Tentative Syllabus
for
CAP5415 - 2018 Fall (Computer Vision)

Instructor: Dr. Sedat Ozer, sedat@crcv.ucf.edu

Class time: Tuesday/Thursday 3-4:15 pm
Class location: HEC 117
Office hours: Tuesday/Thursday 4:30-5:30 pm at HEC 214

Important Deadlines:

- **Submit your “initial” project idea & group members:** by September 4, 2018.
- **Paper presentation:** Submit the paper titles for your presentation: by September 18
- **Midterm:** Tentatively, first (mostly likely) or second week of October
- **Progress Report:** Submit your early results/report for your final project: by October 20
- **Final Project Presentation:** In the finals week

COURSE GOALS: The course is introductory level computer vision course, suitable for graduate students. It will cover the basic topics of computer vision in modern era and introduce some fundamental & modern approaches for computer vision research. Tentative subjects included in the course are:

- Deep Learning for Computer Vision,
  - Intro to classification with Neural Networks,
  - Deep Neural Networks,
  - Convolutional Nets,
  - Optimization,
  - Hyper parameter tuning,
- Image Filtering,
- Edge Detection,
- Interest Points & Features
- Image Classification,
- Object Localization & Detection,
- Segmentation & Semantic Segmentation,
- Optical Flow,
- Imaging Geometry, Camera Modeling.

PRE-REQUEST: Basic Probability/Statistics, a good working knowledge of any programming language (**Python**, Matlab, C/C++, or Java), **Linear algebra, Vector calculus**.

GRADING: Assignments and the term project should include explanatory/clear comments as well as a short report describing the approach, detailed analysis, and discussion/conclusion.

- Programming assignments: total 30%. There will be frequent, (almost weekly or bi-weekly) assignments.
    - The lowest grades assignment will be ignored at the end of the semester.
    - In programming assignments, it is expected that the submitted code is running without any error and generating the correct results as described in the assignments. Codes giving error, will not be graded.
- Term project: 25% (+ 5% for the progress report). Projects will be presented at the end of semester)
- Paper presentation: 20%
    - Students will select and present a paper (in the class) relevant to their term project. See the guidelines below for project and paper presentation.
- Mid-Term Exam 25%

  (tentative date for midterm: Between the first & second weeks of October 2017, in-class, written)

- All the submitted code must be extremely well commented to receive full credit.
  Total points: 100 (+5 bonus)

<u>Grade Scale</u>

[95-100] :A

[90-94]: A-

[85-89]: B+

[80-84]: B

[75-79]:B-

[70-74]: C+

[65-69]:C

[60-64]:C-

[50-59]: D

[0-49]: F

RECOMMENDED BOOKS (optional, follow the lecture slides & in-class notes):

Students are responsible with the material presented in both lecture slides and in-class material (such as discussions, notes on the classboard, etc.). Following books are optional:

- Ian Goodfellow and Yoshua Bengio and Aaron Courville, Deep Learning (www.deeplearningbook.org)
- Simon Prince, Computer Vision: Models, Learning, and Interface (Links to an external site.)Links to an external site., Cambridge University Press,
- Mubarak Shah, Fundamentals of Computer Vision,
- Richard Szeliski, Computer Vision: Algorithms and Applications (Links to an external site.)Links to an external site., Springer, 2010 (online draft), (Links to an external site.)Links to an external site.

PROGRAMMING
Python will be main programming environment for the assignments. Following book (Python programming samples for computer vision tasks) is freely available.
Python for Computer Vision (Links to an external site.)Links to an external site.
For mini-projects, Processing (Links to an external site.)Links to an external site. programming language can be used too (strongly encouraged for android application development)

COLLABORATION POLICY
Collaboration on assignments is encouraged at the level of sharing ideas and technical conversation only. Please write your own code. Students are expected to abide by UCF Golden Rule.

Final Project:

Students will form project groups (formed of 3 students max). Students will be responsible with data collection, network design, hardware, obtaining the results and reporting.

Deadline for submitting your project ideas: September 4, 2018. Submit your project idea with a full (single) page description. Include all your group members in the cover page. Two different groups cannot work on the same project. Therefore, prepare alternative project ideas as well. You will need instructor's approval to work on your final project to receive a credit for that.

Road map for the project:

- Select the most relevant 4-5 papers and understand them. (you will present one of those in class).
- Look for available datasets that can be used in your project.

- Look for available (open source) projects/codes that are doing the same or similar task as your project and describe what is different in your project.
- Training a single NN can easily take days in many projects. Therefore, please start training your very first NN months ago for your project to get an idea!
- You will submit a report in the form of a paper for your project including: the relevance to the literature, the details of the used technique in your project and your results. Include comparisons to other available techniques.
- You will also present your submitted paper at the end of semester.

Paper Presentation:

After the midterm, you will present your chosen paper in class. This will be a group presentation relevant to your final project. Select a paper relevant to your project.

POTENTIAL PROJECT TOPICS

- Autonomous Path Planning with Deep Reinforcement Learning
- Face Detection for Android Applications with Deep learning
- Image inpainting with GANs
- GANs for Object Detection
- Object detection with YOLO and Faster-RCNN
- Object/Actor segmentation with Deep Learning
- Object Tracking in Videos with Deep Learning
- Activity Detection with GANs
- Scene understanding /parsing with GANs
- Person re-identification with GANs
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