

## **SYDE 675 - Pattern Recognition**

Winter 2021

### **Course Outline:**

Pattern recognition addresses the problem of detecting and classifying patterns in data, a process of machine perception in which objects are assigned to classes to which they are most similar. This course introduces the three modern approaches to pattern recognition: statistical, structural and neural. Specific topics include distance and probability based approaches in multidimensional feature spaces, feature extraction, clustering and performance measures, connectionist models, back propagation and self-organizing networks.

**Course Website:** <http://www.eng.uwaterloo.ca/~s6kalra/syde-675-winter2021/>

### **Course Objectives:**

- To learn the fundamental concepts behind pattern recognition/machine learning.
- To learn how to choose the right learning technique for a given problem.
- To learn how to verify the learning capabilities of a given technique.
- To learn how to run experiments and validate/compare algorithms.
- To learn how to do research and write a scientific paper.

### **Lectures, Tutorials, and Office Hours:**

First lecture: Monday, January 11th, 2021

Last Lecture: Monday, April 12th, 2021

Lectures:	Mondays (Synchronous) Asynchronous	14:00 - 15:20 (EST)
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Tutorials:	Asynchronous	
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Office Hours:	Fridays	13:00 - 14:00 (EST)
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Note: All lectures will be made available online after every Monday session (synchronous session). The rest of the teaching material which is not covered during the synchronous session will be uploaded later (asynchronous session). Both synchronous and asynchronous materials are included in the quizzes and assignments.

Note: The TA will provide self-study Jupyter notebooks (in Python) every week.

Reading Week: February 13 - 21, 2021

### **Synchronous Session Information:**

Link:

<https://uwaterloo.webex.com/uwaterloo/j.php?MTID=ma8adda705212a0a8fdafca1b2a87bfb2>

Meeting number: 180 344 0236

Password: rrDPdEEN927

**Instructors:**

- Amir Safarpour (Preferred: Amir)  
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- Shivam Kalra (Preferred: Shivam)  
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**Teaching Assistant:**

- Nargess Heydari  
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**Grading Scheme:**

Q: Quizzes (5)	25%
A: Assignments (2)	30%
Presentation	10%
Project Paper	35%

**Lecture Topics and Course Tasks Schedule:**

Week	Topic	Tasks
Week 1	Introduction to Statistical Learning	
Week 2	Linear Regression & Classification	Quiz 1
Week 3	Decision Theory	
Week 4	Naive Bayes Classifier	Quiz 2
Week 5	Supervised Learning #1	Assignment 1
Week 6	Reading Week	
Week 7	Supervised Learning #2	Assignment 1 Due
Week 8	Model Selection & Regularization	Quiz 3, Proposal Due
Week 9	Unsupervised Learning #1	
Week 10	Unsupervised Learning #2	Quiz 4
Week 11	Neural Networks	Assignment 2
Week 12	Deep Learning #1	Quiz 5
Week 13	Deep Learning #2	Assignment 2 Due
Week 14	Class Presentations	Presentations Due (April 14)
		Final Project Report Due (April 24)

**Course Project Paper:**

The result of the course project paper will be a scientific paper (maximum 6 pages plus one page for the references).

More information will be provided during lectures and Learn.

**Textbooks:**

No particular textbook will be used. A list of several textbooks and resources will be provided during the lectures.

**Rules for Group Work:**

- Quizzes: All online quiz questions should be answered by the individual students without any help from others.
- Assignments: Group work is encouraged but the submissions should not be of “copy/paste” nature.
- Proposal, Presentation, and Project Paper: Group work is encouraged but should be coordinated with the instructor in advance (proposal).

**Rules for Submission:**

- Missed online quizzes will be marked with zero.
- Late assignment will be penalized with 20% per day.
- Submitted project papers after the deadline will be marked with zero.
- Project papers should be uploaded to the designated dropbox folder on Learn. Email submissions will be marked zero.
- Only PDF submissions will be graded.

Note: The instructors should be notified about any valid reason (e.g. illness) for missing the course workload.

**Academic Integrity:** In order to maintain a culture of academic integrity, members of the University of Waterloo community are expected to promote honesty, trust, fairness, respect and responsibility. [Check [www.uwaterloo.ca/academicintegrity/](http://www.uwaterloo.ca/academicintegrity/) for more information.]

**Grievance:** A student who believes that a decision affecting some aspect of his/her university life has been unfair or unreasonable may have grounds for initiating a grievance. Read Policy 70, Student Petitions and Grievances, Section 4, [www.adm.uwaterloo.ca/infosec/Policies/policy70.htm](http://www.adm.uwaterloo.ca/infosec/Policies/policy70.htm). When in doubt please be certain to contact the department’s administrative assistant who will provide further assistance.

**Discipline:** A student is expected to know what constitutes academic integrity to avoid committing an academic offence, and to take responsibility for his/her actions. A student who is unsure whether an action constitutes an offence, or who needs help in learning how to avoid offences (e.g., plagiarism, cheating) or about “rules” for group work/collaboration should seek guidance from the course instructor, academic advisor, or the undergraduate Associate Dean. For information on categories of offences and types of penalties, students should refer to Policy 71, Student Discipline, [www.adm.uwaterloo.ca/infosec/Policies/policy71.htm](http://www.adm.uwaterloo.ca/infosec/Policies/policy71.htm). For typical penalties check Guidelines for the Assessment of Penalties, [www.adm.uwaterloo.ca/infosec/guidelines/penaltyguidelines.htm](http://www.adm.uwaterloo.ca/infosec/guidelines/penaltyguidelines.htm).

**Appeals:** A decision made or penalty imposed under Policy 70 (Student Petitions and Grievances) (other than a petition) or Policy 71 (Student Discipline) may be appealed if there is a ground. A student who believes he/she has a ground for an appeal should refer to Policy 72 (Student Appeals) [www.adm.uwaterloo.ca/infosec/Policies/policy72.htm](http://www.adm.uwaterloo.ca/infosec/Policies/policy72.htm).

**Students with Disabilities:** The Office for Persons with Disabilities (OPD), located in Needles Hall, Room 1132, collaborates with all academic departments to arrange appropriate accommodations for students with disabilities without compromising the academic integrity of the curriculum. If you require academic accommodations to lessen the impact of your disability, please register with the OPD at the beginning of each academic term.

**Turnitin.com and alternatives:** Plagiarism detection software (Turnitin) will be used to screen assignments in this course. This is being done to verify that use of all material and sources in assignments is documented. In the first week of the term, details will be provided about the arrangements for the use of Turnitin and alternatives in this course. Students will be given a reasonable option if they do not want to have their assignment screened by Turnitin. See: <http://uwaterloo.ca/academicintegrity/Turnitin/index.html> for more information.