**San José State University**

**College of Engineering/Computer Engineering Dept**

**CMPE 257 Section 2, Machine Learning**

**Spring 2018**

**Instructor:** Bhavana Bhasker

**Office Location:** ENG- 250

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**Office Hours:** Mon 17:00 – 18:00

**Class Days/Time:** Monday 18:00 – 20:45 (Seminar)

**Classroom:** Dudley Moorhead Hall, Room 161

**Prerequisites:** Instructor Consent

**Instructional Student Assistant:**

## 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](file:///C:\Downloads\2015\Acc%20Outreach\sjsu.instructure.com) course website at http://sjsu.instructure.com. You are responsible for regularly checking with the messaging system through [MySJSU](file:///C:\Downloads\2015\Acc%20Outreach\my.sjsu.edu) at http://my.sjsu.edu (or other communication system as indicated by the instructor) to learn of any updates*.*

**Course Catalog Description**

Machine Learning is a field of study that gives computers the ability to learn without being explicitly programed. It has a wide spectrum of applications in today’s computer engineering world, such as pattern recognition, data mining, optical character recognition, speech recognition, effective web search, computer vision, etc. It is a key technique toward reaching our goal of having the human-level Artificial Intelligence.

In this course, the concept of machine learning and various learning theories and algorithms for data classification, regression, and clustering on linear and nonlinear data space will be discussed. The techniques of improving the prediction accuracy to minimize the errors will be described. The data preprocessing techniques will be addressed. The machine learning project process will be instructed for effective and efficient application development. An individual project as well as a team project will be conducted throughout the course.

**Program Outcomes**

**Course Goals and Student Learning Objectives**

At the end of the course, the student will

1. Be able to explain concepts, practices, tools and methods of Machine Learning.

2. Be able to perform data classification, regression, and clustering tasks in some fields such as

science, engineering, healthcare, or social media, etc. with the appropriate techniques/algorithms.

3. Be able to apply modern tools (such as Scikit-Learn, NLTK, Tensorflow and Keras) and languages (such as R, Java, or Python) to perform the learning from data homework and projects.

4. Be able to work on algorithm fine-tuning research and development projects to improve prediction accuracy and deep learning projects.

5. Be able to design, implement, and present a team project focusing on Machine Learning applications.

**Required Texts/Readings**

**Textbook**

1. *“Learning from Data”, Yaser S. Abu-Mostafa, Malik Magdon-Ismail, and Hsuan-Tien Lin, AMLbook.com, 2012*
2. *The eChapters associated with the textbook 1.*

3. Other *reading material will be assigned in the class.*

**References**

1. *“Machine Learning”, Tom M. Mitchell, McGraw-Hill, 1997*
2. *“An Introduction to Statistical Learning with Applications in R”, Gareth James, Daniela Witten, Trevor Hastie, and Robert Tibshirani, Springer, 2013*

*3. Some required references are to be provided during the class.*

**Assignments and Grading Policy**

The grading percentages for the course work: homework, exams, special topic individual report, and

team project, are as follows:

**Course work components:**

* Assignments 15%
* Quizzes 5%
* Midterm 20%
* Final Exam 30%
* Team Semester Project 30%

Grading Scale

A+ 97-100 A 93-96.9 A- 90-92.9

B+ 87-89.9 B 83-86.9 B- 80-82.9

C+ 77-79.9 C 73-76.9 C- 70-72.9

D+ 67-69.9 D 63-69.9 D- 60-62.9

Late submission of assignments (homework or report) will have penalty. The penalty

amount will be announced in the class.

**Note**: If a student is to miss an exam, the student needs to inform the instructor to obtain

approval before the exam. An official physician statement will be required if the student

is sick and cannot attend the exam.

In the following paragraphs, each assignment component is explained below:

**Homework Assignments:**

Assignments are together worth 15% of the course grade. Late homework credit will be penalized. The due dates for the assignments will be given during the class and Canvas.

**Team Semester Project:**

The project will have frequent checkpoints along the way for which you will have

to turn in status reports, preliminary designs, and the like. The project will be

worth 30% of the course grade. The project specification will be distributed during the class.

A variety of project topics will be presented to the class. The team (3 students per

team) will select one project topic. Each team is required to present and demonstrate its

project, and submit a team project report in Word. An 8-minute presentation in Power Point will be conducted at the end of semester to share the study with other classmates.

* Technical Quality 8%
* Degree of Complexity/Efforts 7%
* Creativity 5%
* Presentation Quality 5%
* Documentation Quality 5%

**Project Schedule:**

There is a final project presentation. No makeup presentation will be given, unless the case is critical. For the exceptional cases, documented reasons (e.g. physician’s statement) are required.

* Final Project Review 05/14/18

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

## Classroom Protocol

Please arrive to class on time. Most recent updates are presented at the very beginning of each class. Even if tardy or absent, each student is personally responsible for staying up- to-date with all instructions and relevant announcements. All participation, including questions during lecture, volunteering solutions, and contributing in group activities, is highly encouraged. You must exhibit a respectful and professional attitude towards everyone in the classroom at all times. Don’t surf smart phones or tablets or use laptops unless required for class related matters.

## University Policies

### **General Expectations, Rights and Responsibilities of the Student**

As members of the academic community, students accept both the rights and responsibilities incumbent upon all members of the institution. Students are encouraged to familiarize themselves with SJSU’s policies and practices pertaining to the procedures to follow if and when questions or concerns about a class arises. To learn important campus information, view [University Policy S90–5](http://www.sjsu.edu/senate/docs/S90-5.pdf) at http://www.sjsu.edu/senate/docs/S90-5.pdf and SJSU current semester’s [Policies and Procedures](file:///C:\Policies%20and%20Procedures), at http://info.sjsu.edu/static/catalog/policies.html. In general, it is recommended that students begin by seeking clarification or discussing concerns with their instructor. If such conversation is not possible, or if it does not address the issue, it is recommended that the student contact the Department Chair as the next step.

### **Dropping and Adding**

Students are responsible for understanding the policies and procedures about add/drop, grade forgiveness, etc. Add/drop deadlines can be found on the current academic year calendars document on the [Academic Calendars webpage](http://www.sjsu.edu/provost/services/academic_calendars/) at http://www.sjsu.edu/provost/services/academic\_calendars/. The [Late Drop Policy](http://www.sjsu.edu/aars/policies/latedrops/policy/) is available at http://www.sjsu.edu/aars/policies/latedrops/policy/**.** Students should be aware of the current deadlines and penalties for dropping classes.

Information about the latest changes and news is available at the [Advising Hub](http://www.sjsu.edu/advising/) at http://www.sjsu.edu/advising/.

### **Consent for Recording of Class and Public Sharing of Instructor Material**

[University Policy S12-7](http://www.sjsu.edu/senate/docs/S12-7.pdf), http://www.sjsu.edu/senate/docs/S12-7.pdf, requires students to obtain instructor’s permission to record the course and the following items to be included in the syllabus:

* “Common courtesy and professional behavior dictate that you notify someone when you are recording him/her. You must obtain the instructor’s permission to make audio or video recordings in this class. Such permission allows the recordings to be used for your private, study purposes only. The recordings are the intellectual property of the instructor; you have not been given any rights to reproduce or distribute the material.”
  + In classes where active participation of students or guests may be on the recording, permission of those students or guests should be obtained as well.
* “Course material developed by the instructor is the intellectual property of the instructor and cannot be shared publicly without his/her approval. You may not publicly share or upload instructor generated material for this course such as exam questions, lecture notes, or homework solutions without instructor consent.”

### **Academic integrity**

Your commitment, as a student, to learning is evidenced by your enrollment at San Jose State University. The [University Academic Integrity Policy S07-2](http://www.sjsu.edu/senate/docs/S07-2.pdf) at http://www.sjsu.edu/senate/docs/S07-2.pdf requires you to be honest in all your academic course work. Faculty members are required to report all infractions to the office of Student Conduct and Ethical Development. The [Student Conduct and Ethical Development website](http://www.sjsu.edu/studentconduct/) is available at http://www.sjsu.edu/studentconduct/.

### **Campus Policy in Compliance with the American Disabilities Act**

If you need course adaptations or accommodations because of a disability, or if you need to make special arrangements in case the building must be evacuated, please make an appointment with me as soon as possible, or see me during office hours. [Presidential Directive 97-03](http://www.sjsu.edu/president/docs/directives/PD_1997-03.pdf) at http://www.sjsu.edu/president/docs/directives/PD\_1997-03.pdf requires that students with disabilities requesting accommodations must register with the [Accessible Education Center](http://www.sjsu.edu/aec) (AEC) at http://www.sjsu.edu/aec to establish a record of their disability.

### **Accommodation to Students' Religious Holidays**

San José State University shall provide accommodation on any graded class work or activities for students wishing to observe religious holidays when such observances require students to be absent from class. It is the responsibility of the student to inform the instructor, in writing, about such holidays before the add deadline at the start of each semester. If such holidays occur before the add deadline, the student must notify the instructor, in writing, at least three days before the date that he/she will be absent. It is the responsibility of the instructor to make every reasonable effort to honor the student request without penalty, and of the student to make up the work missed. See [University Policy S14-7](http://www.sjsu.edu/senate/docs/S14-7.pdf) at http://www.sjsu.edu/senate/docs/S14-7.pdf.

## Student Technology Resources

Computer labs for student use are available in the [Academic Success Center](http://www.sjsu.edu/at/asc/) at http://www.sjsu.edu/at/asc/ located on the 1st floor of Clark Hall and in the Associated Students Lab on the 2nd floor of the Student Union. Additional computer labs may be available in your department/college. Computers are also available in the Martin Luther King Library. A wide variety of audio-visual equipment is available for student checkout from Media Services located in IRC 112. These items include DV and HD digital camcorders; digital still cameras; video, slide and overhead projectors; DVD, CD, and audiotape players; sound systems, wireless microphones, projection screens and monitors.

## SJSU Peer Connections

Peer Connections’ free tutoring and mentoring is designed to assist students in the development of their full academic potential and to inspire them to become independent learners.  Peer Connections tutors are trained to provide content-based tutoring in many lower division courses (some upper division) as well as writing and study skills assistance. Small group and individual tutoring are available.  Peer Connections mentors are trained to provide support and resources in navigating the college experience. This support includes assistance in learning strategies and techniques on how to be a successful student.  Peer Connections has a learning commons, desktop computers, and success workshops on a wide variety of topics.  For more information on services, hours, locations, or a list of current workshops, please visit [Peer Connections website](http://peerconnections.sjsu.edu) at http://peerconnections.sjsu.edu for more information.

**Spring 2018, CMPE257-2 Course Schedule**

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| --- | --- | --- | --- |
| **Week** | **Date** | **Topics, Readings, Assignments** | **Due** |
| 1 | 1/29 | Introduction, ML Overview and Challenges |  |
| 2 | 2/05 | Review on Linear Algebra, Probability, and Statistics. Machine Learning Basics |  |
| 3 | 2/12 | Perceptron Learning Algorithm, Hoeffding Inequality, Linear Models. HW#1 |  |
| 4 | 2/19 | Linear Models, Non-linear Transformation, Errors & Noise, Training & Testing | HW#1 |
| 5 | 2/26 | Generalization, VC Dimension and the Bias-Variance Tradeoff. HW#2 |  |
| 6 | 3/05 | ML Project Process and Data Preprocessing.  Algorithms Overview | HW#2 |
| 7 | 3/12 | **Mid-term Exam** |  |
| 8 | 3/19 | Neural Networks (Multilayer Perceptron, Back Propagation). |  |
| 9 | 3/26 | Overfitting, Regularization, and Validation. Project Case Studies. HW#3 |  |
| 10 | 4/02 | Deep Learning : CNN HW#4 |  |
| 11 | 4/09 | Deep Learning : RNN – Seq to Seq, Attention based models | HW#3 |
| 12 | 4/16 | Unsupervised Learning, (Clustering, kNN, PCA, ICA). | HW#4 |
| 13 | 4/23 | Decision Trees, Ensemble Methods. |  |
| 14 | 4/30 | Computer Vision and Machine Learning |  |
| 15 | 5/07 | Reinforcement Learning |  |
| 16 | 5/14 | Semester Project Presentation. |  |
| 17 | 5/21 | **Final Exam 17:15 – 19:30 pm** | Proj. Rpt |