ECE59500CV: Deep Learning for Computer Vision
Fall 2020

Course Information
Course number and title: ECE59500CV (013, 018, EPA, OXA) Deep Learning for Computer Vision
CRN: 24471, 26480, 25922, 25923
Meeting time: MWF 3:30pm–4:20pm online synchronous via zoom, meeting ID: 928 5663 6867, passcode: ECE59500CV.
Course credit hours: 3.000
Course web page: https://engineering.purdue.edu/ece595cv
Course Brightspace page: https://purdue.brightspace.com/d2l/home/54347
Prerequisites: ECE26400, ECE36900, ECE30200, ECE60000, and MA26500, or permission of instructor

Instructor(s) Contact Information
Name of the instructor: Jeffrey Mark Siskind
Office Location: EE313e
Phone number: 765/496-3197
Purdue Email Address: qobi@purdue.edu
Office hours, times and locations: T 5:00pm–6:00pm online synchronous via zoom, meeting ID: 928 5663 6867, passcode: ECE59500CV.
How to reach the instructors remotely: via the course email mailing lists

Course Description
An introduction to modern computer vision using methods from machine learning and deep learning. Covers segmentation, object classification and localization, activity classification and localization, semantic segmentation, depth reconstruction, 3D reconstruction, generative adversarial networks, image and video captioning, and image and video retrieval. The course will cover fundamental topics as well as recent advances from the literature.

Learning Resources, Technology & Texts
There is no required text for this course. We will cover a recent paper from the literature during each lecture. The papers will be posted at http://engineering.purdue.edu/ece595cv before each lecture. Students should read each paper before the associated lecture and come to class prepared to discuss and ask questions.

Learning Outcomes
Outcome i) Ability to design and implement an object classifier and localizer. [1, 2, 4, 6, 7]
Outcome ii) Ability to design and implement an activity classifier and localizer. [1, 2, 4, 6, 7]
Outcome iii) Ability to design and implement an image or video captioning system. [1, 2, 4, 6, 7]
Outcome iv) Ability to present research results in Computer Vision to peers. [3, 5[

Assignments
There will be no problem sets and no exams. The only assignment is a term paper/project/presentation. Beyond this, there will be a reading assignment for each lecture. A recent paper will be posted on the course web page for each lecture. Students are expected to read the paper prior to lecture and come to class prepared to discuss and ask questions.
The term paper/project/presentation is organized like a conference. Students will be required to select and read three recent conference or journal papers in the field of computer vision. Nominally, the papers should have been published within the last three years in one of the following venues: CVPR, ICCV, ECCV, TPAMI, IJCV, NIPS, ICML, or JMLR. You are welcome to read more than three. Your selection of papers must be approved by me. I may be willing to accept papers from venues other than the above and/or older than three years old. But all paper selections, whether or not they meet the above criteria must be approved by me. You must submit your paper selections by 5:00pm Friday 4 September 2020 with the following information:
(a) a BibTeX entry for each of the papers that you would like to read. For a journal paper this should contain (at least) the paper title, authors, journal, volume, year, and pages. For a conference paper this should contain (at least) the paper title, authors, conference, year, and pages.

(b) a URL containing a pdf file of each paper, included in the BibTeX entry

Paper selections will be submitted through Brightspace. Your submission should be a single BibTeX file with the extension `.bib`. The filename does not matter.

Please note that you should not send me the paper itself. Not even the abstract.

If you intend to select papers that are older than three years old or from a venue other than listed above, I suggest that you discuss this with me prior to Friday 4 September 2020.

You will be required to read all three papers and implement and evaluate the ideas from (at least) one of the papers. Thus (at least) one of the papers that you select should contain material that is suitable for implementation. The implementation must be nontrivial. A good guideline is that the implementation should be at least four pages of code. This is not a strict guideline. Ultimately, I will determine whether or not the implementation meets the non-triviality requirement. The implementation can be in any programming language that you choose, though obviously lower level languages may require much more code to implement the same functionality that could be achieved with less code in a higher level language. You must also conduct a substantive evaluation of your implementation to determine how well it solves the intended problem. Ideally, you should replicate the experiments presented in the paper but I will not require this.

You will be required to write a paper in LaTeX meeting all of the submission format requirements of CVPR 2021 including the typesetting conventions and page length. Approximately half of this paper should be a substantive critique of the three papers that you have read. And approximately half of this paper should be a description of your implementation and evaluation of the material from one of the papers. The term paper must be submitted by 5:00pm Friday 13 November 2020.

Term papers will be submitted through Brightspace Your submission should be a single PDF file with the extension `.pdf`. The filename does not matter.

The term papers will be reviewed by other students in the class. Like all conferences, this process will be double blind: reviewers will not know the identity of authors and vice versa. To support this, like all conferences, you should NOT put your name on the term paper submission. In place of your name, you should put your PUID. Also like conferences, reviews will be confidential. The only person who will be privy to the reviews will be the reviewer, the instructor, and the author.

I will assign each term paper to five students to read. Each student will be required to read five student term papers (other than their own) and prepare conference-style reviews, primarily indicating clarity and the quality of the implementation effort. Peer reviews will be due by 5:00pm Friday 4 December 2020. The exact format for the review will be announced later in the semester.

Reviews will be submitted through Brightspace using a mechanism that will be announced later in the semester. Your reviews should be formatted as text files with the extension `.txt`. Your reviews should be enclosed in a single ZIP file with the extension `.zip`. The filename of the ZIP does not matter. But you should take care to use exactly the names of the text files as will be described later in the semester

You will also be required to make a 25 minute conference-like presentation in class during the last six weeks of classes. The exact schedule will be determined later in the semester. But to accommodate all students in class, presentations will start on Wednesday 4 November 2020. So you should be prepared to give your presentation at any time after that. This is necessarily before the due date for paper submissions and the due date for reviews. This presentation should cover both a summary of the three papers that you have read, a summary of your critique of those papers, and a description of your implementation and evaluation. The presentation must be given over zoom by screen sharing. You can use whatever tools you wish to prepare your presentation (i.e. LaTeX/beamer or PowerPoint). On the day that you are scheduled to give you presentation, make sure ahead of class that you presentation setup works and that you are prepared to give your presentation in the allotted time slot.

Students will be required to attend all student conference-like presentations. Attendance will be taken in the student conference-like presentations.

Grading Scale
See the Teaching Philosophy section.

Academic Guidance in the Event a Student is Quarantined/Isolated
If you become quarantined or isolated at any point in time during the semester, in addition to support from the Protect

Purdue Health Center, you will also have access to an Academic Case Manager who can provide you academic support during this time. Your Academic Case Manager can be reached at acmq@purdue.edu and will provide you with general guidelines/resources around communicating with your instructors, be available for academic support, and offer suggestions for how to be successful when learning remotely. Importantly, if you find yourself too sick to progress in the course, notify your academic case manager and notify me via email or Brightspace. We will make arrangements based on your particular situation. The Office of the Dean of Students (odos@purdue.edu) is also available to support you should this situation occur.

Course Schedule
selections due 5pm ET Friday 4 September 2020
paper due 5pm ET Friday 13 November 2020
reviews due 5pm ET Friday 4 December 2020

Attendance Policy during COVID-19
Students should stay home and contact the Protect Purdue Health Center (496-INFO) if they feel ill, have any symptoms associated with COVID-19, or suspect they have been exposed to the virus. In the current context of COVID-19, in-person attendance will not be a factor in the final grades, but the student still needs to inform the instructor of any conflict that can be anticipated and will affect the submission of an assignment or the ability to take an exam. Only the instructor can excuse a student from a course requirement or responsibility. When conflicts can be anticipated, such as for many University-sponsored activities and religious observations, the student should inform the instructor of the situation as far in advance as possible. For unanticipated or emergency conflict, when advance notification to an instructor is not possible, the student should contact the instructor as soon as possible by email, through Brightspace, or by phone. When the student is unable to make direct contact with the instructor and is unable to leave word with the instructor's department because of circumstances beyond the student's control, and in cases of bereavement, quarantine, or isolation, the student or the student's representative should contact the Office of the Dean of Students via email or phone at 765-494-1747. Our course Brightspace includes a link on Attendance and Grief Absence policies under the University Policies menu.

Classroom Guidance Regarding Protect Purdue
The Protect Purdue Plan, which includes the Protect Purdue Pledge, is campus policy and as such all members of the Purdue community must comply with the required health and safety guidelines. Required behaviors in this class include: staying home and contacting the Protect Purdue Health Center (496-INFO) if you feel ill or know you have been exposed to the virus, properly wearing a mask in classrooms and campus building, at all times (e.g., mask covers nose and mouth, no eating/drinking in the classroom), disinfecting desk/workspace prior to and after use, maintaining appropriate social distancing with peers and instructors (including when entering/exiting classrooms), refraining from moving furniture, avoiding shared use of personal items, maintaining robust hygiene (e.g., handwashing, disposal of tissues) prior to, during and after class, and following all safety directions from the instructor.
Students who are not engaging in these behaviors (e.g., wearing a mask) will be offered the opportunity to comply. If non-compliance continues, possible results include instructors asking the student to leave class and instructors dismissing the whole class. Students who do not comply with the required health behaviors are violating the University Code of Conduct and will be reported to the Dean of Students Office with sanctions ranging from educational requirements to dismissal from the university.
Any student who has substantial reason to believe that another person in a campus room (e.g., classroom) is threatening the safety of others by not complying (e.g., not wearing a mask) may leave the room without consequence. The student is encouraged to report the behavior to and discuss next steps with their instructor. Students also have the option of reporting the behavior to the Office of the Student Rights and Responsibilities. See also Purdue University Bill of Student Rights.

Academic Integrity
Academic integrity is one of the highest values that Purdue University holds. Individuals are encouraged to alert university officials to potential breaches of this value by either emailing integrity@purdue.edu or by calling 765-494-8778. While information may be submitted anonymously, the more information is submitted the greater the

opportunity for the university to investigate the concern. More details are available on our course Brightspace table of contents, under University Policies.

Nondiscrimination Statement
Purdue University is committed to maintaining a community which recognizes and values the inherent worth and dignity of every person; fosters tolerance, sensitivity, understanding, and mutual respect among its members; and encourages each individual to strive to reach his or her own potential. In pursuit of its goal of academic excellence, the University seeks to develop and nurture diversity. The University believes that diversity among its many members strengthens the institution, stimulates creativity, promotes the exchange of ideas, and enriches campus life. More details are available on our course Brightspace table of contents, under University Policies.

Accessibility
Purdue University strives to make learning experiences as accessible as possible. If you anticipate or experience physical or academic barriers based on disability, you are welcome to let me know so that we can discuss options. You are also encouraged to contact the Disability Resource Center at: drc@purdue.edu or by phone: 765-494-1247. More details are available on our course Brightspace under Accessibility Information.

Mental Health Statement

If you find yourself beginning to feel some stress, anxiety and/or feeling slightly overwhelmed, try WellTrack. Sign in and find information and tools at your fingertips, available to you at any time.

If you need support and information about options and resources, please contact or see the Office of the Dean of Students. Call 765-494-1747. Hours of operation are M-F, 8am–5pm.

If you find yourself struggling to find a healthy balance between academics, social life, stress, etc. sign up for free one-on-one virtual or in-person sessions with a Purdue Wellness Coach at RecWell. Student coaches can help you navigate through barriers and challenges toward your goals throughout the semester. Sign up is completely free and can be done on BoilerConnect. If you have any questions, please contact Purdue Wellness at evans240@purdue.edu.

If you're struggling and need mental health services: Purdue University is committed to advancing the mental health and well-being of its students. If you or someone you know is feeling overwhelmed, depressed, and/or in need of mental health support, services are available. For help, such individuals should contact Counseling and Psychological Services (CAPS) at 765-494-6995 during and after hours, on weekends and holidays, or by going to the CAPS office of the second floor of the Purdue University Student Health Center (PUSH) during business hours.

Emergency Preparation
In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances beyond the instructor's control. Relevant changes to this course will be posted onto the course web page or can be obtained by contacting the instructors or TAs via email or phone. You are expected to read your @purdue.edu email on a frequent basis.
1. If you experience any symptoms of COVID-19 or suspect you may have been exposed to someone with COVID-19 stay home and call the Protect Purdue Health Center at 765-496-INFO.
2. Keep your cell phone on to receive a Purdue ALERT text message.
3. Log into a Purdue computer connected to the network to receive any Desktop Popup Alerts.

Instructor Office Hours
Virtual Office Hours are a synchronous session (through zoom) to discuss questions related to weekly readings and/or assignments. Office hours will be held Tuesday evenings 5:00pm–6:00pm. To connect to the weekly session, go to zoom, meeting ID: 928 5663 6867, passcode: ECE59500CV.

Instructor Email Policies
Please do not send any course-related email to my personal email account. Please send all course-related email to one of the following two mailing lists:

- ece59500cv-staff-list@ecn.purdue.edu
- ece59500cv-students-list@ecn.purdue.edu

The former just goes to me, and any TAs if we have any in the future. The latter goes to me, any TAs if we have any in the future, and to all students enrolled. All students are automatically added to the latter under their Purdue Career account. Please send all course-related email from your Purdue Career account.

Missed or Late Work

The only assignments this semester are related to the term paper/project/presentation. These assignments attempt to model the actual experience of submitting to, reviewing for, presenting at, and attending a research conference. Research conferences have submission and reviewing deadlines, and papers are presented according to a fixed schedule. In order to teach what it is like to participate in a research conference, we have strict deadlines for all components of the term paper/project/presentation. There will be no exceptions. No late work will be accepted and no credit will be given for missed or late assignments.

Incompletes

No incompletes will be given.

Teaching Philosophy

On the first day of class, Mr Silver, my eight grade science teacher said: "This is an honors class. You all are smart and deserve a good grade. A 90 is a good grade. None of you are perfect yet. So nobody deserves a 100. Thus I will give everyone a 90. Now that we dispensed with grades, we can get down to learning."

I will follow the same policy in this class this semester. The grading policy is simple. This is a graduate class. You all are smart and deserve a good grade. An A is a good grade. None of you are perfect yet. So nobody deserves an A+. Thus I will give everyone an A. Now that we dispensed with grades, we can get down to learning.

Grades are cheap. An education is expensive. I can manufacture As. When the marginal cost of production goes to zero, the value of the product goes to zero. The As that I give in this course are worthless. I strive to make the education that I give in this course worth the price of tuition. Please don't ask me for a letter of recommendation, to hire you as an RA, or to take you on as a graduate student on the basis of your grade in this course, or even on the basis of the term paper/project/presentation you prepared for this course. You need to do something else that distinguishes you for me to do those things.

Nobody ever listens to Grateful Dead studio albums. The Dead exist solely for their live concerts. People went to Dead concerts for two reasons. To hear Jerry Garcia jam, and to get stoned.

I don't condone getting stoned at Purdue or in Indiana. But I do strive to jam like Jerry Garcia. If you want studio albums, you can watch online videos of AI courses taught at Stanford by well-known researchers like Peter Norvig, Sebastian Thrun, Andrew Ng, Daphne Koller, and Feifei Li. Hundreds of thousands, perhaps millions, of people have taken these MOOCs. But with my course, get to see me jam.

My course is like a concert. You already bought the ticket. I perform. You get out of the class what you put into it. It is your choice whether you come to class (prepared) and do the coursework. If you do, you get an opportunity to learn. If you don't, you wasted your money (or someone else's money).

If you bought a ticket to a Taylor Swift concert, but need to miss the concert, you wouldn't run up on stage and say "Ms. Swift, I'm sorry but I need to miss your concert. But I really like your new songs. So can I come by your home and have you give me a private rendition of the songs I missed at your concert?" So please don't ask me for permission to miss class. And please don't ask me to repeat material from a missed class.

How to Succeed in this Course

If you want to be a successful student:
- Be self-motivated and self-disciplined.
- Be willing to "speak up" if problems arise.
- Be willing and able to commit to 4 to 15 hours per week per course.
- Be able to communicate through writing.
- Be able to meet the minimum requirements for the course.
- Accept critical thinking and decision making as part of the learning process.

In contrast, here are some common behaviors that lead to failing the course.
- Don't read until the night before the discussion.
- Wait until the last day to begin assignments.
- Forget about deadlines.
- Ignore emails from the instructor and/or your peers regarding course activities.
- Don't get familiar with the grade book and syllabus.

Course Logistics
- You are encouraged to "mentally enroll" in this course as if it occurred on Monday mornings. In other words, our weeks will run from Sunday to Saturday. I will post information (online activities, discussion starters, etc.) for the upcoming week by Saturday evening, so that when you log in on Sunday, you can begin the new week.
- All assignments are due by 5:00pm ET on the due date listed in the course schedule (always on a Friday).
- Deadlines are an unavoidable part of being a professional and this course is no exception. Course requirements must be completed and posted or submitted on or before the specified due date and delivery time deadline. Due dates and delivery time deadlines are defined as that used in West Lafayette, Indiana). To encourage you to stay on schedule, due dates have been established for each assignment. No late submission or extensions will be granted.

Copyright
Online educational environments, like all learning environments, should provide opportunities for students to reflect, explore new ideas, post opinions openly, and have the freedom to change those opinions over time. Students enrolled in and instructors working in online courses are the authors of the works they create in the learning environment. As authors, they own the copyright in their works subject only to the university's right to use those works for educational purposes (Visit Purdue University Copyright Office). Students may not copy, reproduce or post to any other outlet (e.g., YouTube, Facebook, or other open media sources or websites) any work in which they are not the sole or joint author or have not obtained the permission of the author(s).

Netiquette
Your instructor and fellow students wish to foster a safe online learning environment. All opinions and experiences, no matter how different or controversial they may be perceived, must be respected in the tolerant spirit of academic discourse. You are encouraged to comment, question, or critique an idea, but you are not to attack an individual. Our differences, some of which are outlined in the University's nondiscrimination statement below, will add richness to this learning experience. Please consider that sarcasm and humor can be misconstrued in online interactions and generate unintended disruptions. Working as a community of learners, we can build a polite and respectful course ambience. Please read the Netiquette rules for this course:
- Do not dominate any discussion. Give other students the opportunity to join in the discussion.
- Do not use offensive language. Present ideas appropriately.
- Be cautious in using Internet language. For example, do not capitalize all letters since this suggests shouting.
- Avoid using vernacular and/or slang language. This could possibly lead to misinterpretation.
- Keep an "open-mind" and be willing to express even your minority opinion.
- Think and edit before you push the "Send" button.
- Do not hesitate to ask for feedback.

Violent Behavior Policy
Purdue University is committed to providing a safe and secure campus environment for members of the university community. Purdue strives to create an educational environment for students and a work environment for employees that promote educational and career goals. Violent Behavior impedes such goals. Therefore, Violent Behavior is prohibited in or on any University Facility or while participating in any university activity. See our course Brightspace under University Policies for a link to the full Violent Behavior Policy.

Diversity & Inclusion Statement
In our discussions, structured and unstructured, we will explore a variety of challenging issues, which can help us enhance our understanding of different experiences and perspectives. This can be challenging, but in overcoming

these challenges we find the greatest rewards. While we will design guidelines as a group, everyone should remember the following points:

- We are all in the process of learning about others and their experiences. Please speak with me, anonymously if needed, if something has made you uncomfortable.
- Intention and impact are not always aligned, and we should respect the impact something may have on someone even if it was not the speaker's intention.
- We all come to the class with a variety of experiences and a range of expertise, we should respect these in others while critically examining them in ourselves.

Basic Needs Security

Any student who faces challenges securing their food or housing and believes this may affect their performance in the course is urged to contact the Dean of Students for support. There is no appointment needed and Student Support Services is available to serve students from 8:00am–5:00pm, Monday through Friday.

Considering the significant disruptions caused by the current global crisis as it related to COVID-19, students may submit requests for emergency funds. Click here for details and the request form.

Course Evaluation

During the last two weeks of the semester, you will be provided with an opportunity to give feedback on this course and your instructor. Purdue uses an online course evaluation system. You will receive an official email from evaluation administrators with a link to the online evaluation site. You will have up to 10 days to complete this evaluation. Your participation is an integral part of this course, and your feedback is vital to improving education at Purdue University. I strongly urge you to participate in the evaluation system.

Student Help and Success

The Brightspace course shell includes links to the following student resources under the Student Help and Success content.

- Registrar
- Financial Aid
- Academic Advising
- Veterans Success Center
- Student Employment
- Center for Career Opportunities.

Disclaimer

This syllabus is subject to change. Updated copies will be posted on Brightspace and the course web page, and will be announced by email on the course email list.

References

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