AGU Graduate School of Engineering and Science Computer Vision Course Program

COURSE RECORD

Code	**ECE531**
Name	Computer Vision
Hour per week	3+0
Credit	
ECTS	10
Level/Year	Graduate
Semester	Fall
Type	Elective
Location	
Prerequisites	Probability, Linear Algebra
Special Conditions	
Coordinator	Kasım Taşdemir
Webpage	
Content	This course provides an introduction to computer vision, including fundamentals of image formation, camera imaging geometry, feature detection and matching, stereo, motion estimation and tracking, image classification, scene understanding, and deep learning with neural networks. The focus of the course is to develop the intuitions and mathematics of the methods in lecture, and then to learn about the difference between theory and practice in the projects.
Objectives	- Recognize and describe both the theoretical and practical aspects of computing with images. Connect issues from Computer Vision to Human Vision - Describe the foundation of image formation and image analysis. Understand the basics of 2D and 3D Computer Vision. - Become familiar with the major technical approaches involved in computer vision. Describe various methods used for registration, alignment, and matching in images. - Get an exposure to advanced concepts leading to object and scene categorization from images.
Learning Outcomes	LO1- Understanding the foundations of modern computer vision theory, problem and state of the art solutions. LO2- Implementing and testing some fundamental computer vision algorithms e.g. image filtering, restoration, image segmentation, camera calibration. LO3- Analyzing and evaluating critically the building and integration of computer vision algorithms and systems. LO4- Designing and demonstrating a working computer vision system through the research project, project report and presentation.
Requirements	Basic Probability/Statistics, a good working knowledge of any programming language (python, Matlab, C/C++, or Java), Linear algebra, Vector calculus.
Reading List	Richard Szeliski, Computer Vision: Algorithms and Applications, Springer, 2010 Simon Prince, Computer Vision: Models, Learning, and Interface, Cambridge University Press, Mubarak Shah, Fundamentals of Computer Vision, Forsyth and Ponce, Computer Vision: A Modern Approach, Prentice Hall, 2002, Palmer, Vision Science, MIT Press, 1999, Duda, Hart and Stork, Pattern Classification (2nd Edition), Wiley, 2000, Koller and Friedman, Probabilistic Graphical Models: Principles and Techniques, MIT Press, 2009, Strang, Gilbert. Linear Algebra and Its Applications 2/e, Academic Press, 1980.
Ethical Rules and Course Policy	

LEARNING ACTIVITIES

Activities	**Number**	**Weight (%)**
Lecture	42	25%
Project	3	25%
Homework	5	25%
Presentations	1	25%
	Total	100

ASSESSMENT

Evaluation Criteria	**Weight** (%)
Midterm Exam	15%
Weekly Assignments	20%
Project Assignments & Presentations	30%
Attendance/Participation	05%
Final Exam	30%
Total	100%

For a detailed description of grading policy and scale, please refer to the website https://goo.gl/HbPM2y section 28.

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COURSE LOAD

Activity	**Duration** (hour)	**Quantity**	**Work Load** (hour)
In class activities	3	14	42
Preparation for the lecture	3	14	42
Exams	30	2	60
Homework	10	5	50
Projects	30	3	90
Pre-work for Presentation	20	1	20
		General Sum	**304**

ECTS: 10 (Work Load/25-30)

CONTRIBUTION TO PROGRAMME OUTCOMES*

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14
LO1	5	5	5	5	5	5	5	5	5	5	5	5	5	5
LO2	2	5	5	5	5	5	5	5	5	5	5	5	5	5
LO3	2	2	2	2	2	2	2	5	3	5	5	5	5	3
LO4	5	5	5	5	5	5	5	5	5	5	5	5	5	5

* Contribution Level: 0: None, 1: Very Low, 2: Low, 3: Medium, 4: High, 5: Very High

WEEKLY SCHEDULE

W	**Topic**	**Outcomes**
1	Introduction to Computer Vision	LO1, LO4
2	Filtering	LO1, LO2, LO4
3	Edge Maps and Histograms	LO1, LO2, LO4
4	Finding Features	LO1, LO2, LO4
5	Affine Invariance and Sift	LO1, LO2, LO4
6	Optical Flow	LO1, LO2, LO4
7	Motion Models, Feature Tracking, Alignment	LO1, LO2, LO4
8	Neural Networks for Computer Vision	LO1, LO2, LO3, LO4
9	Image Segmentation	LO1, LO2, LO4
10	Random Decision Forests for Computer Vision Applications	LO1, LO2, LO3, LO4
11	Support Vector Machines for Computer Vision Applications and HoG	LO1, LO2, LO3, LO4
12	Shapes in Computer Vision	LO1, LO2, LO3, LO4
13	Level Sets and Deformable Part Models	LO1, LO2, LO3, LO4
14	GANs for Vision Applications	LO1, LO2, LO4

Prepared by: KASIM TAŞDEMİR
Date: 01.05.2018