GUJARAT TECHNOLOGICAL UNIVERSITY

Digital Image and Video Processing
SUBJECT CODE: 3714104
ME 1st Semester

Type of course: Program Elective-1

Prerequisite: Fundamentals of Digital Image Processing

Rationale: This course is preliminary requirement for computer vision. Computer vision has application in industrial automation, identification systems, surveillance, navigation, medical imaging and diagnosis etc. It has applications in many engineering fields to solve real life challenges in society and industry.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE(E)	PA (M)	PA (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	**Digital Image and Video Fundamentals** Digital image and video fundamentals and formats, 2-D and 3-D sampling and aliasing, 2-D/3-D filtering, image decimation/ interpolation, video sampling and interpolation, Basic image processing operations, Image Transforms, Need for image transforms, DFT, DCT, Walsh, Hadamard transform, Haar transform, Wavelet transform	8	15%
2	**Image and Video Enhancement and Restoration** Histogram, Point processing, filtering, image restoration, algorithms for 2-D motion estimation, change detection, motion-compensated filtering, frame rate conversion, de-interlacing, video resolution enhancement, Image and Video restoration (recovery).	6	15%
3	**Image and Video Segmentation** Discontinuity based segmentation- Line detection, edge detection, thresholding, Region based segmentation, Scene Change Detection, Spatiotemporal Change Detection, Motion Segmentation, Simultaneous Motion Estimation and Segmentation Semantic Video Object Segmentation, Morphological image processing.	8	20%
4	**Colour image Processing** Colour fundamentals, Colour models, Conversion of colour models, Pseudo colour image processing, Full colour processing	6	15%
5	**Image and Video Compression** Lossless image compression including entropy coding, lossy image compression, video compression techniques, and international standards for image and video compression (JPEG, JPEG 2000, MPEG-2/4, H.264, SVC), Video Quality Assessment	8	20%
6	**Object recognition** Image Feature representation and description-boundary representation, boundary descriptors, regional descriptors, feature selection techniques, introduction to classification, supervised and unsupervised learning, Template matching, Bayes classifier	6	15%

Reference Books:

[1] Alan C. Bovik ,"Handbook of Image and Video Processing", 2nd Edition, Academic Press, 2000.
[2] J. W. Woods, "Multidimensional Signal, Image and Video Processing and Coding",2nd Edition, Academic Press, 2011.
[3] Rafael C. Gonzalez and Richard E. Woods," Digital Image Processing", 3rd Edition, Prentice Hall, 2008.
[4] A. M. Tekalp, "Digital Video Processing", 2nd Edition, Prentice Hall, 2015.
[5] S. Shridhar, "Digital Image Processing", 2nd Edition, Oxford University Press, 2016.

Course Outcomes:

At the end of this course, students should be able to …

- Learn different techniques for image enhancement, video and image recovery
- Understand techniques for image and video segmentation
- Study techniques for image and video compression and object recognition
- Perform image and video enhancement
- Perform image and video segmentation
- Detect object in an image/video

List of Experiments:

- Perform basic arithmetic and logical operations on digital images
- Plot histogram of an image and perform histogram equalization
- Implement image segmentation algorithms
- Perform video enhancement
- Perform video segmentation
- Perform image compression using lossy and lossless techniques
- Perform image restoration
- Calculate boundary feature of an image
- Detect an object in an image/video using template matching/Bayes classifier

Teacher Guided Student Activity:

- As a part of this activity students can perform following activities.
- Refer scholarly articles from well known journal/conferences such as IEEE, ELSEVIER, and SPRINGER etc. in the field of Image and Video Processing, Computer Vision
- Student can be assigned topics for seminars on some research topics.
- Perform practicals open source software python programming and use Hardware like Raspberry PI for implementation.

Major Equipment/software:

Raspberry PI board with USB camera
Python 2.7
SCILAB 6.0.1

List of Open Source Software/learning website:

NPTEL Video lectures: **http://nptel.ac.in/downloads/117104020/**
https://www.scilab.org/
http://vlabs.iitkgp.ernet.in/dsp/#
https://training.ti.com/
https://www.coursera.org/learn/image-processing