

**San José State University**  
**College of Science/Department of Computer Science**  
**CS286, Special Topics: Computer Vision, Section 1, Fall, 2020**

**Course and Contact Information**

Instructor:	Nada Attar
Office Location:	MH 218
Telephone:	(408) 924-5108
Email:	nada.attar@sjsu.edu
Office Hours:	M 12:00-1:00pm   W 2:00-3:00pm
Class Days/Time:	Recorded lectures will be posted on Canvas
Prerequisites:	MATH 42, MATH 129A, and CS 49C or equivalent (with a grade of "C-" or better in each)

**Course Description**

This course provides students with both theoretical knowledge and practical experience with fundamental and advanced Computer Vision algorithms. Topics range from basic image processing techniques such as image convolution and region and edge detection to more complex vision algorithms for contour detection, depth perception, dynamic vision, and object recognition. Moreover, core topics like color processing, texture analysis and visual geometry are covered. In programming assignments, students gain practical insight into the development of vision applications by implementing Computer Vision algorithms in the C programming language. Their final project is the development of their own computer vision program that solves a given problem.

**Course Format**

**Faculty Web Page and MYSJSU Messaging**

Course materials such as syllabus, handouts, notes, assignment instructions, etc. can be found on my faculty web page at <http://www.sjsu.edu/people/firstname.lastname> and/or on [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> (or other communication system as indicated by the instructor) to learn of any updates.

**Course Objectives**

1. To ensure that students are familiar with ways to implement computer vision algorithms
2. To introduce students to the implementation of more complex algorithms, advanced techniques and design in computer vision

**Course Learning Outcomes (CLO)**

3. Understand the human visual system and how to use its techniques in computer vision
4. Use various algorithms to build computer vision applications
5. Learn advanced concepts leading to object and scene categorization from images

6. Become familiar with the major technical approaches involved in computer vision
7. Be able to program various methods used for processing images, detecting edges, recognizing objects, and segmenting images

## Required Texts/Readings

### Textbook

- "Hands-On Computer Vision", by Marc Pomplun (1st Edition, June 2020)
- Recommended for more in-depth study (but not required): "Image Processing, Analysis, and Machine Vision" by Sonka, Hlavac, and Boyle (4th Edition, 2014). Thomson Learning.  
ISBN 10: 1133593607, ISBN 13: 9781133593607
- Notes, and research papers giving by the instructor

## Course Schedule

Week	Date	Topics, Readings, Assignments, Deadlines
1	W 8/19	Course Mechanic & Introduction
2	M 8/24	The Human Visual System ( <i>Ch. 1</i> )
2	W 8/26	Eye Movements and Visual Attention, Vision in Technical Systems ( <i>Ch.2</i> )
3	M 8/31	Digital Images ( <i>Ch.2</i> )
3	W 9/02	Representation of Color ( <i>Ch.3</i> )
4	M 9/07	<b>No Class (Labor Day)</b>
4	W 9/9	Thresholding and Binary Image Processing, Connected components ( <i>Ch.4</i> )
5	M 9/14	Basic Image Transformations, Intensity Transformation ( <i>Ch.4</i> )
5	W 9/16	Edge Detection - Filters ( <i>Ch.4</i> )
6	M 9/21	Characteristics of Edges in Digital Image ( <i>Ch.5</i> )
6	W 9/23	Sobel Operator, Edge Detection using Second-Derivative Approaches ( <i>Ch.5</i> )
7	M 9/28	Canny Edge Detection Algorithm ( <i>Ch.5</i> )
7	W 9/30	Evaluating Edge Detector Performance ( <i>Ch.5</i> )
8	M 10/05	Image Segmentation: Polyline splitting, Circular Arcs, Hough Transform, The Split-and-Merge Algorithm ( <i>Ch.6</i> )
8	W 10/07	<b>Midterm Exam I</b>
9	M 10/12	Shape Representation and Data Structures ( <i>Ch.7</i> )
9	W 10/14	Boundary-following Algorithm ( <i>Ch.7</i> )
10	M 10/19	Texture, Statistical Analysis in the Spatial Domain: Co-occurrence Matrices ( <i>Ch.8</i> )
10	W 10/21	Stereo Vision and Depth ( <i>Ch.10</i> )
11	M 10/26	Object Recognition: Classifiers, k-nearest neighbor, naïve Bayes classifier ( <i>Ch.9</i> )
11	W 10/28	Faces Classification Techniques, Emotion Detection from Facial Expressions ( <i>Notes</i> )
12	M 11/02	Motion Analysis: differential motion analysis method, optical flow ( <i>Ch.16 - recommended book</i> )

Week	Date	Topics, Readings, Assignments, Deadlines
12	W 11/04	Image Understanding and Scene Classifications ( <i>Ch.10 - recommended book</i> )
13	M 11/09	Image Data Compression ( <i>Ch.14 recommended book</i> )
13	W 11/11	No Class (Veteran's Day)
14	M 11/16	Artificial Neural Networks, Simple Perceptron, Learning Examples ( <i>Ch.9</i> )
14	W 11/18	<b>Midterm II</b>
15	M 11/23	Backpropagation Learning in Multi-layer ANNs ( <i>Ch.9</i> )
15	W 11/25	Non-Instructional Day No Class (Thanksgiving Holiday)
16	M 11/30	Deep Learning: Convolutional Neural Networks ( <i>Notes</i> )
16	W 12/02	Review
17	M 12/07	Last Day of Instruction Review
17	W 12/09	Final Exam

**Midterm exams:** There will be two written Midterm exams during the semester.

**Final Examination:**

- One final cumulative exam.
- The exams will contain multiple choice questions, short answer questions and questions that require computations. Students must obtain >50% in each component of the course (homework, project, quizzes & written exams) in order to be eligible for a passing grade.

**Grading Information**

Your grade for the course will be based on the following components:

- Mid Term Exams - 20 %
- End of Semester Exams - 25 %
- Programming Assignments - 25 %
- Final Project - 15 %
- Quizzes/Homework - 15 %

Exams are closed book; final exam is comprehensive. No extra point options. No make-ups exams except in case of verifiable emergency circumstances

**Determination of Grades**

The following shows the grading scale to be used to determine the letter grade:

Percentage	Grade	Percentage	Grade
94 and above	A	90 - 93	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-	59 and below	F

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## 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 S12-3at <http://www.sjsu.edu/senate/docs/S12-3.pdf>.

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

## 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 Office of Graduate and Undergraduate Programs' [Syllabus Information web page](#) at <http://www.sjsu.edu/gup/syllabusinfo/> Make sure to review these policies and resources.

## Policies

### Late homework/projects

All homework and projects will be due on Thursday of the indicated week at 5:00pm. The assignment will be posted at least a week before the due date to give enough time to work and ask for help during my virtual office hours or online on Piazza. Please do not email me few hours before the deadline asking me to help you understand concepts. If I feel that you just start working on your assignment at the due date, I will ignore your emails because I know you won't be able to finish understanding the problem, coding, testing, compiling, and debugging in a few hours. So, please start early and manage your time wisely.

Late Submission: (max one assignment is ok)

- 0-6hr -> no penalty
- 6-12hr -> 30% penalty
- 12hr- 24hr ->60%
- +2 Day -> 100%

### Piazza Etiquette

Ask clear questions to get better answers. Make sure your question has not been already asked and answered. Read these guidelines (<http://superuser.com/help/how-to-ask>) when you ask a question. It is fine to share a couple of lines of code but please don't just post your code or share a significant amount of code. Try to ask general questions.

Piazza sign up link: <https://piazza.com/sjsu/fall2019/cs146section3>

### Email Etiquette

I prefer if you use your school email. SJSU uses sjsu-email as an official means of communication. I demand that they use it when contacting me. If you decide to email me from your personal email (ex, gmail, yahoo, etc) that would be fine with me too, but I don't respond to anonymous account names. Also, if you email me during weekend and I am not responding, don't panic! Please give me some time as I am not ignoring your email, but I might be catching on errands. I promise to get back to your email on Monday. This is why I post assignments at least a week before the deadline and encourage you to use Piazza.

When you email me, please be on topic, be specific, and state your question clearly so I can assist you in the best way I can. I prefer if you use Piazza (private or public message). If you send your code due to some error or bug, state which lines of code you think the problem is. Paste the error message you get from the compiler is helpful

### **Classroom Protocol**

The lectures will be on an asynchronous mode. A video for each lecture will be posted the before the class's actual time. As this section has no online lectures, but there will be an optional live session once a week. Attendance is highly recommended for these live sessions. Please have your camera on and mute your mic if you are not participating. Do not publicly share or upload material for this course such as exam questions, lecture notes, or solutions without my consent.