

Course Syllabus

CP 322 Machine Learning

Physics & Computer Science Department/MAC Program, Faculty of Science, Waterloo

Fall 2019

I acknowledge that in Kitchener, Waterloo, Cambridge and Brantford we are on the traditional territory of the Neutral, Anishnawbe, Haudenosaunee and Neutral peoples.

Instructor Information

Pooja Vashisth | N2084A

pvasisth@wlu.ca

Weekly Office Hours: By Appointment

(During Available Time: 12:00 – 1:00 pm and 2:20 pm – 3:20 pm MW N2084A)

Tutorial Leader, Lab Instructor or Teaching Assistant Information

No

Course Information

Machine learning is usually used to build predictive models by extracting patterns from large datasets. The intent of this course is to provide a broad introduction to the principles of machine learning, including presentations of its major approaches, discussions of its main theoretical issues, and overviews of its most important research themes.

3 lecture hours / Credit: 0.50

Prerequisites

- Required: an introductory course on probability.
- Preferred: basic knowledge on statistics.

Meeting Time : 1:00 pm - 2:20 pm MW BA202 Sep 05,2019 – Dec 04,2019

Course Overview and Approach

Machine learning methods find widespread applications in diverse areas, including image processing, natural language processing, information retrieval, bioinformatics, financial analysis, etc. This course will introduce most important machine learning approaches used in predictive data analytics, covering both theoretical concepts and practical applications. Technical and mathematical material will be augmented with explanatory worked examples.

Four major approaches to machine learning, including information-based learning, similarity-based learning, probability-based learning, and error-based learning will be discussed in class. In addition, we introduce techniques for evaluating prediction models, and offers case studies that describe specific data analytics projects.

Course Goals and Learning Outcomes

By the end of this course students should be able to:

- Identify machine learning models and algorithms appropriate for solving specific problems.
- Explain the essential ideas behind core machine learning models and algorithms
- Identify the main limitations and failure modes of core machine learning models and algorithms
- Program moderately complex machine learning algorithms
- Manage data and evaluate and compare algorithms in a supervised learning setting
- Access and correctly employ a variety of machine learning toolboxes currently available.
- Identify a diversity of pattern recognition applications in which machine learning techniques are currently in use.

Course Tools and Learning Materials

Text book: Fundamentals of Machine Learning for Predictive Data Analytics-Algorithms, Worked Examples, and Case Studies. By John D. Kelleher, Brian Mac Namee and Aoife D'Arcy (ISBN: 9780262331722).

Other reference books:

- Pattern Recognition and Machine Learning. By Authors: Bishop, Christopher (ISBN-13: 978-0387310732)
- Introduction to Machine Learning. By Ethem Alpaydin (ISBN - 13: 9780262028189)

Student Evaluation

Assessment	Weighting
Assignment	30%
Final	30%
Project	20%
Midterm (in lecture)	20%
Total	100%

Students must pass the final exam in order to pass the course. In the case of a missed midterm its weight will be added to the weight of the final exam, provided that medical documentation is produced. This system will not apply to assignments, which must be all submitted. Late programming assignments will not be accepted.

Weekly Schedule(s) (lecture, lab, seminars, tutorials, etc.)

Week	Lecture	Assignment
1	Introduction	
2	Model Evaluation and Selection	
3	Data Exploration	
4	Information-based Learning I Decision Trees	Assignment 1 Due
5	Reading Week	
6	Similarity-based Learning	Midterm
7	K Nearest Neighbor Algorithm	Assignment 2 Due

Week	Lecture	Assignment
8	Probability-based Learning Bayesian Prediction	
9	Error-based Learning I Linear Regression	Project Proposal
10	Error-based Learning II Neural Networks	
10	Error-based Learning III Support Vector Machines	
11	Information-based Learning II Ensemble Learning	Assignment 3 Due
12	Project Demo and Presentation	Project Due
13	Review	

University and Course Policies (proposed and required text)

- 1. Academic Calendars:** Students are encouraged to review the [Academic Calendar](#) for information regarding all important dates, deadlines, and services available on campus.
- 2. Special Needs:** Students with disabilities or special needs are advised to contact Laurier's Accessible Learning Centre for information regarding its services and resources.
- 3. Plagiarism:** The University has approved the following wording for inclusion on all course syllabi about the use of the institutionally supported plagiarism software tool. "Wilfrid Laurier University uses software that can check for plagiarism. If requested to do so by the instructor, students are required to submit their written work in electronic form and have it checked for plagiarism." (Approved by Senate May 14, 2002) .

In addition to the statement above you may wish to add the following text about academic integrity.

- 4. Academic Integrity:** Laurier is committed to a culture of integrity within and beyond the classroom. This culture values trustworthiness (i.e., honesty, integrity, reliability), fairness, caring, respect, responsibility and citizenship. Together, we have a shared responsibility to uphold this culture in our academic and nonacademic behaviour. The University has a defined policy with respect to academic misconduct. As a Laurier student you are responsible for familiarizing yourself with this policy and the accompanying penalty guidelines, some of which may appear on your transcript if there is a finding of misconduct. The relevant policy can be found at Laurier's [academic integrity](#) website along with resources to educate and support you in upholding a culture of integrity. Ignorance is not a defense.
- 5. Final Examinations:** Students are strongly urged not to make any commitments (i.e., vacation) during the examination period. Students are required to be available for examinations during the examination periods of all terms in which they register. Refer to the Handbook on Undergraduate Course Management for more information.

6. **Foot Patrol, the Wellness Centre, and the Student Food Bank:** The University approved the inclusion of information about select wellness and safety services and supports on campus in the course information provided to students. (Approved by Senate November 28, 2011.) Specific language (by campus) is provided below.

Multi-campus Resource:

- Good2Talk is a postsecondary school helpline that provides free, professional and confidential counselling support for students in Ontario. Call 1-866-925-5454 or through 2-1-1. Available 24-7.

Kitchener/Waterloo Resources:

- [Waterloo Student Food Bank](#): All students are eligible to use this service to ensure they're eating healthy when overwhelmed, stressed or financially strained. Anonymously request a package online 24-7. All dietary restrictions accommodated.
- [Waterloo Foot Patrol](#): 519.886.FOOT (3668). A volunteer operated safe-walk program, available Fall and Winter daily from 6:30 pm to 3 am. Teams of two are assigned to escort students to and from campus by foot or by van.
- [Waterloo Student Wellness Centre](#): 519-884-0710, x3146. The Centre supports the physical, emotional, and mental health needs of students. Located on the 2nd floor of the Student Services Building, booked and same-day appointments are available Mondays and Wednesdays from 8:30 am to 7:30 pm, and Tuesdays, Thursdays and Fridays from 8:30 am to 4:15 pm. Contact the Centre at x3146, wellness@wlu.ca or @LaurierWellness. After hours crisis support available 24/7. Call 1-844-437-3247 (HERE247).