CSCI 567 - Machine Learning

Spring 2021

Instructor:	Sirisha Rambhatla	**Time:**	WF 10:00 – 11:50 AM
Email:	sirishar@usc.edu	**Place:**	Held virtually via DEN@USC

Teaching Staff:

1. **Teaching Assistants:** Karishma Sharma (`krsharma`), and Liyu Chen (`liyuc`)
2. **Course Producers:** Dhiti Thakkar (`dhitisam`) and Prateek Jain (`jainp`)

Course Pages:

1. https://courses.uscden.net
2. https://piazza.com/class/kjkinvvwzi12mp

Office Hours: Check https://piazza.com/usc/spring2021/20211csci567/staff for details.

Lectures and Discussions: Each class is divided into a lecture component, followed by a discussion. The discussion sessions are led by TAs and provide more detailed and in-depth exposition of the class materials, as well as reviews of homework and quizzes.

Main References: There is no required textbook for this course, but the following two books are the main recommended readings.

- Kevin Murphy, *Machine Learning: A Probabilistic Perspective* [MLaPP]
- Hastie, Tibshirani and Friedman, *Elements of Statistical Learning* [ESL]

Objectives: The chief objective of this course is to introduce standard statistical machine learning methods, including but not limited to various methods for supervised and unsupervised learning problems. Particular focuses are on the conceptual understanding of these methods, their applications and hands-on experience.

Prerequisites: (1) Undergraduate level training or coursework on linear algebra, (multivariate) calculus, and basic probability and statistics; (2) Basic skills in programming with Python. In addition, an undergraduate level course in Artificial Intelligence may be helpful but is not required.

Tentative Course Outline: We will begin with an overview of machine learning and refresh some of the key mathematical concepts used throughout the course. We will then explore Nearest Neighbour Classification and its theoretical foundations, Linear Regression and its extensions using nonlinear basis, Linear Classifiers, Logistic Regression and Multi-class Classification. Next, we introduce Neural Networks including Convolutional Neural Networks. We then cover Kernel Methods, Support Vector Machine and its various formulations. This will be followed by Decision Trees and Ensemble Methods and Clustering (K-means). Next, we consider Gaussian Mixture Models and Density Estimation, Naive Bayes, Dimensionality Reduction and PCA. We will then move to Hidden Markov models, Multi-armed bandit Models, Reinforcement Learning and time permitting, consider topics like Sequential Models and RNNs and interpretability. We will conclude with a class on Bias in Machine Learning Models with an aim to equip students with the tools for building reliable and fair learning models.

Grading Policy: Homeworks (40%), Quizzes (30%), Project (30%).

Tentative List of Important Dates: Following is a list of important dates. Note that these dates are subject to change as the class progresses.

Project Assigned	February 3, 2021
Quiz #1	March 3, 2021 (in-class)
Project Checkpoint 1	March 10, 2021
Project Deadline	May 3, 2021
Quiz #2 (Final)	May 10, 2021 8:00-10:00 AM

Communication: The main communication tool for this course is Piazza (no Slack). Piazza is integrated into the DEN@USC platform. All announcements of this course will be made on Piazza, so you have to sign up. All questions/messages that do not need a particular instructor/TA/CP's direct attention should be posted on Piazza with the appropriate privacy setting. Students are encouraged to participate in the discussions actively. For all other questions related to a particular instructor/TA/CP, send us an email using your USC email account and **please add "CSCI 567" at the beginning of the subject line**.

Academic Integrity: USC seeks to maintain an optimal learning environment. General principles of academic honesty include the concept of respect for the intellectual property of others, the expectation that individual work will be submitted unless otherwise allowed by an instructor, and the obligations both to protect one's own academic work from misuse by others as well as to avoid using another's work as one's own. All students are expected to understand and abide by these principles. Campus, the Student Guidebook, contains the Student Conduct Code in Section 11.00. Students will be referred to the Office of Student Judicial Affairs and Community Standards for further review, should there be any suspicion of academic dishonesty. For more details visit https://viterbischool.usc.edu/academic-integrity/.

Students with disabilities: Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to the instructor as early in the semester as possible.