

**San José State University**  
**Computer Science Department**  
**CS 256, Topics in Artificial Intelligence, Section 1, Spring 2021**

**Course and Contact Information**

Instructor:	H. Chris Tseng
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Email:	chris.tseng@sjsu.edu
Office Hours:	Tue/Thur 8:45 – 9:15 PM, Sat: 4:30-4:45 PM, and appointment by email
Class Days/Time:	Tue/Thur 7:30 – 8:45 PM
Classroom:	Online
Prerequisites:	CS 156 and Graduate standing. Allowed Declared Major: Computer Science, Bioinformatics, Data Science. Or instructor consent.

**Course Format**

**Technology Intensive, Hybrid, and Online Courses**

This course combines theories with hands-on assignments. Students are expected to work in teams to accomplish machine learning project(s) using open source technologies. Students are expected to be proficient in Python.

**Faculty Web Page and MYSJSU Messaging**

Course materials such as syllabus, handouts, notes, assignment instructions, etc. can be found on the [Canvas Learning Management System course login website](http://sjsu.instructure.com) at <http://sjsu.instructure.com>. You are responsible for regularly checking with the messaging system through [MySJSU](http://my.sjsu.edu) at <http://my.sjsu.edu> to learn of any updates.

**Course Description**

**Catalog description:** Introduction to topics in artificial intelligence such as problem solving methods, game playing, understanding natural languages, pattern recognition, computer vision, and the general problem of representing knowledge. Students will be expected to use LISP.

**Course Learning Outcomes (CLO)**

This course aims to introduce students to the underlying theories and applications for Neural Networks.

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

- Explain Neural Networks concepts and modeling principles
- Use software tools such as Google Colaboratory, Matplotlib, Scitkit- Learn, Pandas, Numpy, and PyTorch to analyze and visualize data.

- Understand and apply Neural Networks and Deep Learning methodologies for natural languages, pattern recognition, and computer vision problems.
- Build, evaluate, and refine Neural Networks models for prediction and identification from data sets.
- Design, implement, and present a team project on Neural Networks applications

## Required Texts/Readings

### Textbook

No textbook is needed. Class material will be posted on the Canvas account under <http://sjsu.instructure.com>.

### References

1. [Introduction to Machine Learning with Python](https://www.amazon.com/exec/obidos/ASIN/1449369413/ref=nosim/sjsu-20), (<https://www.amazon.com/exec/obidos/ASIN/1449369413/ref=nosim/sjsu-20>) Andreas C. Müller and Sarah Guido, 2016, O'Reilly.
2. [Deep Learning \(Adaptive Computation and Machine Learning\)](https://www.amazon.com/exec/obidos/ASIN/0262035618/ref=nosim/sjsu-20), (<https://www.amazon.com/exec/obidos/ASIN/0262035618/ref=nosim/sjsu-20>) Goodfellow, Bengio, etc., 2016, The MIT Press
3. [Mathematics for Machine Learning](https://mml-book.github.io/book/mml-book.pdf), (<https://mml-book.github.io/book/mml-book.pdf>) Deisenroth, Faisal, and Ong, 2020, Cambridge University Press.

### Additional Readings

A list of additional readings will be provided on the Canvas page associated with this class under <http://sjsu.instructure.com>.

### Other technology requirements / equipment / material

You will be required to have a wireless-network ready laptop computer to participate in the class. You will also need to use your own laptop with wireless access to submit your assignment inside the SJSU campus. Your laptop needs to have wireless capability and you need to register a free wireless account at <https://one.sjsu.edu/>. The instructor is not responsible for providing either laptops or alternatives.

## Course Requirements and Assignments

Success in this course is based on the expectation that students will spend, for each unit of credit, a minimum of 45 hours over the length of the course (normally three hours per unit per week) for instruction, preparation/studying, or course related activities, including but not limited to internships, labs, and clinical practica. Other course structures will have equivalent workload expectations as described in the syllabus.

#### a. Projects:

A final team project will be provided for you to practice Neural Networks principles. Self-selected teams of 3-4 people will work together to solve some selected problems discussed in the course.

This team project will be a collaborated group project. You are free to choose your own partners but you cannot change your partners in the middle of the project. Progressive design and implementation of the term project will be done through assignments as part of the learning objectives.

#### b. Exams:

There will be one midterm and one final exam.

c. Quizzes:

There will be 1-2 quizzes and each will be counted as a HW.

d. Homework:

There will be 5-7 HWs. Quizzes and intermediate milestones of your team project will also be counted as HW grades.

e. Tentative course exam and HW due dates:

(Please note that this is “subject to change at the discretion of the instructor”)

HW/Quiz/Project milestones: One of these will be assigned about once a week.

Midterm: Thursday, March 11, 2021

Final: (Per SJSU final schedule) 7:45 PM, Thursday, May 20, 2021.

**Grading Information**

Grades:

HW assignments and quizzes	20 %
Midterm	25 %
Final Team Project	30 %
Final	25 %

**Determination of Grades**

Grades will be assigned as described below. These intervals, however, may change (i.e., either way!) according to the performance of the class as a whole. C- is a passing grade.

- A: [ 93, 100 ]
- A-: [ 90, 93 )
- B+: [ 87, 90 )
- B: [ 83, 87 )
- B-: [ 80, 83 )
- C+: [ 75, 80 )
- C: [ 70, 75 )
- C-: [ 65, 70 )
- D+: [ 60, 65 )
- D: [ 55, 60 )
- D-: [ 50, 55 )
- F: [ 0, 50 )

**Classroom Protocol**

You are expected to attend classes. If you cannot attend, it is your responsibility to get a copy of the lecture notes and class announcements from a reliable classmate. The instructor reserves the right to ignore frivolous or inappropriate e-mail inquiries. Students are expected to participate actively to provide improvement to presentations by other classmates.

## **University Policies**

Per University Policy S16-9, university-wide policy information relevant to all courses, such as academic integrity, accommodations, etc. will be available on the Office of Graduate and Undergraduate Programs' [Syllabus Information web page](http://www.sjsu.edu/gup/syllabusinfo/) at <http://www.sjsu.edu/gup/syllabusinfo/>. Make sure to review these policies and resources.

## CS 256, Topics in AI, Section 1, Spring, 2021 Course Schedule

**Online Zoom link:** <https://sjsu.zoom.us/j/659204428> (Need to login to your SJSU account to gain access to Zoom. All students must turn on the video to participate)

*The schedule is subject to change at the discretion of the instructor.*

### Course Schedule

Week	Date	Topics, Readings, Assignments, Deadlines
1	1/28/2021	Python Review; Google Colaboratory;
1		
2	2/2/2021	EDA with Pandas and Numpy; HW#1 due
2	2/4/2021	Visualization with Pandas, Matplotlib, and Seaborn
3	2/9/2021	Introduction to Supervised Learning; Scikit-Learn; Linear Regression; HW#2 due
3	2/11/2021	Modeling and feature selection; Feature engineering; One-hot-encoding
4	2/16/2021	Logistic Regression; Overfitting and Underfitting; HW#3 due
4	2/18/2021	Regularization; Bias and Variance tradeoff
5	2/23/2021	Feedforward Neural Network; Calculus for machine learning; HW#4 due
5	2/25/2021	Back propagation ; Quiz #1
6	3/2/2021	Neural Networks hidden layer units and depth; learning rate and convergence; HW#5 due
6	3/4/2021	Application of Neural Networks to digit recognition problems
7	3/9/2021	Review
7	3/11/2021	midterm
8	3/16/2021	Keras for Neural Networks
8	3/18/2021	Refining Neural Networks models; Hyperparameters; Grid searching
9	3/23/2021	Introduction to NLP; Count Vectorization; HW# 6 due
9	3/25/2021	Stemming and Lemmatization; TF-ID
10	3/30/2021	Spring break (no class)
10	4/1/2021	Spring break (no class)
11	4/6/2021	Convolutional Networks
11	4/8/2021	Keras for Convolutional Neural Networks
12	4/13/2021	Applications of Neural Networks to time series data and image recognition problems; Final project team forming

<b>Week</b>	<b>Date</b>	<b>Topics, Readings, Assignments, Deadlines</b>
12	4/15/2021	Recurrent Neural Networks; PyTorch
13	4/20/2021	Final project milestone 1 due (presentation)
13	4/22/2021	Image classification with PyTorch
14	4/27/2021	Time Series Prediction with LSTM Recurrent Neural Networks
14	4/29/2021	Final project milestone 2 due (presentation)
15	5/4/2021	Transfer Learning (or other selected Neural Networks topic)
15	5/6/2021	Generative adversarial network (GAN) (or other selected Neural Networks topic)
16	5/11/2021	Final team project presentation
	5/13/2021	Final team project presentation
Final Exam	7:45 PM Thursday, May 20, 2021	Final