SJSU SAN JOSÉ STATE UNIVERSITY

College of Science · Computer Science

Topics in Machine Learning Section 02

CS 271

Spring 2024 3 Unit(s) 01/24/2024 to 05/13/2024 Modified 01/25/2024

Contact Information

Instructor: Saptarshi Sengupta, PhD

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Office Hours: Thursday, 1:00 PM – 3:00 PM

Class Days/Time: TuTh 12:00 PM - 1:15 PM

Classroom: MacQuarrie Hall 222

Course Description and Requisites

Variable topics in machine learning. Content may include hidden Markov models, principal component analysis, support vector machines, clustering, boosting, random forests, neural networks, and deep learning. Relevant applications will be covered.

Prerequisite(s): CS 157A. Allowed Declared Major: MS in Computer Science, Bioinformatics, Data Science. Or instructor consent.

Letter Graded

Classroom Protocols

- Cheating will not be tolerated.
- Student must be respectful of the instructor and other students. For example, No disruptive or annoying behavior
- Turn off cell phones

- Class begins on time
- Valid picture ID required at all times

Program Information

Diversity Statement - At SJSU, it is important to create a safe learning environment where we can explore, learn, and grow together. We strive to build a diverse, equitable, inclusive culture that values, encourages, and supports students from all backgrounds and experiences.

Course Goals

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

1. Develop machine learning algorithms and apply them to problems across various application areas.
2. Achieve competence in performing model development, deployment and testing across multiple modalities in real-world settings.

Course Learning Outcomes (CLOs)

The focus of this course will be machine learning, with examples from fields such as computer vision, natural language processing, anomaly detection, health informatics and prognostics. After completing this course students will develop a solid background in machine learning theory and applications, which will enable them to take up real-world problems and demonstrate competence while working on them.

Course Materials

Textbook:

None Required

Other Readings:

Deep Learning (Adaptive Computation and Machine Learning series)

Authors: Ian Goodfellow, Yoshua Bengio, Aaron Courville

ISBN-13: 9780262035613

ISBN-10: 0262035618

Other technology requirements / equipment / material:

Python 3, Scikitlearn libraries, numpy/scipy, Tensorflow and Keras, PyTorch, gym, Jupyter notebooks. Installing Anaconda is highly recommended. I will be using Jupyter Notebook and VS code in my 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.

Homework, Exams and Final Projects are expected for this class. Homework is due on Canvas by midnight on the due date. Each assigned problem requires a solution and an explanation (or work) detailing how you arrived at your solution. Cite any outside sources used to solve a problem. When grading an assignment, I may ask for additional information.

NOTE that University policy F69-24 at http://www.sjsu.edu/senate/docs/F69-24.pdf states that "Students should attend all meetings of their classes, not only because they are responsible for material discussed therein, but because active participation is frequently essential to insure maximum benefit for all members of the class. Attendance per se shall not be used as a criterion for grading."

Grading Information

Semester grade will be computed as a weighted average of the scores obtained in each of the four categories listed above. No make-up tests or quizzes will be given, and no late homework (or other work) will be accepted. Also, in-class work must be completed in the section that you are enrolled in.

Criteria

Determination of Grades

Semester grade will be computed as a weighted average of the scores obtained in each of the four categories listed above. No make-up tests or quizzes will be given, and no late homework (or other work) will be accepted. Also, in-class work must be completed in the section that you are enrolled in.

Nominal Grading Scale:

Percentage	Grade
97 – 100 plus	A+
93 – 96	A

90 – 92	A-
87 – 89	B+
83 – 86	B
80 – 82	B-
77– 79	C+
73 – 76	C
70 – 72	C-
67 – 69	D+
63 – 66	D
60 - 62	D-
0-59	F

Breakdown

- Homework: 25%
- Exam 1: 25%
- Exam 2: 25%
- Final Project: 25%

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 (http://www.sjsu.edu/senate/docs/F13-1.pdf)for more details.

University Policies

Per University Policy S16-9 (PDF) (http://www.sjsu.edu/senate/docs/S16-9.pdf), relevant university policy concerning all courses, such as student responsibilities, academic integrity, accommodations, dropping and adding, consent for recording of class, etc. and available student services (e.g. learning assistance,

counseling, and other resources) are listed on the Syllabus Information (https://www.sjsu.edu/curriculum/courses/syllabus-info.php) web page. Make sure to visit this page to review and be aware of these university policies and resources.

Course Schedule

CS 271 / Topics in Machine Learning, Spring 2024, Course Schedule

The schedule is subject to change with fair notice communicated via Canvas course page/in-class

Course Schedule

Week	Date	Topics, Readings, Assignments, Deadlines
1	01/25	Introduction
2	01/30	Classification, Regression, Generalization and Model Complexity
2	02/01	K Nearest Neighbors, Linear Models, Naïve Bayes
3	02/06	Decision Trees, Kernelized SVM
3	02/08	Neural Networks Fundamentals
4	02/13	Introduction to Deep Learning
4	02/15	Computer Vision with Convolutional Neural Networks
5	02/20	Advanced Computer Vision: Architectures
5	02/22	Computer Vision Applications, Neural Style Transfer
6	02/27	Generative Adversarial Networks: DCGAN, SRGAN, CycleGAN and InfoGAN
6	02/29	Autoencoders: Vanilla, Sparse, Denoising and Stacked

Week	Date	Topics, Readings, Assignments, Deadlines
7	03/05	Recurrent Neural Networks, BPTT, Vanishing and Exploding Gradients
7	03/07	RNN Cell Variants, RNN Variants and RNN topologies
8	03/12	Attention mechanisms in RNN, Transformers and other SOTA models
8	03/14	Exam 1
9	03/19	Language Modeling: Types, Bag-of-Words, Stopwords, Rescaling, Model Coefficients, n-Grams, Advanced Tokenization, Stemming and Lemmatization
9	03/21	Different kinds of Embeddings
10	03/26	Large language models: BERT and derivatives
10	03/28	Sequence to sequence learning and speech recognition
11	04/02	Spring recess – no classes
11	04/04	Spring recess – no classes
12	04/09	Unsupervised Learning: PCA, NMF, Manifold Learning
12	04/11	Unsupervised Learning: K-Means, Agglomerative Clustering, DBSCAN, CART
13	04/16	Robustness of Models
13	04/18	Time Series Analysis: Classical Approaches
14	04/23	Time Series Analysis: Data-driven Approaches

Week	Date	Topics, Readings, Assignments, Deadlines
14	04/25	Predictive Maintenance in the Data-driven Age
15	04/30	Cyber Physical Systems and Fault Diagnosis
15	05/02	Exam 2
16	05/07	Project Presentations
16	05/09	Project Presentations