ECE 695C Inference Methods for Codes on Graphs

TTh 12-1:15pm   Classroom: EE222
https://engineering.purdue.edu/~chihw/12ECE695C/12ECE695C.html

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Office Hours: MW: 3:30–4:20pm
                          Th: 1:30–2:20pm

- *Course Description:* We will focus on the recent development for codes on graph, including the encoder/decoder structures, analysis and design tools for the graph-based error correcting codes, and the emerging techniques of network coding for network communications. It will be explored step-by-step the frontier knowledge about achieving the channel/network capacity with efficient implementation. Many applications of the underlying principles will be discussed, including the LDPC source codes, the linear system detectors, and the turbo systems, and intra-session and intersession network coding.

- *Goals:*

    1. Learn the concepts of inference and design optimal or near-optimal algorithms for different problems in physical-layer communications, networks, and signal processing.
    2. Learn how to analyze the performance of iterative algorithms for system optimization.
    3. Learn the concepts of the graph-based error control codes that can exchange information at the **close-to-Shannon's-capacity** rates.
    4. Learn the basic concepts of network coding (performing coding over a network).

- *Prerequisites:* The course will be *self-contained* and cover all necessary backgrounds in the first few lectures.

    The students are supposed to have necessary analytical skills such as performing basic calculus and understanding probability notations.

- *Textbook:* The instructor will print out necessary papers and book chapters for proper references. Some recommended references are

    - Richardson, T., Urbanke, R., *Modern Coding Theory*
      (http://lthcwww.epfl.ch/mct/index.php)

- MacKay, D.J.C., *Information Theory, Inference, and Learning Algorithms*, ISBN-13: 9780521642989 — ISBN-10: 0521642981
  (http://www.inference.phy.cam.ac.uk/mackay/itila/)
- Poor, H.V., *An Introduction to Signal Detection and Estimation, 2nd Ed.*, Springer.
- R. Yeung, "Information Theory and Network Coding," Springer 2008, ISBN-10: 0387792333, ISBN-13: 978-0387792330.

- *General format*:

  - **Homework:** The homework is scheduled once every week or once every two weeks. Each contains 4–6 questions. Each homework is distributed on Tuesday and due next Tuesday.
    Collaboration is allowed but not encouraged.
  - **Office hours:** MW: 3:30–4:20pm, and Th: 1:30–2:20pm. MSEE354
  - **Exams:** There are two midterms. The exact dates will be announced two weeks in advance.
    Midterm 1: in the week of 2/13–2/17.
    Midterm 2: in the week of 3/26–3/30.
  - **Final projects or survey papers:** Each student have to turn in a final projects, e.g. turbo system design and simulations, or a survey paper on iterative inference.
  - **Grading:** Homework — 10%, midterms — $30\% \times 2$, and the final project — 30%.
  - **Letter grade system:** This course will use the traditional letter grade system, not the plus/minus system.
  - **Blackboard Vista:** Blackboard Vista will be used extensively for disseminating the scores of HW and midterms. Please constantly check your grades in Blackboard to ensure that we record your grades correctly. The scores in Blackboard will be used to decide your final letter grade.
    http://www.itap.purdue.edu/learning/tools/blackboard/
  - **Email list and the course website:** Important announcements will be sent through email and also posted on the course website
    It is the student's responsibility to check the course website:
    https://engineering.purdue.edu/~chihw/12ECE695C/12ECE695C.html
    on a weekly basis to obtain the latest course information.

- *Academic Dishonesty:*

  The ECE faculty expect every member of the Purdue community to practice honorable and ethical behavior both inside and outside the classroom. Any actions that might unfairly improve a student's score on homework, quizzes, or examinations will be considered cheating and will not be tolerated. Examples of cheating include (but are not limited to):

  - Sharing / passing any information during an examination.
  - Looking around unnecessarily during an exam. The instructor and the TA may ask the student to concentrate on the exam booklet during the exam.
  - Using forbidden material or devices to an examination. (Calculators and help sheets are prohibited, unless further notice.)
  - Using cellular phones, i-Pods, and other electronics during an examination.
  - Collaboration for homework questions is encouraged, but the students MUST hand write / type their own homework separately.
  - Working on an exam before or after the official time allowed.
  - Requesting a re-grade of answers or work that has been altered.

  At the instructor's discretion, cheating on an assignment or examination will result in a reduced score, a zero score, or a failing grade for the course. All occurrences of academic dishonesty will be reported to the Assistant Dean of Students and copied to the ECE Associate Head for Education. If there is any question as to whether a given action might be construed as cheating, please see the instructor or the teaching assistant before you engage in any such action.

- *Campus Emergency Preparedness:*

  In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances. In such an event, information will be provided through the course website and through the course email list.

  Students are encouraged to stay home if having any A/H1N1 symptoms.