ECE 587 / STA 563: Course Information

Information Theory
Duke University, Fall 2015

Overview: Information theory is the science of processing, transmitting, storing, and using information. Pioneered by Claude Shannon in 1948 for problems in data compression and reliable communication, it is now relevant to a wide range of fields, including machine learning, statistics, and neuroscience. This course introduces measures of information and uncertainty – such as entropy, mutual information, relative entropy, and differential entropy – and shows how they are connected to practical problems in communication, compression, and inference. Specific topics include lossless data compression, channel capacity, Gaussian channels, and rate distortion theory. The course is appropriate for beginning graduate students in electrical engineering, computer science, statistics, and mathematics who have a good background in probability and linear algebra.

Prerequisites: This course assumes knowledge of probability at the undergraduate level as well as the basics of undergraduate linear algebra and signals and systems. In particular, students should be familiar with the notions of joint and conditional probability distributions, conditional expectation, independence, Gaussian random vectors and processes, and the sampling theorem for bandlimited signals. If you have not already taken these classes (e.g. ECE 581, ECE 555 or their equivalent) or have any doubts about your understanding of these concepts, please discuss them with the instructor.

Logistics:

Instructor:	Galen Reeves
	Email: galen.reeves@duke.edu
	Office Hours: Thursday 11:30 am – 12:30 pm (or by appointment)
	Location: Gross Hall 321
TA:	Changwei Hu
	Email: ch237@duke.edu
	Office Hours: Monday, 3 pm - 5 pm
	Location: Gross Hall (location TBD)
Lectures:	Tuesday and Thursday, 10:05 am – 11:20 am in Hudson 232
Web site:	https://sakai.duke.edu/
Textbook:	*Elements of Information Theory 2nd Edition*, Cover & Thomas, Wiley, 2006

Grading:		
	15%	Homework (approximately 8 assignments)
	25%	First midterm exam (September 29th)
	25%	Second midterm exam (November 3rd)
	35%	Final exam (Dec. 13th, 2 pm - 5pm)

Homework: Each student must submit an original set of solutions to the instructor at the beginning of class on the due date. Requests for late submissions and/or extensions will not be entertained (except under exceptional circumstances which must be discussed with the instructor).

Collaboration policy: Collaboration and discussion are allowed. These include working out the problems together, or each student can work out the problems individually and then discuss their work to arrive at a final solution. However, each student must turn in an independent write-up. **It is not permitted on any homework** for collaborators to divide up the problems, or for one person to work out a problem or problems and the others check the work.

General advice: The primary function of homework is to clarify concepts and develop proficiency, depth, and rigor through practice. Working on the homework problems is a crucial part of the learning process and will invariably have a major impact on your understanding of the material and, in turn, on your exam performances and final grade! If you miss a problem, study the solutions. Do not wait until the last minute before doing the homework.

Exams: Exams are closed-book and closed-notes. Calculators, computing, and communication devices are neither needed nor permitted. However, you are allowed to bring one 8.5×11-inch sheet of *handwritten* notes (both sides) to the first midterm exam, two sheets (all four sides) to the second midterm exam, and three sheets (all six sides) to the final exam. If you want to bring your sheet from the first exam to the second, then you have only one additional sheet for the second exam. Similarly, if you want to bring both your sheets from the second exam to the final, then you have only one additional sheet for the final exam.

Tentative Schedule: An overview of the topics covered in each lecture, the required readings, the dates that homework will be due, and the exam days can be found at https://docs.google.com/spreadsheets/d/1FV8OmmiUIQQAQ2WKMlf_BxqaXm4n_2taS6jyW-SRBJO/edit?usp=sharing. Please note that the times of the exams will not change, but the other content may be updated to adapt to any unforeseen circumstances that arise during the semester.

The final exam is scheduled on December 13th from 2 pm to 5 pm

Additional Information

- Your responsibilities may involve seeking out information outside the regular course materials for additional reference. Additional resources will be available on the course website.

- All students are expected to abide by the Duke Community Standard. If you are ever in doubt as to the legitimacy of an action, please talk to the instructor immediately.