

ECE 612: Information Theory

Spring 2020

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

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Lecture Schedule: The course is scheduled to be delivered online (as all other Spring 2020 courses are). The registrar does not provide scheduled meet times.

Lectures will either i) be pre-recorded, and posted regularly, or ii) there will be two live online lectures per week, likely delivered by webex at times TBA. If live lectures are delivered, these will be recorded and posted online for viewing by those who could not attend.

Due to COVID-19, the method of lecture delivery is subject to change. I do not know what works well, and may need to revise my methods as we go.

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

Textbook: T. M. Cover and J. A. Thomas, Elements of Information Theory, Wiley, New York, 2nd Edition 2006.

The library has many additional books on information theory as well. I strongly recommend obtaining a copy of the textbook, either a hard copy, or soft copy. Note: it is likely that the midterm and final are open textbook exams, in which case it is a good idea to have 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 midterm exam tentatively set for 16 June that will count for 35% of the grade. This will likely be a 24 hour open textbook takehome exam.
- There will be a final exam that will count for 65% of the grade. This will likely be a 24 hour open textbook takehome exam.

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.

Due to COVID-19, alternate grading schemes, exam arrangements, or course deliverables may be necessary. These will be communicated when available.

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 departments 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.