Syllabus for LIN 629

Learnability – Fall 2017

Course information

Instructor	Course
Jeff Heinz	LIN 629
jeffrey.heinz@stonybrook.edu	Learnability
N237 SBS	TR 4:00-5:20pm
L160 IACS	N117 SBS
Office Hours	
MW 2:00-3:30pm and by appointment	

There is a class website with material posted to it. This site is

https://heinz-jeffrey.github.io/classes/17F/

What is this course?

Humans learn language, but little is understood about how this happens. In fact, there is disagreement about what "learning" means. This course studies definitions of learnability in addition to how anything could learn something like natural language from a computational perspective.

This is the first course in a two semester sequence. It will focus on the theory of grammatical inference. However, we will also discuss computational learning theories including, but not necessarily limited to, identification in the limit, active learning, probably approximately correct learning, and statistical learning theory. We will also discuss a range of machine learning techniques including, but not necessarily limited to, grammatical inference, minimum description length, maximizing likelihood, maximizing entropy, Bayesian inference, statistical relational learning, as well as neural networks and deep learning. Throughout the course we address the tension between theoretical, analytical approaches to learning vis a vis benchmarking on specific tasks.

Prerequisites

While some familiarity with formal language theory, automata, logic and computability will be helpful, there are no formal prerequisites for the course.

On the other hand, learning problems and solutions will often be presented mathematically. Part of the purpose of the course is for you to become familiar with mathematical and computational approaches to learning. Thomas Graf's tips on approaching math in sections 2 and 3 from this old handout is useful.

http://thomasgraf.net/doc/teaching/mathling1/handout1.pd

Course Objectives

By the end of this course, students will be able to critically assess work in machine learning as it applies to problems in language learning. Specifically, they will be able to:

1. Explain advantages and disadvantages of theoretical, analytical approaches to machine learning vis a vis benchmarking on specific tasks.
2. Understand multiple formal definitions of learning.
3. Understand how some algorithms solve some learning problems.
4. Critically assess computational learning research in the linguistic literature.

Furthermore, students will begin to conduct original research on learning problems as they apply to natural language. Students will:

1. Develop learning problems related to one's own interests in linguistics.
2. Develop theoretical or applied solutions to these problems.

It is expected that by the end of the second semester course, students will be able to conduct original research in grammatical inference and/or computational modeling of language-learning.

Course Materials

There is no textbook for the course. I will make readings and notes available online.

Grading

Homework Exercises	50%	Project Proposal	10%
Presentation	10%	Project	30%

Homework. I will give readings and HW exercises throughout the semester. You are welcome to work with others on these exercises, but please write up your own assignment.

Presentation. Once or Twice during the semester, depending on the class size, you will be expected to present a solution to the HW, lead a discussion about a reading, or teach the class about an area of machine learning we are unable to cover fully. These presentations are intended to be 20-30 minutes in length.

Projects. Students will complete a project in the course of the semester which relates to learning and learnability. The project proposal should be 300-500 words, explaining the project and how you plan to go about it. **Proposals are submitted to me and returned to you with feedback in a cycle that repeats until I approve them. Project proposals must be approved by November 1, 2017.**

Projects can be theoretical or applied. I am obviously interested in theoretical problems. I hope to provide a list of open problems soon.

It is not required that a complete solution to the problem be obtained this semester. In some sense, the goal of this semester is to understand a problem. By the end of next semester, however, this project, or another one, will become a publishable proceedings paper or article at a conference on machine learning or linguistics.

Final papers are due December 21.

University Policies and Services

Disability Support Services

If you have a physical, psychological, medical or learning disability that may impact your course work, please contact Disability Support Services, ECC (Educational Communications Center) Building, Room 128, (631) 632-6748. They will determine with you what accommodations, if any, are necessary and appropriate. All information and documentation is confidential.

Students who require assistance during emergency evacuation are encouraged to discuss their needs with their professors and Disability Support Services. For procedures and information go to the following website: `http://www.stonybrook.edu/ehs/fire/disabilities`

Academic Integrity

Each student must pursue his or her academic goals honestly and be personally accountable for all submitted work. Representing another person's work as your own is always wrong. Faculty are required to report any suspected instances of academic dishonesty to the Academic Judiciary. Faculty in the Health Sciences Center (School of Health Technology & Management, Nursing, Social Welfare, Dental Medicine) and School of Medicine are required to follow their school-specific procedures. For more comprehensive information on academic integrity, including categories of academic dishonesty, please refer to the academic judiciary website at `http://www.stonybrook.edu/uaa/academicjudiciary/`

Critical Incident Management

Stony Brook University expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of Judicial Affairs any disruptive behavior that interrupts their ability to teach, compromises the safety of the learning environment, or inhibits students' ability to learn. Faculty in the HSC Schools and the School of Medicine are required to follow their school-specific procedures.