GANPAT UNIVERSITY

FACULTY OF ENGINEERING & TECHNOLOGY

Programme	Bachelor of Technology	Branch/Spec.	Computer Engineering/ Information Technology/ Computer Engineering(Artificial Intelligence)
Semester	VIII	Version	1.0.0.0
Effective from Academic Year	2025-26	Effective for the Batch admitted in	July 2022
Course Code	2CEIT8PE6	Course Name	Video Analytics

Teaching Scheme						Examination Scheme (Marks)			
(Per week)	Lecture (DT)		Practical (Lab.)		Total		CE	SEE	Total
	L	TU	P	TW					
Credit	2	-	1	-	3	Theory	40	60	100
Hours	2	-	2	-	4	Practical	30	20	50

Pre-requisites

Mathematics, Algorithms

Course Outcomes

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

CO1	Explain key concepts of video analytics, spatial and frequency domain processing, background modelling, and object detection techniques.
CO2	Utilize feature extraction techniques (SIFT, Harris, STIP) and tracking algorithms (Kalman Filters, Particle Filters, Bayesian Filters) for motion estimation and object recognition.
CO3	Implement motion estimation techniques (Optical Flow, Block Matching) and advanced segmentation methods (Watershed, GraphCut, UNets, FCN) for video processing.
CO4	Design and implement solutions for video surveillance, face recognition, action recognition, and intelligent transport systems using advanced tracking and classification techniques.

Theory Syllabus

Unit	Content	Hrs.
1	**Introduction:** Video Analytics. Computer Vision: Challenges- Spatial Domain Processing – Frequency Domain Processing-Background Modeling-Shadow Detection- Eigen Faces - Object Detection -Local Features-Mean Shift: Clustering. Computer Vision, Spatial/ Frequency Domain Processing, Background Modeling.	07
2	**Understanding Features and Tracking:** Features Local Features (Harris/SIFT/KB/STIP), Object Detection and Recognition (Eigen Faces, Sparse Representation), Face Detection and Recognition, Tracking - Object Tracking using Active Contours – Tracking & Video Analysis: Tracking and Motion Understanding – Kalman filters, condensation, particle, Bayesian filters, hidden Markov models, change detection and model based tracking- Motion estimation and Compensation-Block Matching Method.	07
3	**Motion estimation and Tracking**: Hierarchical Block Matching, Overlapped Block Motion and compensation-Recursive Motion Estimation, Mesh Based Method, Optical Flow Method – Motion Segmentation -Thresholding for Change Detection, Estimation of Model parameters - Optical Flow Segmentation-Modified Hough Transform Method- Segmentation for Layered Video Representation-Bayesian Segmentation -Simultaneous Estimation and Segmentation-Motion Field Model, Segmentation (Unsupervised: Watershed, Level set, Active Contour, GraphCut), Segmentation (Supervised: Agglomerative clustering, Segmentation as pixel classification - UNets, FCN), MS Theory, MS Tracking.	08
4	**Applications**: Kalman, Particle Filter based tracking, Action Recognition - Low Level Image Processing for Action Recognition: Segmentation and Extraction, Local Binary Pattern, Structure from Motion - Action Representation Approaches: Classification of Various Dimension of Representation, View Invariant Methods, Gesture Recognition and Analysis, Action Segmentation. Case Study: Face Detection and Recognition, Natural Scene Videos, Crowd Analysis, Video Surveillance, Traffic Monitoring, Intelligent Transport System.	08

Practical Content

Practicals, assignments and tutorials are based on the above syllabus.

Text Books	
1	Video Processing and Communications by Yao Wang, Jorn Ostermann and Ya-Qin Zhang,, Prentice Hall.
2	The Essential Guide to Video Processing by Alan C Bovik, Academic Press
3	Digital image processing by Gonzalez, R. C, Pearson education India.
4	Computer Vision: Algorithms and Applications by Richard Szeliski
Reference Books	
1	Introductory Techniques for 3D Computer Vision by Emanuele Trucco and Alessandro Verri, Pearson.
2	Computer Vision by D. H. Ballard and C. M. Brown, Prentice Hall.
3	Programming Computer Vision with Python by Jan Erik Solem, Shroff Publisher/O'Reilly Publisher.
ICT/MOOCs Reference	
1	https://nptel.ac.in/courses/106/105/106105216/
2	https://nptel.ac.in/courses/108/103/108103174/

Mapping of CO with PO and PSO:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1	2	1	1	1	1	0	0	2	3	2	2
CO2	3	3	3	2	3	2	1	1	2	0	1	3	3	3	3
CO3	3	3	3	3	3	2	1	1	2	1	1	3	3	3	3
CO4	2	2	3	3	3	3	2	2	3	2	3	3	2	3	3