Subject Code	Subject Name (Lab oriented Theory Courses)	Category	L	T	P	C
AI19641	COMPUTER VISION AND ITS APPLICATIONS	PC	3	0	2	4

Objectives:	
●	Learn the basic concepts of image processing and computer vision.
●	Understand the ideas about image segmentation and feature based alignment.
●	Explore the ideas of Image Recognition and restoration.
●	Interpret various CNN model for object detection in Computer Vision.
●	Identify possible solutions to Train common problems with GAN model.

UNIT-I	INTRODUCTION	9
Introduction : Image formation -Geometric primitives and transformations - Photometric image formation - The digital camera- Image processing - Point operators - Linear filtering -More neighborhood operators -Fourier transforms - Pyramids and wavelets - Geometric transformations - Global optimization - Feature detection and matching Points and patches - Edges – Lines (Chapter 1,2,3,4 of T1)		
UNIT-II	**IMAGE SEGMENTATION**	**8**
Segmentation : Active contours - Split and merge - Mean shift and mode finding - Normalized cuts -Graph cuts and energy-based methods - Feature-based alignment - **2D and 3D feature-based alignment** - Pose estimation -Geometric intrinsic calibration. (chapter 5,6 of T1)		
UNIT-III	**IMAGE RECOGNITION AND RESTORATION**	**10**
Object detection -Face recognition -Instance recognition - Category recognition -Context and scene understanding - Recognition databases and test set, **3D reconstruction** : Shape from X - Active range finding - Surface representations - Point-based representations - Volumetric representations - Model-based reconstruction -Recovering texture maps and albedos (chapter 12 and 14 of T1)		
UNIT-IV	**OBJECT DETECTION IN COMPUTER VISION**	**10**
CNN architectures-components of a CNN- Image classification using CNNs- Object detection with R-CNN, Object detection with Single-shot detector (SSD)- High-level SSD architecture- Base network- Multi-scale feature layer- Architecture of the multi-scale layers. case study: Train an SSD network in a self-driving car application(Link 5 Chapter 3,6,and 7)		
UNIT-V	**GENERATIVE ADVERSARIAL NETWORKS**	**8**
Overview of GAN Structure-Discriminator-Discriminator Training Data-Generator-GAN Training-Convergence-Loss Functions-Minimax Loss-Modified Minimax Loss-Wasserstein Loss. Case study: Build and train a GAN for generating hand-written digits in the TF-GAN (Link 5 chapter 8,Link 6)		
	Contact Hours :	**45**

List of Experiments			
1.	Write a program to demonstrate the working of CNN architecture to classify images		
2.	Build a simple CNN model for image segmentation		
3.	Build and train a CNN model for Face recognition(L3)		
4.	Design and train a model for objects detection with real time example		
5.	Design and implement Multiple Object Tracking using OpenCV(L9)		
6.	Load and implement the Face Detection method in OpenCV using python (L9)		
7.	Train an SSD network in a self-driving car application(L5)		
8.	A PyTorch implementation of Object Detection with Single Shot Detector (L8)		
9.	Building a simple Generative Adversarial Network (GAN) using TensorFlow		
10.	Build and train a GAN for generating hand-written digits(L5)		
	Contact Hours	**:**	**30**
	Total Contact Hours	**:**	**75**

Course Outcomes: On completion of the course, the students will be able to	
●	Design the computer vision application.
●	Explain the issue of segmentation in computer vision algorithms and implement in open CV.
●	Design and Build a CNN model for image recognition and object detection.
●	Train the CNN model with different real time application.
●	Build and train a GAN for generating hand written digits and other applications.

Text Books:	
1	Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer, 2010.
2	D. Forsyth and J. Ponce, "Computer Vision - A modern approach", 2nd edition, 2012 Pearson Education.

Reference Books:	
1	Richard Hartley and Andrew Zisser man, Multiple view geometry in computer vision 2nd edition, Cambridge University press, 2015 (printing).
2	Anil Jain K, "Fundamentals of Digital Image Processing", Prentice-Hall of India, 2001.

Web link:

1. http://vision.deis.unibo.it/fede/dida/computer_vision/
2. https://www.datacamp.com/community/tutorials/face-detection-python-opencv
3. https://vinsol.com/blog/2016/06/28/computer-vision-face-detection/
4. https://github.com/microsoft/computervision-recipes
5. https://livebook.manning.com/book/grokking-deep-learning-for-computer-vision/chapter-7/286
6. https://developers.google.com/machine-learning/gan/applications
7. https://www.pyimagesearch.com/2016/07/25/convolutions-with-opencv-and-python/
8. https://github.com/enginBozkurt/Object_Detection_With_SSD
9. https://opencv.org