UNIVERSITY OF MADRAS

MASTER OF COMPUTER APPLICATIONS (MCA) DEGREE PROGRAMME

SYLLABUS WITH EFFECT FROM 2023-2024

Title of the Paper	**Computer Vision**		
Core -XIII Theory	II Year & IV Semester	Credit:4	535C4A

Course Objectives:

- To understand the fundamental concepts related to Image formation and processing**.**
- To learn feature detection, matching and detection
- To become familiar with feature based alignment and motion estimation
- To develop skills on 3D reconstruction
- To understand image based rendering and recognition

Unit I: Basic Image Handling and Processing: PIL – the Python Imaging Library-Matplotlib-NumPy-SciPy-Advanced example: Image de-noising. Local Image Descriptors: Harris corner detector-SIFT - Scale-Invariant Feature Transform-Matching Geotagged Images.

Unit II: Image to Image Mappings:Homographies-Warping images-Creating Panoramas. Camera Models and Augmented Reality: The Pin-hole Camera Model-Camera Calibration-Pose Estimation from Planes and Markers-Augmented Reality.

Unit III: Multiple View Geometry:Epipolar Geometry-Computing with Cameras and 3D Structure-Multiple View Reconstruction-Stereo Images. Clustering Images: K-means Clustering-Hierarchical Clustering-Spectral Clustering.

Unit IV: Searching Images: Content based Image Retrieval-Visual Words-Indexing Images-Searching the Database for Images-Ranking Results using Geometry-Building Demos and Web Applications. Classifying Image Content: K-Nearest Neighbors-Bayes Classifier-Support Vector Machines-Optical Character Recognition.

Unit V: Image Segmentation: Graph Cuts-Segmentation using Clustering-Variational Methods. OpenCV: Python Interface-OpenCV Basics-Processing Video-Tracking.

TEXT BOOKS:

1. Richard Szeliski, “Computer Vision: Algorithms and Applications”, Springer- Texts in Computer Science, Second Edition, 2022.

2. Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, Second Edition, 2015

REFERENCES:

1. Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004.

2. Christopher M. Bishop; Pattern Recognition and Machine Learning, Springer, 2006 3. E. R. Davies, Computer and Machine Vision, Fourth Edition, Academic Press, 2012

Course Outcomes

On the successful completion of the course, students will be able to

CO1	To understand basic knowledge, theories and methods in image processing and computer vision.	K1-K6
CO2	To implement basic and some advanced image processing techniques in OpenCV	K1-K6
CO3	To apply 2D a feature-based based image alignment, segmentation and motion estimations	K1-K6
CO4	To apply 3D image reconstruction techniques	K1-K6
CO5	To design and develop innovative image processing and computer vision applications	K1-K6

K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5 Evaluate, K6- Create

Mapping with Programme Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	L	M	L	L	L	M	M	M	S
CO2	S	M	L	M	M	L	S	L	S	L
CO3	S	S	S	M	M	L	M	L	M	L
CO4	S	S	S	M	M	L	M	L	M	L
CO5	S	S	S	M	M	L	S	L	S	L

S- Strong; M-Medium; L-Low