

### ***Course Information***

CSC482: Applied Image Analysis  
Winter 2018-2019  
Thursday 5:45PM-9:00PM  
Loop Campus, CS&TC 200  
Course Management System: <http://d21.depaul.edu>

### ***Instructor Information***

Instructor: Daniela Stan Raicu  
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Office Hours: Thursday 4:15pm-5:00pm, 9:00pm-9:45pm  
Other times by appointment  
Advising Hours: Wednesday, 10:00-12:00 pm  
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### ***Course Description***

The course is for students with prior background in image processing. The course will cover the advance of image analysis from classical computational imaging techniques to deep learning techniques. First, the fundamentals of computational image analysis will be explored in terms of its most two important components, image information extraction and modeling of image patterns. Specific topics include, but are not limited to: image segmentation, multi-scale representation, shape analysis, texture analysis, Fourier analysis, wavelets, Gabor and fractal analysis, and template matching. Second, deep learning models will be explored to extract image representations automatically, i.e. without the need for human engineering of image features. These classical and deep learning imaging techniques will be applied and compared in the context of different image analysis tasks such as image representation, segmentation, classification, retrieval, and object recognition through scientific paper reviews, homework assignments, and final projects. Applications of these techniques will be presented for various domains, including autonomous driving, biometrics, sports analytics, smart and connected communities, and biomedical and health informatics.

### ***Course Learning Objectives***

After completing the course, the students will be able to:

- explain basic and advanced concepts, terminology, models and methods in the field of image processing and analysis
- develop, evaluate, and interpret different basic methods of image analysis and image processing
- apply deep Convolutional Neural Network (CNN) to object segmentation and classification
- compare classical and deep-learning object segmentation and classification techniques
- select, combine, and design image processing and analysis systems for specific computational imaging tasks

The realization of these objectives will allow students to:

- understand basic possibilities and constraints of image analysis and, therefore, assess which imaging related problems can be solved in different domains
- be able to implement, evaluate, and analyze systems for automatic image processing and analysis
- have a broad knowledge of the state-of-the-art research and practice for image processing and image analysis.

### ***Required Textbook***

R. Gonzalez and R. E. Woods, Digital Image Processing, Fourth Edition (2018), Pearson/Prentice Hall Publisher, ISBN number 9780133356724.

Textbook webpage: [http://www.imageprocessingplace.com/DIP-4E/dip4e\\_main\\_page.htm](http://www.imageprocessingplace.com/DIP-4E/dip4e_main_page.htm)

**Recommended Books** (for more details and additional books, see materials for week 1 on D2L)

R. Gonzalez and R. E. Woods, Digital Image Processing using Matlab, Second Edition (available through online book viewer --- request access at [http://imageprocessingplace.com/DIPUM-2E/dipum2e\\_how\\_to\\_order.htm](http://imageprocessingplace.com/DIPUM-2E/dipum2e_how_to_order.htm))

D. Forsyth and J. Ponce, Computer Vision: A Modern Approach, Pearson Education Publisher, Inc. 2003, ISBN 0-13-085198 -1

**Prerequisites**

CSC381/CSC481: Introduction to Image Processing

**Grading**

The homework/programming assignments will be worth 50% 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 10% and the final project will be worth 40% (proposal 5%, presentation 10%, and report 25%). Final presentations and demos will be done on March 14th. The final report will be due on March 21st. The summary of the weights of each assignment contributing to the final grade is as follows:

Assignment	Weight in final grade
Homeworks & Programming Assignments	50%
Literature Review	10%
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	
0 – 50	F	

**Homework/Programming Assignments, Literature Review, and Final Project Policies**

Homework/programming assignments

There will be 4 homework 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.

#### Literature Review:

Throughout the quarter, the students will be also provided with a list of research papers related to the image processing and analysis concepts discussed in class. Each student will have to review these papers and participate in their discussion. Two papers' reviews will have to be submitted and they will represent 10% of the final grade.

The paper readings will be selected from well-known conferences in image processing and analysis such as IEEE International Conference on Image Processing (ICIP), International Conference on Computer Vision and Pattern Recognition (CVPR), and the journal of IEEE Transactions on Image Processing.

#### 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 project. However, appropriate accommodations will be made 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 (February 14th): One-page proposal describing the problem, the proposed approach, and at least three references other than text book or class notes.

Presentation (March 14th): 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 (March 21st): 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 consists of reading and summarizing about 5 to 6 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.

#### **Software** (for more details, see additional materials for week 1 on D2L)

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 concepts and methods will be demonstrated in class and additional course materials will be provided for Matlab.

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

#### **Attendance**

It is expected that you will attend every class and remain for the duration; 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.

*For online students:*

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.

***Attitude***

A professional and academic attitude is expected throughout this course. Measurable examples of non-academic or unprofessional attitude include but are not limited to: talking to others when the instructor is speaking, mocking another’s opinion, cell phones ringing, emailing, texting or using the internet whether on a phone or computer. If any issues arise a student may be asked to leave the classroom. The professor will work with the Dean of Students Office to navigate such student issues.

***Civil Discourse***

DePaul University is a community that thrives on open discourse that challenges students, both intellectually and personally, to be Socially Responsible Leaders. It is the expectation that all dialogue in this course is civil and respectful of the dignity of each student. Any instances of disrespect or hostility can jeopardize a student’s ability to be successful in the course. The professor will partner with the Dean of Students Office to assist in managing such issues.

***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 unobtrusive 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***

Evaluations are a way for students to provide valuable feedback regarding their instructor and the course. Detailed feedback will enable the instructor to continuously tailor teaching methods and course content to meet the learning goals of the course and the academic needs of the students. They are a requirement of the course and are key to continue to provide you with the highest quality of teaching. The evaluations are anonymous; the instructor and administration do not track who entered what responses. A program is used to check if the student completed the evaluations, but the evaluation is completely separate from the student’s identity. Since 100% participation is our goal, students are sent periodic reminders over three weeks. Students do not receive reminders once they complete the evaluation. Please see <https://resources.depaul.edu/teaching-commons/teaching/Pages/online-teaching-evaluations.aspx> for additional information.

### ***Academic Integrity and Plagiarism***

This course will be subject to the academic integrity policy passed by faculty. More information can be found at <https://resources.depaul.edu/teaching-commons/teaching/academic-integrity/Pages/default.aspx>

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. The dropping dates can be found at: <https://academics.depaul.edu/calendar/Pages/default.aspx>

### ***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.

All students are required to manage their class schedules each term in accordance with the deadlines for enrolling and withdrawing as indicated in the University Academic Calendar. Information on enrollment, withdrawal, grading and incompletes can be found at: <http://www.cdm.depaul.edu/Current%20Students/Pages/PoliciesandProcedures.aspx>

### ***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 Grades***

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. All incomplete requests must be approved by the instructor of the course and a CDM Associate Dean. Only exceptions cases will receive such approval. Information about the Incomplete Grades policy can be found at <http://www.cdm.depaul.edu/Current%20Students/Pages/Grading-Policies.aspx>

### ***Students with Disabilities***

Students seeking disability-related accommodations are required to register with DePaul's Center for Students with Disabilities (CSD) enabling them to access accommodations and support services to assist with their success. There are two office locations:

- Loop Campus – Lewis Center #1420 – (312) 362-8002
- Lincoln Park Campus – Student Center #370 – (773) 325-1677

Students who register with the Center for Students with Disabilities are also invited to contact Dr. Gregory Moorhead, Director of the Center, privately to discuss how he may assist in facilitating the accommodations to be used in a course. This is best done early in the term. The conversation will remain confidential to the extent possible. Please see <https://offices.depaul.edu/student-affairs/about/departments/Pages/csd.aspx> for Services and Contact Information.