poster session would be held.
TOTAL			100	

INSTRUCTOR INFO:

Name:..... Ahmed Ashraf
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Office Hours: ..... By appointment

VOLUNTARY WITHDRAW:

Wednesday, 20 March 2019

REQUIREMENTS/REGULATIONS

Student Responsibilities: It is the responsibility of each student to contact the instructor if he/she is uncertain about his/her standing in the course and his/her potential for receiving a failing grade. Students should also familiarize themselves with Sections 4 and 6 of the Regulations dealing with, among others, incomplete term work, deferred examinations, attendance and withdrawal, etc..

Lectures: Attendance at lectures is essential for successful completion of this course. Students must satisfy each evaluation component in the course.

ACADEMIC INTEGRITY

Students are expected to conduct themselves in accordance with the highest ethical standards of the Profession of Engineering and evince academic integrity in all their pursuits and activities at the university. As such, in accordance with the General Academic Regulations and Requirements of the University of Manitoba, Section 7.1, students are reminded that plagiarism* or any other form of cheating is subject to serious academic penalty (e.g. suspension or expulsion from the faculty or university) regardless of media

- examinations
- assignments
- laboratory reports
- term exams

A student found guilty of contributing to cheating in examinations or term assignments is also subject to serious academic penalty

Please refer any questions regarding Academic Integrity to your course instructor.

***Plagiarism:** to steal and pass off (the ideas or words of another) as one's own; use (another's production) without crediting the source