San José State University
Computer Science Department
CS156, Introduction to Artificial Intelligence, 04, Fall 2022

Course and Contact Information

Instructor(s):   Yulia Newton, Ph.D.
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Office Hours: Tue/Thur 6:15 – 7:15pm (via zoom). Also by appointment via zoom upon request. I am available to do one-on-one or group meetings.
Class Days/Time: Mon/Wed 7:30 - 8:45 PM
Classroom: Sciences Building 311
Prerequisites: CS 146 (Data Structures and Algorithms), CS 151/CMPE 135 (Object Oriented Analysis and Design) with a grade of "C-" or better in each; or equivalent knowledge with a proof

COVID-19 safety measures for in-person courses

All students registered for a College of Science (CoS) class with an in-person component must view the CoS COVID-19 Training slides (https://drive.google.com/drive/folders/1Vmp39U9-CNpbwRobtZsGIZPTgRwV_Nh6) and the SJSU Phased Adapt Plan website (https://www.sjsu.edu/healthadvisories/sjsu-adapt/phases/index.php) and acknowledge reading them according to their instructor's directions. By working together to follow these county and SJSU safety practices, we can keep our college safer. Students who do not follow COVID-19 Safety practice(s) outlined in the training, the SJSU Phased Adapt Plan, or instructions from their instructors, TAs or CoS Safety Staff may be dismissed from CoS buildings, facilities or field sites. Please review this training as needed throughout the semester, as updates will be implemented as changes occur (and posted to the same links).

Course Description

Basic concepts and techniques of artificial intelligence: problem solving, search, deduction, intelligent agents, knowledge representation. Topics chosen from logic programming, game playing, planning, machine learning, natural language, neural nets, robotics. Required team-based programming assignment. Prerequisite: CS 146 and CS 151/CMPE 135 (with a grade of "C-" or better in each); Computer Science, Applied and Computational Math or Software Engineering majors only; or instructor consent.

Course Format: technology intensive, in-person

Faculty Web Page and MYSJSU Messaging

We will use Canvas for most class related materials. Any specific/personal questions (grade related or personal situations) must be communicated via email or canvas message.

Course Goals

Understand fundamentals of AI and machine learning. Concentration will be on how-to, rather than mathematical proof. This class has a balance between the theory and practical demonstrations of how to solve AI tasks in python. We will cover application of AI solutions to the fields of bioinformatics, global economy, handwriting recognition, image processing, natural language processing, generative modeling and robotic.

Course Learning Outcomes (CLO)

Upon successful completion of this course, students will be able to:

1. Understanding of artificial intelligence and machine learning principals:
   a. General understanding of formulating a prediction problem
   b. Classification vs. regression
   c. Supervised vs. unsupervised learning
   d. Predictor vs. independent/input variables; feature space
   e. Model overfitting and underfitting; model bias and variance
   f. Curse of dimensionality
   g. Occam's razor
   h. Feature space reduction and techniques; feature engineering
   i. Training vs. test vs. validation sets; cross-validation; stratified cross-validation
   j. Model evaluation methods
   k. Loss function and various types of commonly used loss functions
   l. Model parameters vs. hyperparameters
   m. Optimization with gradient descent

2. Understanding of machine learning models:
   a. KNN
   b. Linear, polynomial, logistic regression
   c. Linear and non-linear SVMs
   d. Decision trees
   e. Single layer perceptron
   f. Multi-layer perceptron
   g. Deep neural networks
   h. Reinforcement learning

3. Understanding of various deep neural network architectures:
   a. Fully connected deep neural networks
   b. Convolutional neural networks
   c. Autoencoders
   d. Recurrent neural networks, LSTMs
   e. Generative adversarial networks

4. Knowledge of how to approach solving various prediction tasks:
   a. Dimensionality reduction and clustering
   b. Classification vs. regression problems
   c. Reinforcement learning problems

5.

c. Handwriting recognition
d. Image processing
e. Natural language processing
f. Generative modeling
g. Robotics

Optional Texts/Readings (no required text)

This class does not require a mandatory textbook. Google is your friend! Always refer to the specification documentation for the libraries you are using.

Optional textbook (I will not be teaching by it)

Artificial Intelligence: A modern approach (3rd or 4th edition)
Author: Stuart Russel and Peter Nerving
ISBN: 9780136042594

Other technology requirements / equipment / material

Python 3, Scikitlearn libraries, numpy/scipy, tensorflow/keras, gym, Jupyter notebooks. Installing Anaconda is highly recommended. I will be using JupyterLab in my code demos in class.

Course Requirements and Assignments

SJSU classes are designed such that in order to be successful, it is expected that students will spend a minimum of forty-five hours for each unit of credit (normally three hours per unit per week), including preparing for class, participating in course activities, completing assignments, and so on. More details about student workload can be found in University Policy S12-3 at

- Final Examination (20%)

Incomplete work:
Points will be deducted for incomplete question responses and solutions that are partially functional. Consult individual assignment for details of point allocation for each problem.

Extra credit:
Extra credit options might be available in this class. All and any possible extra credit options will be announced in class and posted in canvas system if and when they become available.

Homework assignment due date:
Submission is allowed till 11:59 pm on due date.

Late assignments:
10% of the assignment grade will be subtracted for each 1 week of late submission. Even one day late will count as the whole 1 week late. 8 days late submission will count as 2 weeks late, and so on.

Makeup Exams:
You must submit only your own work on exams. Makeup exams will only be given in cases of illness (documented by a doctor) or in cases of documentable, extreme emergency.

Grading scale:

Point % Range	Letter Grade	Point % Range	Letter Grade
97.0 – 100	A+	72.0 – 76.99	C
93.0 – 96.99	A		

Note that "All students have the right, within a reasonable time, to know their academic scores, to review their grade-dependent work, and to be provided with explanations for the determination of their course grades." See University Policy F13-1 at http://www.sjsu.edu/senate/docs/F13-1.pdf for more details.

Classroom Protocol (aka how to succeed in this class)

1. Attend all sessions. From past semesters, data shows that there is a positive correlation between attendance and your overall grade.
2. Come to class on time. Students entering the classroom late disrupt the lecture and / or the students already in class who may be engaged in lab or discussion.
3. A laptop/tablet is required in this class. Bring your device to lectures in order to be able to participate in in-class quizzes and activities.

4. If you miss a lecture you are still responsible for any material discussed or assignments given. A large portion of each class will be used for hands-on lab / discussion. All students are expected to participate in class activities. Students who are often absent will find themselves at a disadvantage during the tests.
5. No audio / video recording or photography in the classroom without prior permission of instructor. Instructor may provide review videos and/or flipped classroom.
6. No personal discussion or cell phone activity during class time. Please set the cell phone on silent/ vibrate mode.
7. Email to be sent to the instructor's SJSU email ID (yulia.newton@gmail.edu or yulia.newton@sjsu.edu) only. I check email periodically during the day but much less during weekends. Please do not expect quick turnaround time during weekends.
8. Start on your homework early and stay on top of them. Some assignments take way more time than you expect. Don't let your initial impression fool you.
9. Start forming study/project groups NOW. It makes it easier to work with the group for the final project. Your project partners are highly important to your success so choose them wisely.
10. Be prepared to learn A LOT. Some of this may require you to self-study certain topics. I will guide you through this journey but the onus of getting the best of this class lies on you.
11. If you are stuck or don't understand something, ASK. Come to office hours. If office hours don't work for you please email, ask on piazza, ask me right after class. I cannot help you if you don't ask for it.

Have fun learning!

University Policies

Per University Policy S16-9 (http://www.sjsu.edu/senate/docs/S16-9.pdf), relevant information to all courses, such as academic integrity, accommodations, dropping and adding, consent for recording of class, etc. is available on Office of Graduate and Undergraduate Programs' Syllabus Information web page at http://www.sjsu.edu/gup/syllabusinfo/".

Important dates

- August 19 – first day of instructions
- August31 – last day to drop a class without W grade
- September 8 – last day to add courses via MySJSU; last day to submit audit/CR-NC option request
- October 19 – midterm exam online (no class meeting)
- October 26 – term project progress report is due
- November 23 - November 25 – Thanksgiving (no class meetings)
- December 5 – term project is due
- December 6 – last day of instructions (the last lecture for this class is on December 5)
- December 12 – Final exam online (no in-person meeting)

Week	Date	Topics, Readings, Assignments, Deadlines	Additional Notes
8	10/5/2022	Introduction to single-layer perceptron	Homework 4 due Homework 6 assigned
8	10/10/2022	Introduction to multi-layer perceptron	
9	10/12/2022	Introduction to multi-layer perceptron	Homework 5 due Homework 7 assigned
9	10/17/2022	Introduction to convolutional neural networks	
10	10/19/2022	Midterm online (no class meeting)	
10	10/24/2022	Introduction to convolutional neural networks	
11	10/26/2022	Introduction to convolutional neural networks	Term project preliminary report due Homework 6 due
11	10/31/2022	Introduction to TensorFlow and Keras	Homework 7 due
12	11/2/2022	Autoencoders	Homework 8 assigned
12	11/7/2022	Introduction to generative adversarial networks (GANs)	
13	11/9/2022	Introduction to recurrent neural networks	Homework 9 assigned
13	11/14/2022	Introduction to natural language processing (NLP)	Homework 8 due Homework 10 assigned
14	11/16/2022	Introduction to reinforcement learning	
14	11/21/2022	Introduction to reinforcement learning	Homework 9 due Homework 11 assigned
15	11/23/2022	Thanksgiving - no instructions	

15	11/28/2022	Introduction to Bayesian inference	
16	11/30/2022	Ethics and artificial intelligence	Homework 10 due
16	12/5/2022	Catch up and special topics	Homework 11 due Term project due
Final	12/12/2022	Final exam online (no in-person meeting)	Online to take any time during that day All late