SE456 /CS 456 Computer Vision
Section W1
Fall 2018

Instructor	Syed Farooq Ali		
Lectures		**Contact**	farooq.ali@umt.edu.pk
Office	**Hall#:** STD 404 **Office Hours:** **Mon** (2:00-4:00 pm) **Thr** (2:00-4:00 pm)	**TA**	**Name:** TBA **Office Hours and Venue:** TBA
Lab	**Lab Engineer Name:** TBA **Labs Day & Timings:** TBA **Venue:**		
Pre-Requisites	None	**Moodle Group,**	
VIP Research Grp.	VIP stands for Vision and Image Processing Research Group at UMT URL: http://sst.umt.edu.pk/vip/home.aspx https://sites.google.com/site/farooq1us/home		
Course Objectives	Computer Vision combines and integrates ideas from different areas, including statistics, linear algebra, pattern recognition, machine intelligence, decision theory and image processing. • To enable students to learn different techniques and algorithms of computer vision. • As this course is designed with an application perspective, hence, implementation of different concepts of computer vision (taught in this course) is an integral part of this course. • To introduce a new area of study, in which students can pursue research and development.		
Textbooks	There is no single text book for this course. However, following is the recommended reading material. • [Shah] Fundamentals of Computer Vision, Mubarak Shah, 1992 • [Shapiro] Computer Vision, Linda G. Shapiro, George C. Stockman, Prentice Hall, 2001 • [Snyder] Machine Vision, Wesley E. Snyder and Hairong Qi, Cambridge, 2004 • [Gonzalez, Woods] Digital Image Processing, 2nd Edition (Freely Available Online)		
Technology	The course provides hands on experience on • Matlab Programming • Irfan View, Video Editing Tools (RV Tool, Sequence Viewer) • C/C++ (optional)		
Midterms	A single 75-minute midterm	**Final**	Will cover the entire course. At least 75%

	from the material covered during the first 8 weeks		of the material would be post midterm.
Classroom Policy	• The plagiarism and cheating cases would be reported to the Disciplinary Committee or Management. • Keep your mobiles switched off. • In case of late absent, it would be the choice of the instructor to either ask you to write a complete lecture again on a white paper signed by the instructor or to mark you Absent. The complete lecture needs to be submitted by 5 pm in the same day in Instructor's office. • It is your responsibility not to delete your assignment even after its submission. • Quizzes can be announced or unannounced. 1 quiz would be dropped out of 5 or 6 quizes. No retake for quizzes.		
Grading Policy	• Class Exercise 10% • Assignments 20% • Project 15% • Quizzes 10% • Mid-Term Exam/Term Test 20% • Final Exam 25%		

Tentative Course Plan:

Week	Contents	Module	Assessments
1	**Introduction** Course introduction, along with an overview of the computer vision, digital images, imaging devices and the human eye, PPM and PGM formats	**1. Imaging Geometry and Transformations**	**Quiz 1** **Assign 1**: PPM, PGM File Manipulation using C
2, 3	**Transformations** 2D Transformations (Translation, Scaling, Shear, Rotation, Affine, Projective) Matlab Tutorial Recovering best affine transformations Image Warping, Image Registrations, 3D transformations (optional)	1	**Quiz 2, Quiz 3** **Assign. 2(week 2):** Transformations, Image Warping (Matlab) **Assign 3 (Handwritten):** Tranformations, imaging geometry
4, 5	**Imaging Geometry** Camera Model, Perspective and Orthographic Cameras, Camera Calibration, Stereo	1	**Assign 3 (CONT.)** Quiz 4, Quiz 5
5	**Pyramids** Gaussian Pyramids, Sampling and Aliasing	**2. Motion (Optional)**	
6	**Optical Flow** Brightness constancy equation, normal vs. perpendicular flow, Lucas-Kanade method	2	Quiz 6

7	**Global Motion Estimation** Affine global motion estimation, Projective global motion estimation, applications Tentative: Motion Tracking	2	
8	Revision		Mid Term
9, 10	**Basic Binary Operations** Thresholding, morphology, region properties, moments (optional), connected component labeling **Smoothing and Denoising** Low Pass Filter, Averaging Filter, Noise, Denoising **Edge Detection** Difference masks, Laplacian of Gaussian (LoG), Canny	**3. Binary Image Processing**	**Assign 4:** Connected Component Labeling, Canny, Hough Transform (Matlab)
10, 11, 12	**Shape Representation** Hough Transform, Generalized Hough Transform	3	
13	**Correlation and Template Matching** Correlation, Normalized Correlation, Distance Transform, Medial Axis Transform, Hausdorff Distance Applications: Background subtraction, Change Detection, skin detection	**4. Segmentation and Clustering**	Quiz 7 **Assign 5/Project** (optional) (Matlab)
14	**Clustering and Segmentation (Optional)** K-Means, How to choose K, Split and Merge, Agglomerative and Divisive Clustering, Motion Segmentation, Color Segmentation **Relevant Areas and Courses** *Digital Image Processing, Computer Graphics, Image and Video Coding*	4	
15	*Pattern Recognition, Machine Learning, Artificial Intelligence* Revision	4	