

**San José State University**  
**Computer Science Department**  
**CS156, Introduction to Artificial Intelligence, 01, Spring 2022**

**Course and Contact Information**

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Office Hours:	Mon/Wed 4:45 – 5:45 (DH 282). Also by appointment via zoom, flexible time, upon request. I am available to do one-on-one or group meetings.
Class Days/Time:	Mon/Wed 7:30 - 8:45 PM
Classroom:	Washington Square Hall 207
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](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 Format**

**Technology Intensive, Online Course**

**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 direct message to me.

**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, Introduction to Artificial Intelligence, CS156, Section 01 Spring 2022

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 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. Familiarity with solving problems in the following domains:
- a. Global economy
  - b. Bioinformatics
  - 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 <http://www.sjsu.edu/senate/docs/S12-3.pdf>.

- Each student is expected to be present, punctual, and prepared at every scheduled class and lab session. It is assumed that the students already have basic knowledge of digital Boolean logic and fundamentals of programming.
- Attendance is NOT optional though it does not form any part of your grade. Individual participation is also required. There will be no make-ups for missed midterm or assignments, unless any special arrangements is made with the instructor beforehand. The student is responsible for any material he/she may have missed.
- There will be homework assignments (some of which might be team based), one midterm and final exam. All homework should be submitted through Canvas. No scanned copy of handwritten solution is allowed.

## Final Examination or Evaluation

There is an online Final Exam for this course. Please check the university Final Exam schedule for the exact date and time of the final exam (<http://info.sjsu.edu/static/catalog/final-exam-schedule-spring.html>).

## Grading Information

### Grading calculation will be based on the following:

- Assignments/Problem Sets (30%)
- Quizzes (20%)
- Midterm exam (20%)
- Term project (10%)
- 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 the 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	70.0 - 71.99	C-
90.0 - 92.99	A-	67.0 - 69.99	D+

87.0 - 89.99	B+	62.0 - 66.99	D
82.0 - 86.99	B	60.0 - 61.99	D-
80.0 - 81.99	B-	<60.0	F
77.0 - 79.99	C+		

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.com](mailto:yulia.newton@gmail.com) or [yulia.newton@sjsu.edu](mailto:yulia.newton@sjsu.edu)) only. Please DO NOT use canvas for emailing. 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) (<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](http://www.sjsu.edu/gup/syllabusinfo/) at <http://www.sjsu.edu/gup/syllabusinfo/>.

## **Important dates**

- January 26 – first day of instructions
- February 7 – last day to drop a class without W grade
- February 8 – late drop petition required
- February 14 – last day to add courses via MySJSU; last day to submit audit/CR-NC option request
- March 23 – midterm exam online (no class meeting)
- March 28 - April 1 – Spring break (no class meetings)
- April 4 – Term project preliminary report is due
- May 16 – last day of instructions (the last lecture for this class is on May 16)
- May 16 – Term project submission is due
- May 23 – Final exam online (no in-person meeting)

**Course Schedule** *Tentative schedule. Subject to change with notice.*

Week	Date	Topics, Readings, Assignments, Deadlines	Additional Notes
1	1/26/2022	Class introduction, logistics, misc.	Attendance quiz due on 1/28/22
2	1/31/2022	High level overview of artificial intelligence, terminology and main concepts	
2	2/2/2022	High level overview of artificial intelligence, terminology and main concepts	Quiz#1 assigned
3	2/7/2022	High level overview of artificial intelligence, terminology and main concepts	Quiz#1 due on 2/6/22
3	2/9/2022	High level overview of artificial intelligence, terminology and main concepts	Quiz#2 assigned
4	2/14/2022	High level overview of artificial intelligence, terminology and main concepts	Quiz#2 due on 2/13/22
4	2/16/2022	High level overview of artificial intelligence, terminology and main concepts	Homework 1 assigned Quiz#3 assigned
5	2/21/2022	Introduction to PCA, k-means clustering, and KNN classification	Quiz#3 due on 2/20/22 Homework 2 assigned
5	2/23/2022	Regression models	Homework 1 due Quiz#4 assigned
6	2/28/2022	Regression models	Quiz#4 due on 2/27/22 Homework 2 due Homework 3 assigned
6	3/2/2022	Support vector machines	Quiz#5 assigned Homework 4 assigned
7	3/7/2022	Decision tree based models	Quiz#5 due on 3/6/22 Homework 3 due
7	3/9/2022	Decision tree based models; Discussion of the term project and midterm	Quiz#6 assigned Homework 5 assigned
8	3/14/2022	Introduction to single-layer perceptron	Quiz#6 due on 3/13/22 Homework 4 due Homework 6 assigned
8	3/16/2022	Introduction to multi-layer perceptron	Quiz#7 assigned
9	3/21/2022	Introduction to multi-layer perceptron	Quiz#7 due on 3/20/22 Homework 5 due Homework 7 assigned
9	3/23/2022	Midterm online (no class meeting)	

10	3/28/2022	Spring break (no class)	
10	3/30/2022	Spring break (no class)	
11	4/4/2022	Introduction to convolutional neural networks	Term project preliminary report due Homework 6 due
11	4/6/2022	Introduction to convolutional neural networks	Homework 7 due Quiz#8 assigned
12	4/11/2022	Introduction to convolutional neural networks	Quiz#8 due on 4/10/22 Homework 8 assigned
12	4/13/2022	Introduction to TensorFlow and Keras	Quiz#9 assigned
13	4/18/2022	Autoencoders	Quiz#9 due on 4/18/22 Homework 9 assigned
13	4/20/2022	Introduction to generative adversarial networks (GANs)	Homework 8 due Quiz#10 assigned Homework 10 assigned
14	4/25/2022	Introduction to recurrent neural networks	Quiz#10 due on 4/24/22
14	4/27/2022	Introduction to natural language processing (NLP)	Quiz#11 assigned Homework 9 due
15	5/2/2022	Introduction to reinforcement learning	Quiz#11 due on 5/1/22 Homework 11 assigned Homework 10 due
15	5/4/2022	Introduction to reinforcement learning	Quiz#12 assigned
16	5/9/2022	Introduction to Bayesian inference	Quiz#12 due on 5/8/22
16	5/11/2022	Ethics and artificial intelligence	Homework 11 due Quiz#13 assigned
17	5/16/2022	Catch up and/or special topics	Quiz#13 due on 5/15/22 Term project due
Final	5/23/2021	Final exam online (no in-person meeting)	Online to take any time during that day  All late work must be submitted by 5/24/22