New York University Tandon School of Engineering
Computer Science and Engineering
CS-GY 6643 Computer Vision
Spring 2021
Professor James Fishbaugh and Guido Gerig

To contact professor:

Course Pre-requisites: CS 5403 (Data Structures) or equivalent, proficiency in programming and familiarity with matrix arithmetic.

Course Description: An important goal of artificial intelligence (AI) is to equip computers with the capability of interpreting visual inputs. Computer vision is an area in AI that deals with the construction of explicit, meaningful measurements and descriptions of physical objects from images. It includes as parts many techniques from image processing, pattern recognition, geometric modeling, and cognitive processing. This course introduces students to the fundamental concepts and techniques in computer vision.

Capstone Course: This course counts as a capstone course and includes *programming projects* in addition to theoretical assignments. Strong emphasis will also be laid on reporting projects, i.e. in writing a *formatted lab report* that summarizes motivation, approach, methods used, code developed, results as graphs and images, and the testing, validation of the program. Please note that the report is as important as the code itself as it reflects the level of understanding of the methodology.

Readings:

Reference material for the course comes from the following books:

- Milan Sonka, Vaclav Hlavac, and Roger Boyle, *Image Processing, Analysis, and Machine Vision*, 4th Edition, 2015
- David A. Forsyth and Jean Ponce, *Computer Vision: A Modern Approach*, 2nd Edition, 2012

Course Load: There will be handwritten homework assignments, plus programming projects and one group project that require programming and also reporting. You can use any high-level programming language to do the projects, but Python, C/C++, Java, or Matlab are the recommended languages. There will be two exams (midterm, final).

Grade Calculation:

Homework	20%
Programming Projects and Reports (individual)	30%
Final Project (groups)	20%
Midterm Exam	15%
Final Exam	15%

Final Project: This is a more extensive programming project which includes a design phase, making use of knowledge and methods learned in class, proposing an advanced solution, implementation of such a new method, and testing and verifying the method. The project requires a detailed report and also a short video showing procedures and results. The instructor will discuss possible group projects with student groups.

Topics (subject to change):

Part I
>Image Representation and Properties (Connectivity, Histograms)
>Image Preprocessing
>Convolution, Filtering
>Edge Detection, Canny Filter
>Geometric Image Transformations, Image Resampling
>Mathematical Morphology
>Segmentation

Part II
>Camera Calibration
>Baseline Stereo, Epipolar Geometry
>Shape From Motion/Shape From Shading
>Optical Flow

Part III
>Special Topics in Computer Vision (Deep Learning)

Moses Center Statement of Disability
If you are student with a disability who is requesting accommodations, please contact New York University's Moses Center for Students with Disabilities (CSD) at 212-998-4980 or mosescsd@nyu.edu. You must be registered with CSD to receive accommodations. Information about the Moses Center can be found at www.nyu.edu/csd. The Moses Center is located at 726 Broadway on the 3rd floor.

NYU School of Engineering Policies and Procedures on Academic Misconduct – complete Student Code of Conduct here

>A. Introduction: The School of Engineering encourages academic excellence in an environment that promotes honesty, integrity, and fairness, and students at the School of Engineering are expected to exhibit those qualities in their academic work. It is through the process

of submitting their own work and receiving honest feedback on that work that students may progress academically. Any act of academic dishonesty is seen as an attack upon the School and will not be tolerated. Furthermore, those who breach the School's rules on academic integrity will be sanctioned under this Policy. Students are responsible for familiarizing themselves with the School's Policy on Academic Misconduct.

B. Definition: Academic dishonesty may include misrepresentation, deception, dishonesty, or any act of falsification committed by a student to influence a grade or other academic evaluation. Academic dishonesty also includes intentionally damaging the academic work of others or assisting other students in acts of dishonesty. Common examples of academically dishonest behavior include, but are not limited to, the following:

1. Cheating: intentionally using or attempting to use unauthorized notes, books, electronic media, or electronic communications in an exam; talking with fellow students or looking at another person's work during an exam; submitting work prepared in advance for an in-class examination; having someone take an exam for you or taking an exam for someone else; violating other rules governing the administration of examinations.
2. Fabrication: including but not limited to, falsifying experimental data and/or citations.
3. Plagiarism: intentionally or knowingly representing the words or ideas of another as one's own in any academic exercise; failure to attribute direct quotations, paraphrases, or borrowed facts or information.
4. Unauthorized collaboration: working together on work meant to be done individually.
5. Duplicating work: presenting for grading the same work for more than one project or in more than one class, unless express and prior permission has been received from the course instructor(s) or research adviser involved.
6. Forgery: altering any academic document, including, but not limited to, academic records, admissions materials, or medical excuses.

NYU School of Engineering Policies and Procedures on Excused Absences – complete policy here
   A. Introduction: An absence can be excused if you have missed no more than **10 days of school**. If an illness or special circumstance has

caused you to miss more than two weeks of school, please refer to the section labeled Medical Leave of Absence.

B. Students may request special accommodations for an absence to be excused in the following cases:

1. Medical reasons
2. Death in immediate family
3. Personal qualified emergencies (documentation must be provided)
4. Religious Expression or Practice

Deanna Rayment, deanna.rayment@nyu.edu, is the Coordinator of Student Advocacy, Compliance and Student Affairs and handles excused absences. She is located in 5 MTC, LC240C and can assist you should it become necessary.

NYU School of Engineering Academic Calendar – complete list here.
The last day of the final exam period is _____. Final exam dates for undergraduate courses will not be determined until later in the semester. Final exams for graduate courses will be held on the last day of class during the week of _____. If you have two final exams at the same time, report the conflict to your professors as soon as possible. Do not make any travel plans until the exam schedule is finalized.
Also, please pay attention to notable dates such as Add/Drop, Withdrawal, etc. For confirmation of dates or further information, please contact Susana: sgarcia@nyu.edu