Course Syllabus of CSE 5522

Survey of Artificial Intelligence II: Advanced Topics

August 21, 2019

1 Course Information

Fall 2019, Wed/Fri, 2:20-3:40 PM, Ramseyer Hall 110

Instructor: Dr. **Amir Asiaee**-Taheri, asiaeetaheri.1@osu.edu

Office Hours: Ramseyer Hall 110, Wed/Fri 3:45pm - 4:45pm. Office hours subject to change

TA: Shuangsheng (Victor) Lou, lou.125@buckeyemail.osu.edu

Office Hours: Dreese Lab 778, Tue/Thu 4pm -5pm.

Course Description

Survey of advanced concepts, techniques, and applications of artificial intelligence, including knowledge representation, learning, natural language understanding, and vision.

Credits, Prerequisites

3 semester credits. Official prerequisite is 3521, 5521 or 630. Graduate students may take the class without having taken the prerequisite, although the instructor should be consulted to determine if this course is appropriate. Not open to students with credit for CSE 730.

Terms Offered, General Information, Exclusions, Cross-Listings, etc.

- Offered both Autumn and Spring Semesters.
- There are programming projects and prior programming experience is assumed.
- This course satisfies an Application Core requirement in the CSE MS program.
- This course is a core course in the undergraduate Cognitive Science minor. Information regarding the minor and its requirements may be found online at https://cog.osu.edu/academics/cognitive-science-undergraduate-minor.
- Please note that this course will be taught at the level of an introductory graduate class, and students should be prepared to work significantly outside of class time. Undergraduates are welcome but should be prepared for a significantly higher workload than in Survey of Artificial Intelligence I.
- Please note that many of the examples in class will be working with python. You should be comfortable programming at least simple scripts in python.

2 Course Material

Objectives

- Master advanced AI concepts, theories, and terminology.
- Master computational techniques in typical AI subareas.
- Master knowledge representation and reasoning methods in AI.
- Be exposed to current research topics in AI.

Textbook

Artificial Intelligence, A Modern Approach by Russell and Norvig, third edition, Prentice Hall, 2009. Please use this edition, Prentice Hall, 2009. Please use this edition - previous editions do not have significant coverage of some of the topics.

Topics

- Probability theory review, probabilistic inference (Chapter 13)
- Bayesian Networks (Chapter 14)
- (Hidden) Markov Models (Chapter 15)
- Survey of Machine Learning (Chapter 18, 20)
  - Decision trees, Neural Networks, Support Vector Machines, Expectation Maximization
- Survey of AI Applications: AI Research at OSU
  - Computer Vision, Bioinformatics, Automatic Speech Recognition, Natural Language Processing

3 Grading Plan

Grades will be assigned using the standard OSU scale. This is the *approximate* weighting of the different components of this course:

- Homeworks: $2 \times 8\%$ each (16%)
- Labs: $5 \times 8\%$ each; lowest grade counts 2% (34%)
- Midterm Exam: 20%
- Final Exam: 25%
- Participation: 5%

Homeworks and Labs: There will be two homework assignments (written problems) to prepare you for the midterm and final. There are five labs (programming assignements). All due at 11:59 PM on Friday on the date listed in Carmen (and Table 1). Late submissions will be penalized 10 points for every day late, up to three days late. No submissions will be allowed after three days. All code must be runnable on the stdlinux unix system, even if you've developed it on other platforms. You are responsible for making sure that the code runs there. You may use the programming language of your choice.

Exams: There will be one midterm exam and one final exam.

- Midterm: In-class on Wed Oct 9, 2:20 - 3:40pm
- Final exam: Wednesday Dec 11, 12:00-1:45pm
- Makeup policy: Check the final exam date for possible conflict with your other exams. If you know you won't be able to make a deadline or exam, please see me before you miss the deadline or exam. If you miss the midterm or final, you will have to provide extensive written documentation for your excuse.

Participation: You are expected to be present and active in class, particularly for hands-on days. Participation checkpoints will be used randomly throughout the semester.

	Wed	Topic	Fri	Topic	Due on Fri - 11:59 pm
1	21-Aug	Course overview, problem formulation	23-Aug	Optimization, linear regression	
2	28-Aug	Hands on: gene expression	30-Aug	Ridge/logistic regression	
3	4-Sep	Probability theory/Bayes Nets/ Bayesian Classification	6-Sep	BN: Inference, Naïve Bayes, MCMC	Lab 1 due: linear and logistic regression
4	11-Sep	MoG, EM	13-Sep	Hands on: Sentiment Analysis	
5	18-Sep	Sequences: HMMs, Viterbi search	20-Sep	Sequences: MEMMs, CRFs	Lab 2 due: extended sentiment analysis, MoG
6	25-Sep	Bioinformatics	27-Sep	Intro to NLP	HW1 due
7	2-Oct	Hands-on: named entity recognition	4-Oct	Midterm review	
8	9-Oct	**Midterm**	11-Oct	Autum Break (no class)	
9	16-Oct	Decision trees	18-Oct	D-tree/Perceptrons	Lab 3 due: sequence processing
10	23-Oct	Multi-layer perceptrons	25-Oct	Recurrent & Convolutional Networks	
11	30-Oct	Computational Audition	1-Nov	Speech Recognition	
12	6-Nov	Hands-on: Neural Nets for Computational Audition	8-Nov	K-means algorithm	
13	13-Nov	MoG/Topic Modeling	15-Nov	Computer Vision	Lab 4 due: application of NN
14	20-Nov	Hands-on: Foreground/Background	22-Nov	Neural structure learning	HW2 due
15	27-Nov	Thanksgiving Break (no class)	29-Nov	Thanksgiving Break (no class)	
16	4-Dec	Review			Lab 5 due: clustering
Wednesday Dec 11, 12:00pm-1:45pm					

Table 1: Course Schedule.

4 Others

Announcements and Communication

I will put announcements onto the main page of the CSE 5522 Carmen website carmen.osu.edu. Announcements of urgent matters will be mailed to yourName.# @osu.edu address. If you do not regularly read that account, make sure you forward it to somewhere that does. I will also monitor discussions on the Carmen discussion groups and answer as appropriate, but students should feel free to use the forums to have group discussions as well. Fair game for the homework discussion site might be questions like"What did Dr. A. mean by 'Give an example of foo' " or "How could I start approaching problem X?" but not "Can someone give me the answer for this question." Use common sense, keeping in mind the Code of Student Conduct.

Statement on Academic Misconduct:

It is the responsibility of the Committee on Academic Misconduct to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term academic misconduct includes all forms of student academic misconduct wherever committed; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Instructors shall report all instances of alleged academic misconduct to the committee (Faculty Rule 3335-5-487). For additional information, see the Code of Student Conduct http://studentlife.osu.edu/csc/. In particular, you should note that you are not allowed to, among other things, (a) knowingly provide or receive information during exams, (b) knowingly provide or receive assistance on homeworks unless I say it's OK, and (c) submit plagiarized (copied but unacknowledged) work for credit. If I suspect that any violation occurs, I am required to report the violation to the Council on Academic Misconduct. COAM will determine the guilt or innocence and appropriate penalties if any.

Statement about Disability Services:

Students with disabilities (including mental health, chronic or temporary medical conditions) that have been certified by the Office of Student Life Disability Services will be appropriately accommodated and should inform the instructor as soon as possible of their needs. The Office of Student Life Disability Services is located in 098 Baker Hall, 113 W. 12th Avenue; telephone 614-292-3307, slds@osu.edu ; http://slds.osu.edu/.