كليـــة الهندســـة والعمـــــارة
FACULTY OF ENGINEERING
AND ARCHITECTURE
مكتـــب العميـــد
OFFICE OF THE DEAN

1866 AUB American University of Beirut الجامعة الأميركية في بيروت

MECH642 Computer Vision

Fall 2015-16

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Lectures

Tuesdays and Thursdays from 2:00-3:30, IOEC 224A

Textbook (refrences)

1. Forsyth and Ponce, Computer Vision, A Modern Approach. Prentice Hall, 2nd edition, 2011.
2. Hartley and Zisserman, Multiple View Geometry, Cambridge University Press, 2004
3. Richard Szeliski, Computer Vision: algorithms and applications, Springer Science & Business Media, 2010

Description

This is a course that is primarily structured for upper-level undergraduate and graduate students, who are interested in the applications of computer vision. Image formation and image models are first introduced, including topics ranging from geometric camera models and calibration, to lighting sources, shadows and shading, to color. Next, topics related to early vision such as linear filters, edge detection, and texture are covered. Multiview geometry is covered next including stereopsis and structure from motion. Topics in mid-level vision are also studied including segmentation and tracking. Finally, high-level vision topics are covered including model-based vision, finding templates using classifiers, and range data.

Prerequisites

There are no official prerequisites to this course although it does rely on the following knowledge:

- Linear algebra,
- Probability and statistics,
- Programming skills in Matlab and/or C.

Syllabus (Chapter sections given for Forsyth & Ponce)

Topic	Chapter	Sections	Key topics
1	1, 4	1.1, 4	Pinhole cameras, radiometric terminology
2	5, 6	5.1-5.5, 6.1-6.4	Local shading models; point, line, and area sources Photometric stereo, color – physics Human perception, color spaces

3	2, 3	all	Camera models and their calibration
4	7, 9	7; 9.1-9.3	Linear filters, texture as statistics of filter outputs Texture synthesis
5	10, 11	all	Multiview geometry, stereo as an example
6	12, 13	all	Affine structure from motion; projective structure from motion
7	26	all	Image based rendering
8	14	all	Segmentation
9	15	all	Fitting lines, curves, robustness, RANSAC
10	16	all	Hidden variables and EM
11	25	all	Finding images in digital libraries
12	17	all	Tracking; the Kalman filter and data association
13	18	all	Model-based Vision
14	22	all	Finding templates using classifiers
15	21	all	Range data

Assessment

All lectures in the course will integrate student assessment and feedback in the form of homework assignments, quizzes, a final exam, and a team project.

Entry	Weight	Remarks
Quizzes & participation	15%	First 15 minutes in class
Homework assignments	30%	Programming involved
Final	30 %	To be discussed
Project + Paper	25 %	Team project

Resources for the Course

Resources for the course include the textbook, the instructor; class notes and handouts, your teammates, the library, and the web.

I will be available on Wednesdays from 8:00-10:00 or by private appointment if you contact me via email.

Course Policy

Quizzes & Participation

This type of course highly relies on the instructor's help and it is therefore essential you do not skip classes. 15% of the course grade will therefore be dedicated to in-class quizzes and participation.

Homework assignments

Homework problems will be assigned in conjunction with lecture topics. Most of these assignments will involve programming and manipulating images. I leave you the liberty to use any software you want for these assignments although I recommend Matlab, given that many low-level functions are already implemented in the image processing toolbox. Homework can be done individually or in groups of 2.

Final

In addition to the homework assignments, you will also be required to write a final exam at the end of the semester. The final includes all the material learned in class

during the entire semester and is a comprehensive test. The exam will be written in the lab on a computer and will involve both programming and problem solving.

Project
The final measuring stick for this course is a team-oriented project and paper. The specifics of this project will be discussed throughout the course. The paper resulting for each of these projects should be in standard IEEE conference format. The project can be done in groups of 2 or 3. Please set up your lists as soon as possible and send me the lists. NO groups of 4 will be allowed.

Make-up tests and late homework policy
NO make up test will be given. Late homework assignments will NOT be accepted unless the reason is beyond the student's control.