Professor Erdem Varol
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Time: 11:00 AM - 1:30 PM Thursdays;
Classroom: 2 MetroTech Room 801
Office hours: TBA (via Zoom)
TA's: Rishabh Raj & Malhar Patel

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

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

Please note that this is NOT a Machine/Deep Learning course but an introductory course into image processing and computer vision.

Capstone Course: This course counts as a capstone course and includes comprehensive programming projects in addition to theoretical assignments. Strong emphasis will also be laid on reporting the programming 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 and 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. Materials such as slides, written handouts and solutions of quizzes, assignments and homeworks will be distributed via Brightspace and Slack. We will not do class recordings, and students are strongly encouraged to attend classes to actively participate in discussions.

Readings:

Reference material for the course comes from the following books:

- **Primary Book:** Richard Szeliski, Computer Vision: Algorithms and Applications.

(available online: https://szeliski.org/Book/download.php)
- Milan Sonka, Vaclav Hlavac, and Roger Boyle, Image Processing, Analysis, and Machine Vision, 4th Ed, 2015
- David A. Forsyth and J Ponce, Computer Vision: A Modern Approach, 2012

Course Load: There will be handwritten homework assignments, plus 3 programming projects that require programming with detailed and formatted reporting, all with fixed deadlines. You can use any high-level programming language to do the projects, but Python is the recommended language supported by the CAs. There will be one exam (midterm), and one final group project which includes an in-class presentation.

Grade Calculation:

Homeworks (3 individual assignments)	20%
Programming Projects & Reports (3 individual projects)	45%
Midterm Exam (scheduled *October 24*, subject to change)	15%
Final Project (Groups of 3-4)	20%

Programming Projects: These are extensive programming project which include a first phase to implement and test a method according to instructions. Projects also include a second "project-like" phase of where students can try out ideas on their own and being creative in further experimenting with methods or extending those beyond its standard use.

Projects require detailed reports on both, first and second phases.

Topics (subject to change):

Part I

- Image Representation and Properties (Connectivity, Histograms) Image Preprocessing

- Convolution, Filtering

- Edge Detection

- Segmentation: Hough Transform

- Segmentation: Deformable objects "Snakes"

Part II

- Camera Calibration

- Baseline Stereo, Epipolar Geometry

- Optical Flow

- Image alignment

- Shape from Shading

Inclusion, Diversity, Belonging, Equity and Accessibility (IDBE)

NYU is committed to creating an inclusive and equitable environment for all students. In this class, I aim to cultivate a strong sense of community, emphasizing that it is a space where individuals of diverse backgrounds—spanning beliefs, ethnicities, national origins, gender identities, sexual orientations, religious and political affiliations, and abilities—are treated with respect. All members of the class are expected to contribute to an inclusive atmosphere for each other. While disagreement and differing ideas are welcome, the expectation is that we respect perspectives beyond our own, even when they diverge from our personal beliefs or experiences. If you encounter disrespect or discrimination in the class or feel that the outlined standards are not being upheld, please report your experiences to me.

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

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.

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:

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.

Fabrication: including but not limited to, falsifying experimental data and/or citations.

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.

Unauthorized collaboration: working together on work meant to be done individually.

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.

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

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.

Students may request special accommodations for an absence to be excused in the following cases: Medical reasons, Death in immediate family, Personal qualified emergencies (documentation must be provided), 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.

Please pay attention to notable dates such as Add/Drop, Withdrawal, etc. For confirmation of dates or further information, please contact Susana Garcia: sgarcia@nyu.edu