San José State University
Computer Science Department
CS286 Section 1, Machine Learning on Graphs, Spring 2023

Course and Contact Information

Instructor:	Aikaterini Potika
Office Location:	MacQuarrie Hall 215
Telephone:	408-9245134
Email:	katerina.potika@sjsu.edu
Office Hours:	Mondays-Wednesdays 9:30-10:00 am and Mondays 1:30-2:30 pm or by appointment
Class Days/Time:	Mondays-Wednesdays 12:00-1:15 pm
Classroom:	MacQuarrie Hall 222
Prerequisites:	CS 146 (with a grade of "C-" or better in each); or instructor consent.

Course Format

Faculty Web Page and MYSJSU Messaging

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

Course Description

Graphs are a powerful way to model networks. Networks contain a plethora of valuable information about the underlying data of various scientific fields. Students are introduced to various network analysis and machine learning techniques to help them extract, analyze and visualize networks.

Course Learning Outcomes (CLO)

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

- **CLO1** Carry out techniques on analyzing social networks.
- **CLO2** Recognize network properties and features.
- **CLO3** Integrate machine learning techniques, like clustering and classification, for graph problems.
- **CLO4** Generate deep learning techniques for representing graphs, nodes and edges.

Required Texts/Readings

Textbooks recommended

Graph Representation Learning, by William L. Hamilton

Networks, Crowds, and Markets: Reasoning About a Highly Connected World, by David Easley and Jon Kleinberg, Cambridge University Press, ISBN-13 978-0521195331

Network Science by Albert-László Barabási, Cambridge University Press, ISBN-13 978-1107076266

Deep Learning, Ian Goodfellow, Yoshua Bengio, Aaron Courville, MIT press, ISBN-13 978-0262035613

Knowledge Graphs: Fundamentals, Techniques, and Applications, by Mayank Kejriwal, Craig A. Knoblock and Pedro Szekely, MIT press, ISBN-13 978-0262045094

Online resources

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.

Final Examination or Evaluation

Faculty members are required to have a culminating activity for their courses, which can include a final examination, a final research paper or project, a final creative work or performance, a final portfolio of work, or other appropriate assignment.

Homework assignments (3 total): individual, regularly assigned will include written problem assignments, and perhaps some online exercises. Solutions will not be posted. The homework is a tool for you to learn the material and prepare for the exams.

Reading assignments: Reading assignments will regularly be for the next class (see schedule).

Quizzes: Unannounced quizzes (at least 4) may be given during class, each of 5 minutes total. These will generally be problems from the reading assignment and/or the homework.

Activities: In class hands on examples of the problems and methods we cover using various datasets.

Group Project: A programming project of your choice related to the course's topics in groups of no more that three students. Never use any code you find on the web, unless given by me. Penalty for late submission 5% for every 3 days up to 9 days, after that no submission will be accepted. Final presentation at the end of the semester is mandatory.

Participation: In-class participation and activities, online polls etc.

Midterm exam: There will be one written Midterm exam during the semester.

Final exam: One written final exam.

The exams will contain multiple-choice questions, short answer questions and questions that require pseudocode and/or computations.

Grading Information

Determination of Grades

Final Grade:

30% Project

10% Homework
10% Participation & Discussions

10% Quizzes

10% Activities

15% Midterm

15% Final

Final exam is comprehensive. No extra point options. No make-ups exams except in case of verifiable emergency circumstances.

Grade	***Percentage***
A plus	96 to 100%
A	93 to 95%
A minus	90 to 92%
B plus	86 to 89 %
B	82 to 85%
B minus	78 to 82%
C plus	74 to 77%
C	70 to 73%
C minus	65 to 69%
D plus	62 to 64%
D	58 to 61%
D minus	55 to 57%
F	<54%

Classroom Protocol

Attendance is highly recommended. Please avoid disturbing the class: turn-off cell phones (or put them on vibrate mode), no text messaging in the class or the exams, **no taking pictures and video**, avoid coming late. You may not publicly share or upload material for this course such as exam questions, lecture notes, or solutions without my consent.

University Policies

Per University Policy S16-9 *(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 at http://www.sjsu.edu/gup/syllabusinfo/".

CS286: Machine Learning on graphs, Spring 2023

The schedule is subject to change with fair notice and how the notice will be made available

Lesson	Date	Topic	Reading/Projects (part of chapters covered)
1	1/25	Introduction	
2	1/30	Motivation	
3	2/1	Background and traditional ML approaches	
4	2/6	Graphs	
5	2/8	Traditional Machine Learning	Homework 1 out
6	2/13	Statistic measures	
7	2/15	Deep Learning and NLP	
8	2/20	Node embeddings and random walks	
9	2/22	Node embeddings and random walks	
10	2/27	Link analysis and web search	
11	3/1	Link analysis and web search	
12	3/6	Community Detection Modularity	Project proposal
13	3/8	Community Detection Non overlapping	Homework 1 due

14	3/13	Community Detection Overlapping	Homework 2 out
	3/15	Midterm	
15	3/20	Graph Neural Networks basics	
16	3/22	Graph Neural Networks in practice	
	3/27-4/2	**Break**	
17	4/3	Node classification	
18	4/5	Graph Classification	Project demo
19	4/10	Existing methods for classification	Homework 2 due
20	4/12	Existing methods for classification	Homework 3 out
21	4/17	Graph generation approaches	
22	4/19	Graph generation approaches	
23	4/24	Knowledge graphs	
24	4/26	Knowledge graphs link prediction	
25	5/1	Knowledge graphs completion	
26	5/3	Epidemics, Influence maximization	Project presentations due
27	5/8	Advanced topics	Project due
28	5/10	Project presentations	Homework 3 due
29	5/15	Project presentations	
		Final exam Wednesday, May 17 9:45 AM-12:00 PM	