ECE 612: Information Theory  
Winter 2022

Note: Due to the current situation, this course syllabus is preliminary and subject to change.

Instructor: Prof. Patrick Mitran

- Office Hours: 1 hour/week. Time/location TBD
- E-mail: pmitran@uwaterloo.ca

Lecture Schedule: Wednesdays and Fridays, from 2:30-3:50pm in EIT-3141

The course is scheduled to be delivered in-person. If you are unable to attend in-person, this course is not for you.

Due to COVID-19, the method of lecture delivery is subject to change.

Pre-requisite: Undergraduate probability and mathematical maturity.

Aims: This is a first course in information theory. It covers the basic concepts such as entropy, mutual information, channel capacity and rate distortion theory.

Course Outline

1. Entropy, Relative Entropy, and Mutual Information
2. Asymptotic Equipartition Property
3. Entropy Rates
4. Data Compression
5. Channel Capacity
6. Differential Entropy
7. Gaussian Channel
8. Rate Distortion Theory
9. Information Theory and Statistics (time permitting)
10. Maximum Entropy (time permitting)
Textbook and references


The library has many additional books on information theory as well. I strongly recommend obtaining a copy of the textbook.

Course Evaluation

- Problem sets will be handed out. You should attempt them all. Solutions will be posted on the course website.
- There will be 1 in-class in-person midterm exam tentatively set for 1 March that will count for 35% of the grade. The date of the midterm may change based on how quickly the course material is covered.
- There will be an in-person final exam that will count for 65% of the grade.

I reserve the right to provide an alternative grading scheme as necessary if the class grades are below what I deem reasonable. I guarantee that no student shall receive a grade less than that of the official scheme above, but the alternate scheme, if any, may improve your grade.

Alternate Arrangements: The situation may change/evolve due to several reasons. For example, the instructor becomes unavailable (e.g., the instructor is sick, etc.), Public Health orders in-person lectures be stopped, etc. This change may be short-term (e.g., one week) or long-term.

Should the situation change and in-person lectures are no longer possible for either a short-term period or long-term period:

- the instructor led lectures will be either i) replaced by pre-recorded videos or ii) moved online as live lectures.
- the in-class midterm and/or final will be conducted online using crowdmark.

Further details will be provided at the time that the in-person activities are suspended.

Due to privacy reasons, I may not always be able to provide a reason for these changes to in-person lectures.

In-person classroom safety: [The following instructions are based on Fall 2021 safety guidelines and will be updated to reflect Winter 2022 guidelines when available]

We will follow all university guidelines. In addition, if I feel there is a safety issue, I reserve the right to cancel the lecture immediately, and ask everyone to leave. If a lecture is cancelled
because someone makes the lecture room unsafe, the issue may be raised with the associate dean of graduate studies under Policy 71.

- Students shall not attend class if they are experiencing influenza-like illness, have been in close contact with someone who is ill, or have travelled outside of Canada within the past 14 days.

- Wearing of face-covering/mask is a requirement in all common areas on campus, including all indoor instructional spaces.

- As such, no food is allowed to be consumed in instructional space. Beverages are allowed if a straw is used or if the mask is lowered only for a brief period.

- When a student asks or answers a question it may be difficult to be heard while wearing a mask. A student may briefly lower their mask to ask/answer the question and then the mask must be replaced.

- Students are expected to practice frequent hand hygiene (handwashing with soap and water or use of hand sanitizer), including immediately before coming into an instructional space.

- Students are permitted to sit where they wish. You are encouraged to sit with one seat left empty between you and other students when possible. Also, please be considerate – the person next to you may want some distance as well.

- If you becomes ill in class: i) please proceed directly home to self-isolate and to contact Health Services’ Testing and Assessment Centre to book an appointment for testing, ii) you will be directed on self-isolate and are asked to report a positive test to Health Services via the COVID-19 Support and Advice form: https://uwaterloo.ca/campus-wellness/covid-19-testing-assessment-centre/covid-19-support-and-advice

- If you have tested positive for COVID-19: i) report the positive result to Health Services via the COVID-19 Support and Advice form below, ii) staff managing the form submissions will guide you through next steps and co-ordinate tracking the case and initiating Public Health contact tracing. https://uwaterloo.ca/campus-wellness/covid-19-testing-assessment-centre/covid-19-support-and-advice

- COVID-19 Return to Campus safety information and protocols: https://uwaterloo.ca/coronavirus/return

**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/ 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.
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 [check www.uwaterloo.ca/academicintegrity/] 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. For typical penalties check Guidelines for the Assessment of Penalties, 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.

Note for Students with Disabilities: AccessAbility Services, located in Needles Hall, Room 1401, 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 AccessAbility Services at the beginning of each academic term.