Syllabus

Sunday, January 31, 2021 1:28 PM

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Fundamentals of Artificial Intelligence

Computer Science 101a
Spring 2021
Tue and Thu, 2:00-3:30
Professor Jordan B. Pollack
213 Volen Center, 781 736 2713, Pollack@brandeis.edu

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Course Summary

This course will cover the basic concepts and programming techniques used in Artificial Intelligence, concentrating initially on cognitive level problem-solving, search strategies and knowledge-representation schemes, and later on Machine Learning, both at the symbol level and with biologically inspired neural/genetic approaches. This is a **high effort programming course, as there will be a number of problems to be written in COMMON LISP through the semester, although Python will also be accepted.** The goals are that you can solve new problems, and that you can also teach computers to solve problems.

Learning Goals

At the end of this course you will:

- Be familiar with basic concepts of Artificial intelligence
    - Including Search, Representation and Machine Learning
- Be able to program in Common Lisp (or gain more expertise in Python:)
- Be able to solve problems using recursive and applicative forms of programming
- Become more flexible in your use of data representations beyond arrays and sequences.

Prerequisites

CS12b and CS21a are prerequisite. CS 121b is recommended since Scheme is a baby version of Lisp.

Text

PDF excerpts from *Paradigms of AI Programming, by Peter Norvig.*

Famous AI Papers, to be found online in Notabene.

The Common LISP reference by Steele, is online at www.cs.cmu.edu/Groups/AI/html/cltl/cltl2.html

Programming Environment

Steel Bank Common Lisp is the dialect we are using for this class. Download from sbcl.org.

Lisp can be run directly where you load files or copy-paste, but it is better to run it as a process under EMACS. This is already set up on the departmental workstations as well as for use via ssh. You can download from www.gnu.org/software/emacs/ Emacs has a built in Lisp Mode, from which you can edit your source files and interactively test the definitions. You will need to set up a .emacs init file with 2 lines to specify what executable emacs runs when you esc-x run-lisp.

Grading

Programming 32%

You will have a lisp warm-up worth 2%, and 3 programming assignments, each worth 10% of the final grade. You can do your assignments in lisp or python if you have learned python already ['in' 'Python' 'using' 'recursive' 'style']. (We do not recommend self-learning python just for this course). Assignments are due in Latte by 11:55PM on the assigned date, and you lose 5% per day in late fees, so after 3 weeks late, don't bother handing it in. No assignments will be accepted after May 1st.

Reading 20%

In lieu of a textbook, we will read and comment online on historically significant papers related to the lecture themes thru the semester. Your 10 best comments, graded as 1 or 2, will be counted towards your final grade. Contact us if you cannot get into notabene which is at https://nb.mit.edu

Examinations 45%

There will be a midterm (20%) in class and a final (25%) during finals week. Programming questions on exams will be at an abstract level rather than lisp-centric to accommodate pythonistas.

Class participation 3%

Questions and discussions on the lectures and readings are welcome.

Other Policies

Disability: If you are a student with a documented disability on record at Brandeis University and wish to have a reasonable accommodation made for you in this class, please get me your paperwork in the first two weeks of class.

Workload: Success in this 4-credit hour course is based on the expectation that students will spend a minimum of 9 hours of study time per week in preparation for class (reading, programming, preparation for exams, etc.). Some weeks will be light while others (when assignments are due) will be heavier.

Academic Integrity: Giving or receiving code, copying code off github or stackunderflow, leaving printouts around, photographing other student's screens, hiring rent-a-coders, and so forth are violations of the academic honesty code at Brandeis. If you use someone else's function, you must attribute it correctly to avoid being accused of a plagiarism violation. While it is true that industry jobs require collaboration and Machine Learning has come to mean the employment of libraries and API's written by others, in this class you are meant to learn by doing it yourself. Winning at Artificial Intelligence occurs by solving problem after problem by banging your head against the wall! Besides code, cutting and pasting comments on the readings you find online or in Wikipedia and presenting as your own work is also a violation.

ZOOM Recording: Class sessions will be recorded for educational purposes and linked from LATTE. You may decline to be recorded; if so, please contact me to identify suitable alternatives for class participation. These recordings will be deleted within two months after the end of the semester. If you can be personally identified in a recording, no other use is permitted without your formal permission. You may not record classes on your own without my express permission, and may not share the URL and/or password to anyone unaffiliated with this course.

Draft Schedule

Date	Topic	Reading	Handout	Due
TUE 2/02	Class Overview			
THU 2/04	History of AI	Turing		
TUE 2/09	Lisp	Norvig1	Warmup	
THU 2/11	Lisp			
TUE 2/16	Lisp	Norvig3		
THU 2/18	Problem Spaces	GPS	HW1	Warmup
TUE 2/23	Breadth and Depth			
THU 2/25	Heuristic Search	Korf-Rubik		
TUE 3/02	NLP Syntax	Chomsky		
THU 3/04	NLP Semantics	Schank		
*THU 3/11	Logical Representation			
TUE 3/16	Semantic Networks	Quillian		HW1
THU 3/18	**Midterm**			
TUE 3/23	Games	Michie61	HW2	
THU 3/25	Games	DeepBlue		
TUE 3/30	Games	Axelrod		
THU 4/01	ML Intro			
TUE 4/06	Decision Trees	Quinlan		
THU 4/08	Discovery	Lenat	HW3	HW2
TUE 4/13	Neural Nets	Rumelhart		
THU 4/15	Neural Representations	Pollack		
*THU 4/22	Deep Learning	ConvolutionNN		
TUE 4/27	Game Learning	Tesauro		
THU 4/29	Game Reinforcement Learning	Alphazero		
TUE 5/4	Evolutionary Learning	Koza		HW3

A Final will be held during finals week. * indicates one or more missed classes.