CAP 6412: Advanced Computer Vision (3 units)  
Spring 2016

Basic information:
- Lecture time: Tuesday and Thursday, 3:00pm—4:15pm  
- Lecture place: HEC 0117  
- Instructor: Boqing Gong  
  - Email: bgong@crcv.ucf.edu  
  - Office: HEC 214  
  - Office house: TBA or by appointment  

Course description:
This is an advanced course in computer vision. We will examine some central topics and key techniques in computer vision, mainly through reading, writing reviews on, presenting, and discussing the most recent and/or classic papers published on top-notch computer vision conferences and journals. Candidate topics are appended below.

The main goal of the course is to prepare students for graduate research in computer vision. Through the class, the students are expected to understand in-depth the state-of-the-art approaches to the topics to be selected jointly by the students and the instructor. In addition to better domain knowledge in computer vision by the end of this course, the students will also develop the skills that are vital to their graduate research, such as writing paper reviews, presenting technical papers, analyzing the strengths and weaknesses of the research papers, and potentially identifying open questions and directions for future research.

Texts and materials:
Research papers published on top-notch computer vision conferences and journals. The electronic copies of the papers will be accessible through the UCF library (http://library.ucf.edu/).

Prerequisites and preparation:
- Prerequisite courses: CAP 5415 or CAP 4453 or permission of instructor.  
- Recommended preparation: basic probability, statistics, linear algebra, calculus, optimization, and some programming languages (Matlab, python, C/C++, Java, etc.).

Exams and grading policy:
- Reports (writing paper reviews): 25%  
  Paper Presentations: 20%  
  Discussion and Attendance: 20%  
  Programming Projects: 25%  
  Project presentation: 10%  
- Final project presentation: 1:00pm—3:50pm, April 28th.  
**Late homework policy:**
Each student will have three late days in total for all the reports and projects. No additional late days are allowed.

**Topics to choose from:**
- Fundamentals of object recognition
  - Classification and detection of object categories
  - Local features, invariance, bag-of-words models, Fisher vector
  - Middle-level representations of objects: parts, attributes, embedding, etc.
  - Convolutional neural networks and large-scale object recognition
- Scene understanding
  - GIST and scene categorization
  - Image segmentation and semantic parsing
  - Image retrieval and matching
- Human-centered computer vision
  - Face, pedestrian, pose, and activity recognition, detection, and identification
  - Ego-centric videos
  - Computer vision with humans in the loop
- Low-level computer vision
  - Edges, contours, textures, shapes, and colors
  - Motion, optical flow, and tracking
- Visual saliency
  - Saliency and gaze detection
  - Object proposal, selective search, and object detection
- Machine learning and computer vision
  - Clustering and segmentation
  - Supervised classification and object/scene/attribute/activity recognition
  - Probabilistic models and Fisher vectors
  - Learning to rank and image retrieval
  - Dimensionality reduction, manifold learning, and image
  - Convolutional neural networks and large-scale image classification
  - Recurrent neural network, Long Short-Term Memory, and image and video captioning
- Computer vision and natural language processing (NLP)
  - Image captioning
  - Video description/scripting
  - Visual question answering
  - Scalable concept annotation

**Useful links:**
- CV Online
• **Annotated Computer Vision Bibliography**

• **Computer vision conferences**

• **Visual Object Recognition synthesis lecture** by Grauman and Leibe (short book on object recognition methods)

• **OpenCV** (open source computer vision library)

• **Weka** (Java data mining software)

• **Netlab** (Matlab toolbox for data analysis techniques, written by Ian Nabney and Christopher Bishop)
  o [http://www.ncrg.aston.ac.uk/netlab/](http://www.ncrg.aston.ac.uk/netlab/)

**Important dates:**
- Jan 11th, 2016: Classes begin
- Jan 14th, 2016: Last day to drop and request full refund
- Jan 15th, 2016: Add deadline on myUCF
- March 23rd, 2016: Withdrawal deadline
- April 26th, 2016: Classes end; Last day to remove incomplete
- April 28th, 2016: Final project presentation

**Please be referred to** [http://calendar.ucf.edu/2016/spring](http://calendar.ucf.edu/2016/spring) **for any updates**

**Statement on Academic Integrity:**
The UCF Golden Rule ([http://goldenrule.sdes.ucf.edu/](http://goldenrule.sdes.ucf.edu/)) will be observed in the class. Plagiarism and Cheating of any kind on an examination, quiz, or assignment will result at least in an "F" for that assignment (and may, depending on the severity of the case, lead to an "F" for the entire course) and may be subject to appropriate referral to the Office of Student Conduct for further action. I will assume for this course that you will adhere to the academic creed of this University and will maintain the highest standards of academic integrity. In other words, don't cheat by giving answers to others or taking them from anyone else. I will also adhere to the highest standards of academic integrity, so please do not ask me to change (or expect me to change) your grade illegitimately or to bend or break rules for one person that will not apply to everyone.