BLG453E Computer Vision

Istanbul Technical University

Syllabus - Fall 2018 **CRN: 11043**

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Lecture Hours: Mondays 9:30-11:30 @ EEB 5303

Credits: ECTS 5

Course Description

The aim of the course is to study computer vision, which tries to "make computers see and interpret" using the observations in the form of multiple 2D (or 3D) images. In this undergraduate level course, the focus is on mainly 2D image processing fundamentals and basic computer vision concepts. The course will provide the participants with a background in Computer Vision both in practical aspects as being able to implement computer vision algorithms, and their mathematical understanding. A tentative list of topics for the course is included in the Course Schedule Table at the end.

Prerequisites

Programming, Calculus, Linear Algebra, Probability, Algorithms knowledge at the basic level are expected.

Assignments: Programming homework assignments + in Class Quizzes and Labs (Labs TBD)

*** Homeworks will consist of mainly **PYTHON Programming of basic vision algorithms.**

Grading Policy:

Midterm Exam (in class) Tentative Date: DECEMBER 3rd, 2018	25%
In – Class Quizzes	10%
5 Homework Assignments and In – Class Labs	30%
Final Exam	35%

Final Exam (non-VF) Conditions: All of the following should be satisfied:

1. **Minimum 70% In – Class Quizzes in Lectures should be taken**
2. **(0.25 * MT + 0.3 * HWs (first 4 HWs) + 0.1 * Quizzes) > 35**
3. **MT grade > 20**
4. **You must submit at least 3 of first 4 HWs (HW is considered submitted if you get at least 25)**

LEARNING OUTCOMES of the Course

Upon successful completion of BLG453E, students are expected to be able to:

1. Learn and discuss the main problems of computer (artificial) vision, and the uses and applications of computer vision
2. Design and implement various image transforms: point-wise transforms, neighborhood operation-based spatial filters, and geometric (coordinate) transforms over images
3. Define, construct, and apply segmentation, feature extraction, and visual motion estimation algorithms to extract relevant information from 2D or higher dimensional images
4. Construct least squares solutions to problems in computer vision
5. Describe the idea behind dimensionality reduction for high-dimensional datasets and how it is used and applied in data processing
6. Know and apply object recognition approaches to problems in computer vision

References

1. Concise Computer Vision: An Introduction into Theory and Algorithms, Springer, Series: Undergraduate Topics in Computer Science, by Reinhard Klette, 2014. ISBN 978-1-4471-6319-0

2. Digital Image Processing, R.C. Gonzalez, R.E. Woods, Pearson Prentice Hall 2008.

3. Computer and Machine Vision (Theory, Algorithms, Practicalities), E.R. Davies, Academic Press, 4th Ed., 2012.

4. R. Szeliski's Computer Vision Book (2010) can be downloaded from http://szeliski.org/Book/

5. http://www.computervisiononline.com/

6. Image Processing, Analysis, and Machine Vision, 2008, M. Sonka, V. Hlavac, R. Boyle

7. Digital Image Processing, B. Jahne, Springer, 2002.

8. Computer Vision: A modern Approach, D. Forsyth, J. Ponce, 2002

9. Computer Vision, D. Ballard and C.M. Brown, Prentice Hall, old book, online at: http://homepages.inf.ed.ac.uk/rbf/BOOKS/BANDB/bandb.htm

10. Mastering OpenCV with Practical Computer Vision Projects, Baggio et al.

11. Computer Vision: Models, Learning, and Inference, Prince http://www.computervisionmodels.com/

BLG453E Computer Vision Fall 2018 Tentative Course Schedule

Note: This syllabus and schedule are subject to change. If you are absent from class, it is your responsibility to check on announcements made while you were absent.

Week	Date	Topic	Reading List (to-be-updated)
1	Sep 17	Away at conf	Klette 1.1, 1.3, 2.1.1, 2.1.2
2	Sep 24	Quick Introduction to Computer Vision and Image Data; Pointwise Image Processing	
3	Oct 1	Image Intensity Transformations, Histograms, Enhancement	
4	Oct 8	Geometric/Coordinate Transforms, Interpolation	
5	Oct 15	Image Neighborhood Operations/Spatial Filtering	
6	Oct 22	Edge Detection Operators;	
7	Oct 29	Republic Holiday	
X	Nov 5	SEMESTER BREAK	
8	Nov 12	Feature Extraction: Corners, Template Matching Parametric Detection of Lines, Circles, Ellipses	
9	Nov 19	Basic Segmentation (Adaptive Thresholding, Clustering, K-Means, Region Growing …)	
10	Nov 26	Visual Motion Estimation/Dynamic Scenes	
11	Dec 3	**In class MIDTERM EXAM**	
12	Dec 10	Principal Component Analysis and Applications	
13	Dec 17	Basic Geometric 2D shape analysis: Area, Length, Distance Transform, Shape Context	
14	Dec 24	Wrap-up	

Course Policies

Discussions among students for course assignments and projects are encouraged. However, what you submit should be always the output of your own efforts and your own work.

Cheating and Plagiarism: "Cheating is the actual or attempted practice of fraudulent or deceptive acts for the purpose of improving one's grade or obtaining course credit; such acts also include assisting another student to do so. Typically, such acts occur in relation to examinations. However, it is the intent of this definition that the term 'cheating' not be limited to examination situations only, but that it include any and all actions by a student that are intended to gain an unearned academic advantage by fraudulent or deceptive means. Plagiarism is a specific form of cheating which consists of the misuse of the published and/or unpublished works of others by misrepresenting the material (i.e., their intellectual property) so used as one's own work." [1]
Penalties for cheating and plagiarism range from a 0 or F on a particular assignment, through an FF grade for the course, to disciplinary action and to expulsion from the university.
For more information, read the **page: ITU Ethics in University:** http://www.odek.itu.edu.tr/?SayfaId=13

Disruptive Classroom Behavior [1]: "The classroom is a special environment in which students and faculty come together to promote learning and growth. It is essential to this learning environment that respect for the rights of others seeking to learn, respect for the professionalism of the instructor, and the general goals of academic freedom are maintained. … Differences of viewpoint or concerns should be expressed in terms, which are supportive of the learning process, creating an environment in which students and faculty may learn to reason with clarity and compassion, to share of themselves without losing their identities, and to develop an understanding of the community in which they live. … Student conduct which disrupts the learning process shall not be tolerated and may lead to disciplinary action and/or removal from class."

Reference:
[1] http://conduct.ucr.edu/docs/disruptive.pdf