Course Syllabus

CMPEN/EE 454: Computer Vision I
Fall 2024 Course Syllabus

Instructor:
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Teaching Assistant: (office hours zoom link will be on Canvas)
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Course Description: Introduction to computer vision topics, including image formation, feature extraction, matching, stereo, motion, tracking and object recognition.

Class Schedule: MWF 1:25-2:15 pm in Willard Bldg 162
Credits: 3

Prerequisites: Good programming experience, especially programming in Matlab; CMPSC 201C or CSE103 or equivalent; MATH 230 or 231 or equivalent; familiarity with basic concepts of linear algebra / matrices.

Goal and Objectives:

- Introduce the fundamental problems of computer vision.
- Introduce the main concepts and techniques used to solve those problems.
- Enable students to implement vision algorithms.
- Enable students to make sense of the vision literature.

Textbook: There is no required textbook, but you may find it useful to locate one or two for background reading. In the past, we used *Introductory Techniques for 3-D Computer Vision* by E. Trucco and A. Verri, Prentice Hall, 1998. Another good textbook is *Computer Vision: A Modern Approach*, by D. Forsyth and J. Ponce, Prentice Hall, 2002. The book *Computer Vision: Algorithms and Applications* by Rick Szeliski, Springer, 2011 is a good reference text and is available for free at http://szeliski.org/Book/Links to an external site. . Another free book is *Computer Vision: Models, Learning, and Inference* by Simon Prince, Cambridge Univ Press, 2012. Available at https://udlbook.github.io/cvbook/Links to an external site., it is beautifully illustrated and emphasizes the use of statistical machine learning in computer vision.

Grading:

- *Homework Assignments (6):*   30%
- *Project Assignments (3):*   30%
- *Midterm Exams (2):*   20%   **(Sep 25 and Nov 6)**
- *Final Exam (Comprehensive):*   20%   **(TBA, during finals week)**

Individual exams and assignments are not scaled/curved, but we do scale the accumulated numeric course scores before assigning a letter grade at the end of the course.

Homework Assignments:

Homework assignments <u>are done individually</u> and are due at the date/time specified. To make grading this number of assignments manageable for a class this size, many of them will be online quizzes that can be graded automatically by the Canvas system. When that happens, it will not be possible to get partial credit for wrong answers, so double check your answers before submitting. All homework will be <u>submitted electronically in Canvas</u>. This may require scanning in handwritten sketches or equations, or drawing them in some software package. Take a moment now to figure out how to do this so you won't be running around in a panic before the first deadline trying to get your answers into the computer.

Project Assignments:

- There will be three computer projects due during the semester. These are more serious programming efforts than the homework assignments and involve implementing end-to-end vision algorithms with several components.
- Projects are team efforts, performed in groups of 2 or 3. **The deadline to form groups is Sep 4** (second week of class). Students not belonging to a group will be assigned to each other randomly, which from past experience does not result in happy groupings. Assign yourself!
- Each group submits code, a written report, and a "spotlight" video. Typically, all members of the team receive the same grade for the submission, but a member who clearly is not contributing will receive a lower grade.
- Projects are to be submitted in Canvas, by the specified date and time. Your code must be in running order and adhere to input and output formats that will be specified. We might run your code on new input data, and if it doesn't work the grade will reflect that.
- In addition, 50% of the grade of the projects will be based on the written report and short spotlight video, which will include a problem statement, description of solution approach, rationale for any design decisions made, description of user-defined parameter settings, pictures of results produced, and a discussion of the results, including explanation of any deficiencies observed. We intend that each spotlight video will be visible to other members of the class.
- Computer projects will be done in Matlab. We will make it clear what high-level functions you can use, but in general we do not want you to indiscriminately use Matlab's increasingly comprehensive set of high-level vision routines – these are what we are teaching you to implement! When in doubt, ask.

Exams Schedule:

There will be two <u>in-class</u> midterms, on September 25 and November 6, and a final exam during Finals week. Date and time for the final will be announced after it is scheduled by the university. All exams are closed book, but calculators are allowed. In addition, you may prepare one 8 1/2 x 11 inch cheat sheet for each exam (yes, you can write on both sides).

Academic Integrity Statement:

Academic integrity is the pursuit of scholarly activity in an open, honest, and responsible manner. Academic integrity is a basic guiding principle for all academic activity at The Pennsylvania State University, and all members of the University community are expected to act in accordance with this principle. Consistent with this expectation, the University's Code of Conduct states that all students should act with personal integrity, respect other students' dignity, rights, and property, and help create and maintain an environment in which all can succeed through the fruits of their efforts.

Dishonesty of any kind will not be tolerated in this course. Dishonesty includes, but is not limited to, cheating, plagiarizing, fabricating information or citations, using AI to generate code or text, facilitating acts of academic dishonesty by others, having unauthorized possession of examinations, submitting work of another person or work previously used without informing the instructor, or tampering with the academic work of other students. Such acts of dishonesty violate the fundamental ethical principles of the University community and compromise the worth of work completed by others. Students who are found to be dishonest will receive academic sanctions and will be reported to the University's Office of Student Conduct for possible further disciplinary sanctions. For more details, refer to [Senate Policy G-9Links to an external site.](https://undergrad.psu.edu/aappm/G-9-academic-integrity.html) (https://undergrad.psu.edu/aappm/G-9-academic-integrity.html).
The CSE Department has an additional statement on [Academic IntegrityLinks to an external site.](https://www.eecs.psu.edu/students/resources/EECS-CSE-Academic-Integrity.aspx) (https://www.eecs.psu.edu/students/resources/EECS-CSE-Academic-Integrity.aspxLinks to an external site.).

Disability Accommodation Statement:

 Penn State welcomes students with disabilities into the University's educational programs. Every Penn State campus has an office for students with disabilities. For further information, please visit [Student Disability Resources websiteLinks to an external site.](http://equity.psu.edu/sdr/) (http://equity.psu.edu/sdr/).
In order to receive consideration for reasonable accommodations, you must contact the appropriate disability services office at the campus where you are officially enrolled, participate in an intake interview, and provide documentation: [See documentation guidelinesLinks to an external site.](http://equity.psu.edu/sdr/guidelines) (http://equity.psu.edu/sdr/guidelines). If the documentation supports your request for reasonable accommodations, your campus disability services office will provide you with an accommodation letter. Please share this letter with your instructors and discuss the accommodations with them as early as

possible. You must follow this process for every semester that you request accommodations.

Counseling and Psychological Services Statement:

Many students at Penn State face personal challenges or have psychological needs that may interfere with their academic progress, social development, or emotional wellbeing. The university offers a variety of confidential services to help you through difficult times, including individual and group counseling, crisis intervention, consultations, online chats, and mental health screenings. These services are provided by staff who welcome all students and embrace a philosophy respectful of clients' cultural and religious backgrounds, and sensitive to differences in race, ability, gender identity and sexual orientation.

[Counseling and Psychological Services at University Park (CAPS)Links to an external site.](http://studentaffairs.psu.edu/counseling/): 814-863-0395

Penn State Crisis Line (24 hours/7 days/week): 877-229-6400
Crisis Text Line (24 hours/7 days/week): Text LIONS to 741741

Educational Equity and Reporting Bias:

Penn State takes great pride to foster a diverse and inclusive environment for students, faculty, and staff. Acts of intolerance, discrimination, or harassment due to age, ancestry, color, disability, gender, gender identity, national origin, race, religious belief, sexual orientation, or veteran status are not tolerated and can be reported through Educational Equity via the [Report Bias webpageLinks to an external site.](http://equity.psu.edu/reportbias/).

Reporting Sexual Misconduct:

Sexual misconduct is never tolerated at Penn State. Prohibited conduct includes sexual and gender-based harassment, stalking, sexual assault, and dating violence. These behaviors are not allowed in the classroom, the campus community, labs, or anywhere students, staff, and faculty are located. Prohibited behaviors can include degrading comments such as belittling female-identified students, LGBTQ+ individuals, and gender-diverse students, People of Color, and other marginalized students. It can also include harassment, touching someone without their consent, following someone without consent, repeated calls or messaging, physical acts of violence, and more. In other words, professional and appropriate behavior is always expected, and inappropriate or unprofessional behavior is never tolerated. For more information, please refer to the Student Code of Conduct and Penn State Policies AD85 and AD91. ([Title IX Sexual Harassment | Penn State Policies (psu.edu)Links to an external site.](#) and [Discrimination and Harassment and Related Inappropriate Conduct | Penn State Policies (psu.edu)Links to an external site.](#))
If you or anyone you know has experienced or is concerned about inappropriate or unprofessional behavior, you can talk with your instructor, report to police or the Office

of Sexual Misconduct Reporting & Response ([titleix.psu.eduLinks to an external site.](titleix.psu.edu)), or you can seek confidential support and assistance from the Gender Equity Center. The Gender Equity Center supports any student who has had negative relationship experiences including those impacted by sexual violence, relationship violence, stalking, harassment, and other campus climate issues. Services include one on one crisis intervention/support, advocacy, exploring options, accommodations, safety planning, and referrals. They also promote awareness, build support for survivors, and conduct educational programs and events. All services are free and confidential. [Gender Equity Center | Penn State Student Affairs (psu.edu)Links to an external site.](psu.edu)