

Course Information

CSC528: Computer Vision
Spring 2019
Thursday 5:45PM-9:00PM
Loop Campus, CS&TC 200
Course Management System: <http://d2l.depaul.edu>

Instructor Information

Instructor: Daniela Stan Raicu
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Office Hours: Tuesday 10:00am-11:30am
 Thursday 4:15pm-5:00pm, 9:00pm-9:45pm
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Course Description

Developing computer vision algorithms is motivated by the human vision system which is richest sense that we have. Although vision seems easy to us, in reality we are processing around 60 images per second with millions of pixels in each image. In fact, over half the human brain is involved in processing visual information, and this seems a good indication that this is a very complex task. While the ultimate goal of computer vision to emulate human vision is a long way away, we are applying computer vision to advance more complex applications such as self-driving cars, advanced user interfaces (using face tracking), license plate recognition (for issuing automatically issuing speeding tickets), computer-aided diagnosis (using computers as second readers of medical images), surveillance and alert security, image search, and new image generation.

We will develop basic methods and modern deep learning models for computer vision topics that include:

- fundamentals of image formation
- camera imaging geometry
- camera calibration
- reconstruction of depth based on stereo
- feature detection and matching
- stereo and motion analysis, and
- object detection, recognition, and tracking.

The course will focus on the mathematics of these methods and models through lectures and hands-on practice through homework assignments and projects. Building on the fundamentals of computer vision, students will trace the development of modern techniques such as convolutional neural networks for optical flow estimation and object detection, and generative adversarial networks for artificial image generation through class discussions and presentations of relevant and scientific papers.

Course Learning Goals

Upon completion of the course, students will be able to:

- Be familiar with both the theoretical and practical aspects of computing with images and videos

- Have described the foundation of image formation, measurement, and analysis
- Have gained exposure to object and scene recognition and categorization from images
- Have implemented common methods for computer vision, including feature detection, robust image matching and alignment, motion analysis, and video and image recognition
- Grasp the principles of state-of-the-art deep neural networks for computer vision
- Developed the practical skills necessary to build computer vision applications.

Recommended Books

- D. Forsyth and J. Ponce, “Computer Vision: A Modern Approach”, Pearson Education Publisher, Inc. 2003, ISBN 0-13-085198 -1
- R. Jain, R. Kasturi, B. G. Schunck, “Machine Vision”, Mc Graw-Hill, 1995, ISBN 0-07-032018-7

Prerequisites: CSC381/CSC481: Introduction to Image Processing

Grading

The homework/programming assignments will be worth 40% of the course grade. Instead of a midterm and a final exam, there will be a literature review and a final project for this course. The literature review will be worth 20% and the final project will be worth 40% (proposal 5%, presentation 10%, and report 25%). Final presentations and demos will be done on June 6, 2019. The final report will be due on June 13th.

The summary of the weights of each assignment for contributing to the final grade is as follows:

Assignment	Weight in final grade
Homework & Programming Assignments	40%
Paper discussion	20%
Final Project	40%

The final grade will be assigned according to the following scale:

Percentage Grade	Letter Grade	Manner of fulfillment
95-100	A	Excellent
90-94	A-	
85-89	B+	
80-84	B	Very Good
75-79	B-	
70-74	C+	
65-69	C	Satisfactory
60-64	C-	
55-59	D+	
50-54	D	Poor
0 – 50	F	

Homework/Programming Assignments, Papers' Reviews, and Final Project Policies

Homework/programming assignments

There will be 4 homework and programming assignments during the quarter. Work to be submitted for the course is generally due one or two weeks after it was assigned; late submissions are allowed with a 5%, 10%, and 15% penalty for a one day, two days, and three days, respectively. No late work will be accepted after three days since the assignment was due.

The assignments must be submitted online on the D2L site at <https://D2L.depaul.edu>. Only legible, organized homework which shows your work will be graded. Include your name, section number, date, and homework number on the first page of your assignment. **It is your responsibility to check that your files are uploaded correctly on D2L; you should always keep a copy of your submission.**

Extra credit points will be given for additional problems in assignments and midterm, paper reviews, active participation in the lectures and Discussion Forum.

Final Project

The purpose of the final project is to demonstrate your ability to apply the knowledge and the techniques learned during this course. The final project for this class is more extensive analysis task, chosen by you from among the topics we discuss. Final projects will include a presentation to the rest of the class at the end of the quarter, in place of a final exam. As part of your final project, you will also be asked to critique your classmates' projects. These critiques will be collected by me, collated, and passed on anonymously to the presenter.

Whenever it is possible, it is recommended that the DL students attend the final presentations to participate in the live discussions of the final projects and to complete critiques of the other projects. However, appropriate accommodations through SKYPE/ZOOM will be arranged for the DL students not being able to give the presentations in class; the DL students will still have to submit their critiques on the other projects.

Deliverables for the final project:

- Proposal (May 9): one-page proposal describing the problem, the proposed approach, and at least three references other than text book or class notes.
- Presentation (June 6): Each project is to be presented using PowerPoint, and the PPT file will have to be submitted to be published on course web site.
- Report (June 13): The report will be written in a format of a paper (abstract, introduction, literature review, methodology, results, discussion, conclusions and future work). The literature review for the final report will reading and summarizing about 8 to 10 published papers on the review topic. While the internet can serve as a good source of information, the DePaul Library also has extensive holdings, most of them available electronically. The submission of the final report should be in a zip file consisting of all program source code and report itself.

Papers' discussion and reviews

Throughout the quarter, the students will be also provided with a list of research papers that are applying the theory discussed in class. Each student will be expected to review these papers and submit a one-page review summary for each paper. The papers will be also discussed in class and on the discussion forum (by the DL students).

The paper discussions will be grouped under the main computer vision systems including 1) face and gesture recognition; 2) visual information retrieval and search; 3) visual guidance of vehicles; 4) surveillance; 5) biometrics; 6) artificial image generation, and 7) computer-aided medical diagnosis.

The papers' reviews represent 20% of the final grade.

Software

Students can use any programming languages, but they are strongly encouraged to use Matlab for their assignments and final projects. The appropriate Matlab functions implementing the image analysis and computer vision concepts and methods will be demonstrated in class: Matlab homepage:

<http://www.mathworks.com/>

Another software package useful for computer vision is the OpenCV Library written in C and C++ and available from <http://sourceforge.net/projects/opencvlibrary/>

Attendance

It is expected that you will attend every class; it is the single most important action you can take in mastering the course objectives. You are responsible for all material covered, assignments delivered or received, and announcements made in class sessions that you miss.

For distance learning students: this means viewing the classes in a timely manner, participate in the discussion forum, and being sure to email or call in any questions that you have. Recordings of each lecture will be available a few hours after the "live" class, and can be found at the course website <https://d2l.depaul.edu>. Online students are expected to watch the lectures every week and to keep up with the course information posted on the course website.

Email

Email is the primary means of communication between faculty and students enrolled in this course outside of class time. Students should be sure their email listed under "demographic information" at <http://campusconnect.depaul.edu> is correct.

Changes to Syllabus

This syllabus is subject to change as necessary to better meet the needs of the students. Significant changes are unlikely, and will be thoroughly addressed in class. Minor changes, especially to the weekly agenda, are possible at any time. If a change occurs, it will be thoroughly addressed during class and posted under Announcements in D2L.

Class Cancellation

Unless DePaul University closes because of weather, we will have class.

Cell Phones/On Call

If you bring a cell phone to class, it must be off or set to a silent mode. Should you need to answer a call during class, students must leave the room in an undistruptive manner. Out of respect to fellow students and the professor, texting is never allowable in class. If you are required to be on call as part of your job, please advise me at the start of the course.

School policies:

Online Course Evaluations

Instructor and course evaluations provide valuable feedback that can improve teaching and learning. The greater the level of participation, the more useful the results. As students, you are in the unique position to view the instructor over time. Your comments about what works and what doesn't can help faculty build on the elements of the course that are strong and improve those that are weak. Isolated comments from students and instructors' peers may also be helpful, but evaluation results based on high response rates may be statistically reliable (believable). As you experience this course and material, think about how your learning is impacted. Your honest opinions about your experience in and commitment to the course and your learning may help improve some components of the course for the next group of students. Positive comments also show the department chairs and college deans the commitment of instructors to the university and teaching evaluation results are one component used in annual performance reviews (including salary raises and promotion/tenure). The evaluation of the instructor and course provides you an opportunity to make your voice heard on an important issue – the quality of teaching at DePaul. Don't miss this opportunity to provide feedback!

Academic Integrity and Plagiarism

This course will be subject to the academic integrity policy passed by faculty. More information can be found at <http://academicintegrity.depaul.edu/>.

The university and school policy on plagiarism can be summarized as follows: Students in this course should be aware of the strong sanctions that can be imposed against someone guilty of plagiarism. If proven, a charge of plagiarism could result in an automatic F in the course and possible expulsion. The strongest of sanctions will be imposed on anyone who submits as his/her own work any assignment which has been prepared by someone else. If you have any questions or doubts about what plagiarism entails or how to properly acknowledge source materials be sure to consult the instructor.

Withdrawal

Students who withdraw from the course do so by using the Campus Connection system (<http://campusconnect.depaul.edu>). Withdrawals processed via this system are effective the day on which they are made. Simply ceasing to attend, or notifying the instructor, or nonpayment of tuition, does not constitute an official withdrawal from class and will result in academic as well as financial penalty.

Retroactive Withdrawal

This policy exists to assist students for whom extenuating circumstances prevented them from meeting the withdrawal deadline. During their college career students may be allowed one medical/personal administrative withdrawal and one college office administrative withdrawal, each for one or more courses in a single term. Repeated requests will not be considered. Submitting an appeal for retroactive withdrawal does not guarantee approval.

College office appeals for CDM students must be submitted online via MyCDM.

The deadlines for submitting appeals are as follows:

Autumn Quarter: Last day of the last final exam of the subsequent winter quarter

Winter Quarter: Last day of the last final exam of the subsequent spring quarter

Spring Quarter: Last day of the last final exam of the subsequent autumn quarter

Summer Terms: Last day of the last final exam of the subsequent autumn quarter

Excused Absence

In order to petition for an excused absence, students who miss class due to illness or significant personal circumstances should complete the Absence Notification process through the Dean of Students office. The form can be accessed at <http://studentaffairs.depaul.edu/dos/forms.html>. Students must submit supporting documentation alongside the form. The professor reserves the sole right whether to offer an excused absence and/or academic accommodations for an excused absence.

Incomplete

An incomplete grade is a special, temporary grade that may be assigned by an instructor when unforeseeable circumstances prevent a student from completing course requirements by the end of the term and when otherwise the student had a record of satisfactory progress in the course. CDM policy

requires the student to initiate the request for incomplete grade before the end of the term in which the course is taken. Prior to submitting the incomplete request, the student must discuss the circumstances with the instructor. Students may initiate the incomplete request process in MyCDM.

- All incomplete requests must be approved by the instructor of the course and a CDM Associate Dean. Only exceptions cases will receive such approval.
- If approved, students are required to complete all remaining course requirement independently in consultation with the instructor by the deadline indicated on the incomplete request form.
- By default, an incomplete grade will automatically change to a grade of F after two quarters have elapsed (excluding summer) unless another grade is recorded by the instructor.
- An incomplete grade does NOT grant the student permission to attend the same course in a future quarter.

Students with Disabilities

Students who feel they may need an accommodation based on the impact of a disability should contact the instructor privately to discuss their specific needs. All discussions will remain confidential.

To ensure that you receive the most appropriate accommodation based on your needs, contact the instructor as early as possible in the quarter (preferably within the first week of class), and make sure that you have contacted the Center for Students with Disabilities (CSD) at:

Student Center, LPC, Suite #370

Phone number: (773)325.1677

Fax: (773)325.3720

TTY: (773)325.7296