Department of Mathematics & Statistics
Concordia University

STAT 497 (MAST 679/MAST 881), Sec. P
Topics in Statistics & Probability
Winter 2021

Preface: **Due to exceptional circumstances, this course will be taught and all assessments will be done completely ONLINE**.

Instructor: Dr. L. Popovic
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Class Schedule: Wednesdays, 14:45-17:30.

Lectures: The content of the lectures (readings to be done before the live Zoom-ins) will be provided asynchronously online on Moodle. Live Zoom-ins will be held at the class scheduled times and a recording will be posted on Moodle. Announcements and all important information about the course will be made on Moodle.

Office Hours: All questions will be answered during lectures or privately after the lectures over Zoom. An online Forum on Moodle will be used for students to ask questions asynchronously, exchange information and interact with fellow course attendees.

Prerequisites: Advanced courses in probability theory and statistical inference.

Text: **Required:**
Koller, Daphne, and Nir Friedman. "Probabilistic graphical models: principles and techniques", MIT press, 2009/2010.
The textbook will be available at:
https://www.bkstr.com/concordiastore/home
Note: Students should order textbooks as early as possible, especially for printed versions in case books are backordered or there are any shipping delays.

Additional recommended references:
Murphy, Kevin P., *"Machine learning: a probabilistic perspective"*, MIT Press, 2012.

Wainwright, Martin J. and Michael I. Jordan, *"Graphical models, exponential families, and variational inference."* Foundations and Trends in Machine Learning, 2008.

Outline: This course introduces probabilistic graphical models from the very basics to some commonly used algorithms in machine learning.

Probabilistic graphical models are a framework for representing large systems of random variables with complex interactions. Theory of probabilistic graphical models studies probability distributions on directed and undirected graphs and combines statistical and optimization theory to develop effective computer algorithms. It has been used in many applications in machine learning, computer vision, natural language processing and bioinformatics. A general list of topics the course will cover are:

i) Forms of graphical representation: Bayesian networks; Markov random fields; undirected versus directed models.
ii) Inference: variable elimination; belief propagation; MAP inference, sampling based inference; variational inference.
iii) Learning maximal likelihood estimators for Bayesian networks; maximal likelihood estimation with gradient descent; Bayesian learning

Evaluation: Grading will be based on: bi-weekly theoretical assignments from the listed textbook (50%); and in-class presentations of listed textbook sections and a final project presentation (50%).

If the grading scheme for this course includes graded assignments, a reasonable and representative subset of each assignment may be graded. Students will not be told in advance which subset of the assigned problems will be marked and should therefore attempt all assigned problems.

Academic Integrity and the Academic Code of Conduct
This course is governed by Concordia University's policies on Academic Integrity and the Academic Code of Conduct as set forth in the Undergraduate Calendar and the Graduate Calendar. Students are expected to familiarize themselves with these policies and conduct themselves accordingly. "Concordia University has several resources available to students to better understand and uphold academic integrity. Concordia's website on academic integrity can be found at the following address, which also includes links to each Faculty and the School of Graduate Studies: concordia.ca/students/academic-integrity." *[Undergraduate Calendar, Sec 17.10.2]*

Use of Zoom
Zoom will be used in this course to facilitate learning at a distance. It may be used to record some or all of the lectures and/or other activities in this course. If you wish to ensure that your image is not recorded, please keep the video turned off during Zoom meetings. Note that you may not share recordings of your classes and that the instructor will only share class recordings for the purpose of course delivery and development. Any other sharing may be in violation of the law and applicable University policies, and may be subject to penalties.

Behaviour
All individuals participating in courses are expected to be professional and constructive throughout the course, including in their communications.

Concordia students are subject to the Code of Rights and Responsibilities which applies both when students are physically and virtually engaged in any University activity, including classes, seminars, meetings, etc. Students engaged in University activities must respect this Code when engaging with any members of the Concordia community, including faculty, staff, and students, whether such interactions are verbal or in writing, face to face or online/virtual. Failing to comply with the Code may result in charges and sanctions, as outlined in the Code.

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Extraordinary circumstances

In the event of extraordinary circumstances and pursuant to the Academic Regulations the University may modify the delivery, content, structure, forum, location and/or evaluation scheme. In the event of such extraordinary circumstances, students will be informed of the change.