University of Tehran
School of Electrical and Computer Engineering

Course:	Machine Vision - 8101429		
Course type:	Main Course	AI and Robotics	3 Credit Points
Level:	Postgraduate		
Co-requisite(s):			
Prerequisite(s):			
Prerequisite by topic:	Linear Algebra- Signal Processing		
Textbook(s):	[1] Rafael C. Gonzalez and Richard E. Woods. Digital Image Processing (3rd Edition). Prentice Hall, 3 edition, August 2007 [2] Richard Hartley and Andrew Zisserman. Multiple View Geometry in Computer Vision. Cambridge University Press, 2 edition, April 2004. [3] Emanuele Trucco and Alessandro Verri. Introductory Techniques for 3-D Computer Vision. Prentice Hall, March 1998.		
Coordinator:			
Goals:	Rephrasing machine vision problem as a pattern recognition problem, where the inputs are images and videos. Explaining the main tools for solving inference problems in machine vision. Some of these tools and inference problems are linear systems, edge and corner detection, camera models, camera estimation and 3D reconstruction.		
Outcome:	Students who successfully pass the course can: 1. Enhance the images 2. Extract features from images and use these features in an inference task 3. Estimate transformations between images based on estimated keypoints 4. Calibrate a camera 5. Reconstruct 3D structure from images		
Topics:	Included topics in the course are: 1. Elements of biological vision; image formation 2. Linear systems (filtering, sampling, Fourier transform) 3. Intensity transformations (gamma transformation, histogram transformation) 4. Color spaces (theory of color, standards: XYZ, sRGB, RGB, HIS, Y'CrCb) 5. Feature extraction (edge, line, keypoints) 6. Image segmentation (mixture of Gaussians, snakes, graph-based methods) 7. Projective geometry; 2D and 3D transformations 8. Non-linear least squares methods 9. 2D homography estimation 10. Projective camera model 11. Camera estimation using a calibration object 12. Image of 3D primitives 13. Camera calibration without any calibration object		

	14. Epipolar geometry; fundamental matrix 15. Estimating the fundamental matrix 16. 3D structure estimation
Computer usage:	Implementing some of course homeworks and course projects using programming languages
Assignments:	Three to four assignments that cover different topics
Projects:	• First project related to feature extraction, image segmentation • Second project related to camera matrix and 3D reconstruction
Grading:	Assignments 15% Quiz 10% Mid-term exam 20% Final exam 25% Project 30%
Further readings:	[1] Richard Szeliski. Computer Vision: Algorithms and Applications (Texts in Computer Science). Springer, 2011 edition, October 2010.
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