198:534 Computer Vision
Spring 2022

Instructor: Dr. Ahmed Elgammal -- email: elgammal (at) cs

Regular class time: Monday 6:00-9:00 PM – (with 20 minutes break around 7:20pm.)

Office hours: Wednesday 6-7pm (online via zoom)

Class TAs/Graders: Diana Kim: dsk101@scarletmail.rutgers.edu

Class Web page: Sakai page

Canvas web site for the class where the assignment, announcements, grades, and other resources will be posted.

Overview:
This is a basic graduate-level computer vision course that intends to cover a variety of fundamental computer vision topics to get you acquainted with the field.

Topics:
Image Formation: Cameras, Geometric camera models, Calibration, Radiometry, Color.
Early Vision: Linear filters, Edge detection, Texture, Geometry of multiple views.
Mid-level Vision: Motion, Segmentation, and Tracking.
High-Level Vision: Model-based vision, Pose estimation, Appearance-based vision, Generic Object Recognition.

Recommended Background:
Linear algebra and basic statistics.
The class doesn't assume any prior knowledge of computer vision
Familiarity with Matlab and Python programming is an advantage, however you can learn them during the class.
Pre-requisite: 198:520 or 198:530 or equivalent.

Textbooks
The class will be covered from different sources; these two textbooks contain most of the topic that will be covered.

"Computer Vision: A Modern Approach" – Second Edition
By David Forsyth and Jean Ponce
Prentice Hall 2012

"Computer Vision Algorithms and Application"
By Richard Szeliski
Springer 2010
https://szeliski.org/Book/1stEdition.htm
New Edition Draft:
http://szeliski.org/Book/

Other useful reading materials will be provided.

Other useful references:
- G. Medioni, S.B. Kang "Emerging Topics in Computer Vision", Prentice Hall
- Y. Ma, S. Soatto, J. Koseca, S. S. Sastry "An Invitation to 3D Vision, From Images to Geometric Models" Springer
- L. Shapiro, G. C. Stockman "Computer Vision", Prentice Hall.
- O. Faugeras "Three-Dimensional Computer Vision: A Geometric View Point", MIT press.
- Horn "Robot Vision", MIT press.
- D. Marr "Vision", Freeman 1982.

Course Load

- Assignments: (50%) 3-4 assignments, Python or Matlab.
- Semester-long Class Project (20%)
- Biweekly Quizzes (30%) about 5-6 quizzes

Tentative Class Schedule:

Date		Lecture
1/25/21	Week 1	- Introduction to Computer Vision and Applications - Biological Vision- a brief into
2/1/21	Week 2	- Cameras and Lenses
2/8/21	Week 3	- Binary Image Analysis (flat world vision)
2/15/21	Week 4	- Linear Filters - Convolution - Edge Detection - Learning Filters: Convolution Neural Networks
2/22/21	Week 5	- Local Features - Fourier Transform of images
3/1/21	Week 6	- Texture - Color
3/8/21	Week 7	- Camera Geometry - Projective Geometry
3/15/21		Spring break
3/22/21	Week 8	- Camera Calibration
3/29/21	Week 9	- Stereo imaging + MRFs
4/5/21	Week 10	- Perceptual Grouping and Segmentation by Clustering - Segmentation by Graph Cuts. - Segmentation- statistical methods, mean shift
4/12/21	Week 11	– Segmentation: Model Fitting - Segmentation – Deep NN models
4/19/21	Week 12	- 3D Model-based Recognition and Pose Recovery - RANSAC
4/26/21	Week 13	- Appearance-based Vision - Local-Feature based Object Detection and Recognition
5/3/21	Week 14	- Recognition using Deep Neural Networks