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| **Course Code: CSE4047** | | **Course Title: Computer Vision** | **TPC** | **3** | | **2** | **4** |
| **Version No.** | | **1.1** | | | | | |
| **Course Pre-requisites** | | **CSE4007- Digital image Processing** | | | | | |
| **Course Anti-requisites** | | **CSE4018-Computer Vision and Robotics** | | | | | |
| **Objectives:** | | To enable students to study about computer vision and get a first-hand experience on dealing with real world images and videos. | | | | | |
| **COs Mapping with POs and PEOs**   |  |  |  | | --- | --- | --- | | **Course Outcomes** | **Course Outcome Statement** | **POs / PEOs** | | **CO1** | Identify basic concepts, terminology, theories, models and methods in the field of computer vision. | PO1, PO2 | | **CO2** | Describe basic methods of computer vision related to multi-scale representation, edge detection and detection of other primitives, stereo, motion and object recognition. | PO1/ PEO3 | | **CO3** | Choose appropriate computer vision methods for edge detection, object recognition, filtering etc. | PO5/ PSO2/ PEO2 | | **CO4** | Develop and apply computer vision techniques for solving practical problems. | PO5, PO6/ PSO1, PSO3/ PEO1 | | **CO5** | Acquire good and practical skills in computer vision. | PO5/ PSO2/ PEO3 | | **TOTAL HOURS OF INSTRUCTIONS: 45** | | |   **a** | | | | | | | |
| **Module No. 1** | **Introduction to Computer Vision** | | | | **4 hours** | | |
| Introduction to Computer vision, Real time computer vision applications, Image representation and analysis. | | | | | | | |
| **Module No. 2** | **Feature Engineering** | | | | **12 hours** | | |
| Edges - Canny, LOG, DOG; Line detectors (Hough Transform), Corners - Harris and Hessian Affine, Orientation Histogram, SIFT, SURF, HOG, GLOH, Scale-Space Analysis- Image Pyramids and Gaussian derivative filters, Gabor Filters and DWT. | | | | | | | |
| **Module No. 3** | **Feature modeling and analysis** | | | | **6 hours** | | |
| Background Subtraction and Modeling, Optical Flow, KLT, Spatio-Temporal Analysis, Dynamic Stereo; Motion parameter estimation. | | | | | | | |
| **Module No. 4** | **Computer Vision applications** | | | | **8 hours** | | |
| Classifiers – Deep Neural Network(DNN), Object tracking, Model based vision, Finding Templates and Recognition, Case study 1: Face recognition system, Case Study 2: Vehicle anomaly detection in video surveillance | | | | | | | |
| **Module No. 5** | **Feature detection and matching** | | | | **8 hours** | | |
| Points and patches • Edges and contours • Contour tracking • Lines and vanishing points • Segmentation, Image alignment and stitching- Pairwise alignment • Image stitching • Global alignment • Compositing | | | | | | | |
| **Module No. 6** | **3D reconstruction** | | | | **7 hours** | | |
| Shape from X • 3D scanning • Surface representations • Point-based representations • Volumetric representations • Model-based reconstruction • Recovering texture maps and albedos | | | | | | | |
| **Text Books**   1. Szeliski, Richard. Computer vision: algorithms and applications. Springer Nature, Second Edition, 2022. 2. E. R. Davies**,** Computer Vision Principles, Algorithms, Applications, Learning, Elsevier,5th Edition, 2017 | | | | | | | |
| **References**   1. Rafael C. Gonzales, Richard E. Woods, “Digital Image Processing”, Fourth Edition, Pearson Education, 2018. 2. [Richard Szeliski](https://www.amazon.com/Richard-Szeliski/e/B001K6GZ1Q/ref=dp_byline_cont_book_1) ,”[Computer Vision: Algorithms and Applications”](http://szeliski.org/Book/) , Springer 2015 | | | | | | | |
| **Lab Experiments:**   1. Write a program to compute the histogram of an input image and equalization of the histogram 2. Write and execute programs to remove noise using spatial filters 3. Understand 1-D and 2-D convolution process 4. Use 3\*3 mask for low and high pass filter 5. Write a program to add noise in the image and apply image restoration technique using Wiener ﬁlter and median 6. ﬁlter 7. Write a program for Geometric transformations that shows image rotation, scaling, and translation 8. Write a program for Determination of edge detection using operators 9. Write a program to identify edges in image using hough transform 10. Write a program to formulate a 2D signal processing description of images including filtering procedures, discrete approximations of the gradient operator, gaussian filtering, image pyramids, and image warping 11. Write a program to implement motion estimation algorithms and image warping to perform basic image alignment. 12. Write a program to formulate an appearance based recognition algorithm using principle components analysis 13. Write a program to formulate a feature-based recognition algorithm using feature vectors computed around key points 14. Write a program to formulate statistical pattern recognition algorithms for automated understanding of visual scenes 15. Implement Object tracking using OpenCV 16. Write a program to implement Face Recognition System 17. Write a program to develop vehicle anomaly detection in video surveillance | | | | | | | |
| **Course Type** | | **Embedded Theory and Lab (ETL)** | | | | | |
| **Mode of Evaluation** | | **Theory 75%**  Continuous Assessment Test-1 15  Continuous Assessment Test-2 15  Digital Assignments/Quizes (Min) 30  Final Assessment Test 40  **Laboratory 25%** | | | | | |
| **Prepared by** | | **Dr. Reeja S R** | | | | | |
| **Recommended by the Board of Studies on** | | **14th BoS, 11.05.2024** | | | | | |
| **Date of Approval by the Academic Council** | | **12th Academic Council, 25.05.2024** | | | | | |