**COURSE PLAN**

V-TRIMESTER (2024-25)

**SECTION I**

| Semester | | V | | Class | MCA |
| --- | --- | --- | --- | --- | --- |
| Course Code | | MCA571 | | Course title | Computer Vision |
| Hours | | 75 | | Hours per week | (3+ 4) 7 |
| Course Type | | Theory & Practical (Full CIA) | | Credits | 5 |
| Faculty name | | Dr.Helen K Joy | | Contact details | [helenk.joy@christuniversity.in](mailto:helenk.joy@christuniversity.in)  9845691317 |
| Class policies and guidelines | | * Please ensure strict compliance with the class policies of the University/Department as outlined in the following link: [https://christuniversity.in/general-regulations](about:blank). * Students must adhere to the timetable and be present in their designated classrooms. * Attendance will be taken within the first 5 minutes, and latecomers will not be permitted for attendance. * All communication will be conducted through Google Classroom. * All the programs must be uploaded to the Google Classroom account, and the account must be associated with your official Christ ID. * Cell phones, pagers, iPods/MP3 players should be kept in your bag and turned off, as these items cause disruptions during valuable class time. * All students are required to bring their laptops with necessary software installed. Laptops should only be used when instructed in class. * It is expected that students will employ genuine, sincere, and fair methods to complete tests, tasks, or projects, which will be used to evaluate their progress. Any instances of plagiarism, copying, or cheating will result in automatic zeros. | | | |
| Course Description/Objectives | | This course enables the learners to understand various image processing and computer vision algorithms and work in lower, middle and higher level of computer vision tasks. It also enables the learners to impart knowledge on advanced concepts in image representation, analysis, object detection and recognition. This course helps the learners to implement vision algorithms efficiently in research or industry. | | | |
| Course Outcomes | | Upon successful completion of the course, the student will be able to  CO1: Understand the basic concepts, terminologies and methods in computer vision and image processing.  CO2: Describe different image enhancement and restoration techniques in spatial and frequency domain.  CO3: Design mid-level and higher-level computer vision applications.  CO4: Develop simple object detection and recognition model for a particular application. | | | |
| **SECTION II** | | | | | |
| Module/ Unit/ Topic number and title | Module/ Unit/ Topic details | Week (starting and end dates) | Hours per week | Pedagogy (teaching learning methods used)/ activities and or class trips/ dates for assessment | Resource/ Reference details |
| Unit-I | Introduction to computer vision-Limitations of human vision-Computer vision and Image processing- Different Applications of Computer Vision-Simple image formation model-Types of digital images-Fundamental Steps in Image Processing, Elements of Digital Image Processing System  **Lab Programs:**   1. Illustrate Spatial Transformations - Convolution and correlation method (Use at least 2 kernels) | Week 1  (09/09/2024  To  14/09/2024) | 7 | Interactive Lectures and  PPT | [1] Computer Vision: Algorithms and Applications, Richard Szeliski, Springer Science & Business Media, 2nd Edition, ISBN-13: 978-1848829343, 2022.  [2] Digital Image Processing, R. C. Gonzalez & R. E. Woods, Pearson Education, 4th Edition, 2018. |
| Unit-I | Correlation and Convolution- Image Sampling and Quantization- resolution of images-Basic relationships: Neighbors, Connectivity, Distance Measures between pixels-Different color models.  **Lab Programs:**   1. Demonstrate the concept of sampling and quantization. | Week 2  (16/09/2024  To  21/09/2024) |  | Interactive Lectures,  PPT, Experiential Learning | [1] Computer Vision: Algorithms and Applications, Richard Szeliski, Springer Science & Business Media, 2nd Edition, ISBN-13: 978-1848829343, 2022.  [2] Digital Image Processing, R. C. Gonzalez & R. E. Woods, Pearson Education, 4th Edition, 2018. |
| Unit-I &  Unit 2 | Geometric transformations (unit-I)  **IMAGE ENHANCEMENT AND RESTORATION TECHNIQUES**  **Spatial Domain:** Gray Level Transformations, point operations, Histogram Processing, Histogram equalization, Image Degradation and Restoration Process, Noise Models, Restoration in the presence of Noise- Basics of Spatial Filters, Smoothening and Sharpening Spatial Filters.  **Lab Programs:**  3.1 Write a code to convert the image from the given color model to different color models.  3.2 Include different types of noises in the input image with various densities and apply linear and non-linear spatial filters to the noise contaminated image with different mask size. | Week 3  (23/09/2024  To  28/09/2024) | 7 | PPT, Flipped Classroom, Hands on Training  **CIA Component**  **-I**  **MCQ (40 Questions- 20 Marks)** | [1] Computer Vision: Algorithms and Applications, Richard Szeliski, Springer Science & Business Media, 2nd Edition, ISBN-13: 978-1848829343, 2022.  [2] Digital Image Processing, R. C. Gonzalez & R. E. Woods, Pearson Education, 4th Edition, 2018. |
| Unit 2 | **Frequency Domain:** Introduction to Fourier Transform and the frequency Domain, Smoothing and Sharpening, Frequency Domain Filters.  **Lab Programs:**  I4. llustrate "Fourier Transform" decompose an image into its sine and cosine components and apply the following filters in frequency domain 4.1. Ideal Low Pass Filter 4.2. Ideal High Pass Filter  5. Demonstrate Wavelet transform to extract and display different frequency bands like LL, LH, HL, HH. | Week-4  30/09/2024 To  05/10/2024 | 7 | PPT, Flipped Classroom, Hands on Training | [1] Computer Vision: Algorithms and Applications, Richard Szeliski, Springer Science & Business Media, 2nd Edition, ISBN-13: 978-1848829343, 2022.  [2] Digital Image Processing, R. C. Gonzalez & R. E. Woods, Pearson Education, 4th Edition, 2018. |
| Unit 2 & Unit 3 | Discrete Cosine Transformation (DCT)-Wavelets.  **IMAGE FEATURES AND SEGMENTATION:**  Image features- Local and global features-Feature detection, description and matching-Point, Line and Edge detection, Thresholding  **Lab Programs:**   1. Demonstrate the following edge detection methods and interpret the results   First Order Derivative Methods  Second Order Derivative Methods  Optimum Edge Detection Method   1. Illustrate the segmentation method based on watershed | Week-5  07/10/2024  To  12/10/2024 | 7 | PPT, Flipped Classroom, Hands on Training  CIA-II (Lab Test, 30 Marks) | [1] Computer Vision: Algorithms and Applications, Richard Szeliski, Springer Science & Business Media, 2nd Edition, ISBN-13: 978-1848829343, 2022.  [2] Digital Image Processing, R. C. Gonzalez & R. E. Woods, Pearson Education, 4th Edition, 2018. |
| Unit 3 | Basic global thresholding, optimum global thresholding using Otsu’s Method. Region Based Segmentation – Region Growing and Region Splitting and Merging-Watershed Segmentation-Active Contours  **Lab Programs:**   1. Implement Active contour segmentation method | Week-6  14/10/2024 To  19/10/2024 | 7 | PPT, Flipped Classroom, Hands on Training | [1] Computer Vision: Algorithms and Applications, Richard Szeliski, Springer Science & Business Media, 2nd Edition, ISBN-13: 978-1848829343, 2022.  [2] Digital Image Processing, R. C. Gonzalez & R. E. Woods, Pearson Education, 4th Edition, 2018. |
| Unit 3 & Unit 4 | Graph based segmentation.  **STRUCTURE FROM MOTION**  Image Alignment-Triangulation- Structure from motion-Projective (uncalibrated) reconstruction-Self-Calibration-Constrained structure and motion-Motion Segmentation.  **Lab Programs:**   1. Illustrate triangulation / two-frame motion | Week-7  21/10/2024  To  26/1/2024 | 7 | PPT, Flipped Classroom, Hands on Training | [1] Computer Vision: Algorithms and Applications, Richard Szeliski, Springer Science & Business Media, 2nd Edition, ISBN-13: 978-1848829343, 2022.  [2] Digital Image Processing, R. C. Gonzalez & R. E. Woods, Pearson Education, 4th Edition, 2018. |
| Unit 4 | Translational Alignment-Optical Flow.  **IMAGE BASED RENDERING**: View interpolation, layered depth images, light fields.  **Lab Programs:**   1. Implement linear interpolation method | Week-8  28/10/2024 To  02/11/2024 | 7 | PPT, Flipped Classroom, Hands on Training  ETE-1 (Lab Test-30 Marks) | [1] Computer Vision: Algorithms and Applications, Richard Szeliski, Springer Science & Business Media, 2nd Edition, ISBN-13: 978-1848829343, 2022.  [2] Digital Image Processing, R. C. Gonzalez & R. E. Woods, Pearson Education, 4th Edition, 2018. |
| Unit 4 & Unit-5 | video-based rendering.  **OBJECT DETECTION AND RECOGNITION**  Object detection and recognition- Detection of classes of objects (faces/ motorbikes/ trees)  **Lab Programs:**   1. Develop a simple Object detection and recognition model for any particular application | Week-9  04/11/2024 To  09/11/2024 | 7 | PPT, Flipped Classroom, Hands on Training  ETE-2 (Theory Test-50 Mars Scale down to 30 Marks) | [1] Computer Vision: Algorithms and Applications, Richard Szeliski, Springer Science & Business Media, 2nd Edition, ISBN-13: 978-1848829343, 2022.  [2] Digital Image Processing, R. C. Gonzalez & R. E. Woods, Pearson Education, 4th Edition, 2018. |
| Unit-5 | Instance Recognition- Classification of images | Week-10  11/11/2024 To  16/11/2024 | 7 | PPT, Flipped Classroom, Hands on Training | [1] Computer Vision: Algorithms and Applications, Richard Szeliski, Springer Science & Business Media, 2nd Edition, ISBN-13: 978-1848829343, 2022.  [2] Digital Image Processing, R. C. Gonzalez & R. E. Woods, Pearson Education, 4th Edition, 2018. |
|  | Classification of parts of images for medical or scientific applications.  **Discussion on:**  Self Study: Additional topics in Computer Vision. | Week-11  18-11-2024 To  23-11-2024 | 7 | PPT, Flipped Classroom, Hands on Training | [1] Computer Vision: Algorithms and Applications, Richard Szeliski, Springer Science & Business Media, 2nd Edition, ISBN-13: 978-1848829343, 2022.  [2] Digital Image Processing, R. C. Gonzalez & R. E. Woods, Pearson Education, 4th Edition, 2018. |
|  | **Revision & Retest** | Week 12  (25/11/2024  To  30/11/2024) | 7 | ETE-3 Submission & Evaluation  Group Discussion |  |

**Text Books and Reference Books**

[1] Computer Vision: Algorithms and Applications, Richard Szeliski, Springer Science & Business Media, 2nd Edition, ISBN-13: 978-1848829343, 2022.

[2] Digital Image Processing, R. C. Gonzalez & R. E. Woods, Pearson Education, 4th Edition, 2018.

**Essential Reading / Recommended Reading**

[1] Abhinav Dadhich, Practical Computer Vision: Extract insightful information from images using TensorFlow, Keras, and OpenCV, Packt Publishing Ltd, Feb-2018.

[2] Mastering OpenCV with Practical Computer Vision Projects, by Daniel Lélis Baggio, Shervin Emami, David Millán Escrivá, Khvedchenia Ievgen, Naureen Mahmood, Jasonl Saragih, Roy Shilkrot, Packt Publishing,

**Note:** Lab programs can be implemented using MATLAB / PYTHON

**Web Resources:**

1. A Gentle Introduction to Computer Vision - https://machinelearningmastery.com/what-iscomputer-vision/
2. Everything You Ever Wanted to Know About Computer Vision -

https://towardsdatascience.com/everything-you-ever-wanted-to-know-about-computer-vision-heresa-look-why-it-s-so-awesome-e8a58dfb641e

1. Computer Vision: What it is and why it matters https://www.sas.com/en\_in/insights/analytics/computer-vision.html.
2. Computer vision – ScienceDaily - https://www.sciencedaily.com/terms/computer\_vision.htm
3. Introduction to Computer Vision | Algorithmic Blog - https://algorithmia.com/blog/introductionto-computer-vision
4. What is Computer Vision? - https://hayo.io/computer-vision/
5. Various MOOC courses – SWAYAM – UDEMY – COURSERA etc

**SECTION III**

Mapping:

|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CO1: Understand the basic concepts, terminologies and methods in computer vision and image processing. | 3 | 2 | 2 | 2 | 1 |  | 2 |  |  |  |  |  |
| CO2: Describe different image enhancement and restoration techniques in spatial and frequency domain. | 2 | 2 | 2 | 1 | 1 |  | 1 |  |  |  |  | 1 |
| CO3: Design mid-level and higher-level computer vision applications. | 2 | 1 | 1 | 1 | 2 |  | 1 |  |  |  |  | 1 |
| CO4: Develop simple object detection and recognition model for a particular application. | 1 | 1 | 1 | 3 | 3 | 1 | 2 | 1 |  |  |  | 2 |

A template to map the Course Outcomes against the components of assessment is given below:

| Course Outcomes | Components of assessment (with the break up of marks) | | | | | |
| --- | --- | --- | --- | --- | --- | --- |
| CIA  Comp-1  **MCQ (20 M)** | CIA  Comp-2  **Lab Test**  **(30 M)** | CIA  Comp-3  **Regular Lab Exercises (40 M)** | ETE  Comp-1  **Lab Test**  **(30 M)** | ETE  Comp-2  **Theory Test (30 M)** | ETE  Comp-3  **CV Model (40 M)** |
| CO 1 | 10 | 10 | 10 | 10 | 9 | - |
| CO 2 | 10 | 10 | 10 | 10 | 9 | 5 |
| CO 3 | - | 10 | 10 | 10 | 9 | 10 |
| CO 4 | - | - | 10 | - | 3 | 25 |

Assessment outline:

|  |  | Components of assessment | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Components | CIA I  (Comp-1) | CIA II  (Comp-2) | CIA III  (Comp-3) | Attendance | ESE  (Comp-1) | ESE  (Comp-2) | ESE  (Comp-3) |
| Marks  /Percentage | 20 | 30 | 40 | 10 | 30 | 30 | 40 |

**SECTION IV**

**Assessment Description: CIA Componet-1**

| **Nature of Assignment** | MCQ |
| --- | --- |
| **Submission Mode** | Online (Moodle) |
| **Date of Exam** | Week 3 |
| **Duration** | 40 Mins (40 Questions) |
| **Total Marks** | 20 Marks |
| **Assignment Description** | In this component learner will be tested on their understanding of fundamentals of image processing, elements of image processing and basic concepts of computer vision. The component consists of 40 multiple-choice questions (MCQs) related to the topics of image processing, sampling and quantization, Neighbors, Connectivity, Distance Measures between pixels, Image formation model, Grayscale and Color images representation. |

**Learning outcomes:**

LO1: Understand the fundamentals of image processing & computer Vision concepts.

LO2: Analyse the elements of image processing and different formats and types of images.

**Evaluation Rubric/s:**

| Score | Impression | Description |
| --- | --- | --- |
| 16-20 | Proficient | Excellent understanding and comprehensive knowledge on fundamental image processing and computer vision concepts. |
| 11-15 | Good | Good understanding of image processing and computer vision concepts. Provides correct answers to most of the MCQs, with a few minor errors or omissions. |
| 8-10 | Satisfactory | Fair understanding of image processing and computer vision concepts. Provides partially correct answers to some of the MCQs but lacks clarity or makes significant errors in understanding. |
| 1-7 | Need to  Improve | Limited understanding of image processing and computer vision concepts. Provides incorrect or incomplete answers to the MCQs, demonstrating a lack of knowledge in the topics covered. |

**Mapping the Learning Outcomes of the assignment with components of the evaluation rubrics:**

| Learning Outcome of the assignment | Method of assessment | Components of the evaluation rubrics |
| --- | --- | --- |
| LO1: Understand the fundamentals of image processing & computer Vision concepts. | MCQ Test | Components of the evaluation rubrics include understanding, knowledge, accuracy, detail, clarity, level of performance, and overall knowledge and skill. |
| LO2: Analyse the elements of image processing and different formats and types of images. |

**Assessment Description: CIA Componet-2(lab test)**

| **Nature of Assignment** | Lab Test |
| --- | --- |
| **Date of Exam** | Week 5 |
| **Duration** | 2 Hours |
| **Total Marks** | 30 Marks |
| **Assignment Description** | * The lab test will consist of two questions that assess students' understanding of geometric transformation techniques, various image enhancement techniques, frame extraction techniques and filtering techniques. Corresponding code for each concept should be submitted on Google classroom. It is expected that students provide comprehensive descriptions in their code, specifying the purpose and usage of each function or package. |
|  | **Evaluation Rubrics**  1. Implementation Accuracy  a. task 1(concept clarity) – 10 Marks  b.task 2 (solve a scenario)=20 Marks  2. Usage of Built-in & User defined function- 5 Marks  3. Demonstrating the flow of the algorithm (Preprocessing, Feature detection, extraction, matching, segmentation, classification e.t.c)- 10 Marks  4. Visualization & Interpretation of results – 5 Marks  5. Concept Clarity – 10 Marks |

Learning outcomes:

**LO1:** Demonstrate different Spatial transformation, sampling and Quantization techniques.

**LO 2:** Apply various image enhancement and filtering techniques with user defined and built in functions

| Category | Implementation Accuracy (10 M) | Usage of Built-in & User defined function- (6 Marks) | Demonstrating the flow of the algorithm (7 Marks) | Visualization & Interpretation of results (4 Marks) | Concept Clarity (3 Marks) |
| --- | --- | --- | --- | --- | --- |
| Excellent | 9-10 Marks | 6 Marks | 7 Marks | 4 | 3 |
| Good | 7-8 Marks | 5 Marks | 5-6 Marks | 3 | 2 |
| Satisfactory | 4-6 Marks | 3-4 Marks | 3-4 Marks | 2 | 1 |
| Need to Improve | 0-3 Marks | 0-2Marks | 0-2 Marks | 0-1 | <1 |

Mapping the Learning Outcomes of the assignment with components of the evaluation rubrics:

| Learning Outcome of the assignment | Method of assessment | Components of the evaluation rubrics |
| --- | --- | --- |
| **LO1:** Demonstrate different Spatial transformation, sampling and Quantization techniques. | Implementation of image processing concepts | Correctness, implementation, visualization and concept clarity. |
| **LO 2:** Apply various image enhancement and filtering techniques with user defined and built in functions | Purpose and Function Documentation | Correctness, implementation, visualization and concept clarity. |

**Assessment Description: CIA Componet-3**

| **Nature of Assignment** | Regular Lab |
| --- | --- |
| **Total Marks** | 40 Marks |
| **Assignment Description** | For each lab program, marks will be assigned as per the following rubric (maximum marks of 10 for each program) and total mark will be converted into 40 marks   | **Content** | **Score** | | --- | --- | | Implementation (Built in & User defined function) | 3 Marks | | Flow of algorithm & Accuracy | 3 Marks | | Visualization & Interpretation | 2 Marks | | Concept Clarity | 2 Marks | | Total | 10 Marks | |

**Assessment Description: ESE Componet-1**

| **Nature of Assignment** | Lab Test |
| --- | --- |
| **Date of Exam** | Week 8 |
| **Duration** | 2 Hours |
| **Total Marks** | 30 Marks |
| **Assignment Description** | * The lab test will consist of two questions that assess students' understanding of various linear, non-linear spatial and frequency filtering techniques and also different image segmentation techniques. Corresponding code for each concept should be submitted on Google class room. It is expected that students provide comprehensive descriptions in their code, specifying the purpose and usage of each function or package. |
|  | **Evaluation Rubrics**  1. Implementation Accuracy  a. Program 1 – 5 Marks  b. Program 2 – 5 Marks  2. Usage of Built-in & User defined function- 6 Marks  3. Demonstrating the flow of the algorithm (Preprocessing, Feature detection, extraction, matching, segmentation, classification e.t.c)- 7 Marks  4. Visualization & Interpretation of results – 4 Marks  5. Concept Clarity (VIVA)– 3 Marks |

Learning outcomes:

**LO1:** Illustrate various linear and non-linear spatial and frequency filtering techniques

**LO2:** Demonstrate various image segmentation & triangulation techniques.

Evaluation Rubric/s:

| Category | Implementation Accuracy (10 M) | Usage of Built-in & User defined function- (6 Marks) | Demonstrating the flow of the algorithm (7 Marks) | Visualization & Interpretation of results (4 Marks) | Concept Clarity (3 Marks) |
| --- | --- | --- | --- | --- | --- |
| Excellent | 9-10 Marks | 6 Marks | 7 Marks | 4 | 3 |
| Good | 7-8 Marks | 5 Marks | 5-6 Marks | 3 | 2 |
| Satisfactory | 4-6 Marks | 3-4 Marks | 3-4 Marks | 2 | 1.5 |
| Need to Improve | 0-3 Marks | 0-2 Marks | 0-2 Marks | 0-1 | 0 to 1 |

Mapping the Learning Outcomes of the assignment with components of the evaluation rubrics:

| Learning Outcome of the assignment | Method of assessment | Components of the evaluation rubrics |
| --- | --- | --- |
| **LO1:** Illustrate various linear and non-linear spatial and frequency filtering techniques. | Implementation of spatial and frequency filtering. | Correctness, implementation, visualization and concept clarity. |
| **LO2:** Demonstrate various image segmentation & triangulation techniques. | Purpose and Function Documentation | Correctness, implementation, visualization and concept clarity. |

**Assessment Description: ESE Componet-2**

| **Nature of Assignment** | Theory Test |
| --- | --- |
| **Date of Exam** | Week 9 |
| **Duration** | 2 Hours |
| **Total Marks** | 50 Marks (Converted to 30 Marks) |
| **Assignment Description** | Portion: Unit-I, Unit-II, Unit-III and Unit-IV  No of questions: 5 with internal choices  Each question is for 10 Marks  Total Marks: 50 marks and reduced to 30 Marks  Time Duration: 120 Minutes  Mode of Test: Offline |

Learning outcomes:

**LO1:** Understand the fundamental concepts of image processing and computer vision.

**LO2:** Analyse and implement different image enhancement, restoration and segmentation techniques.

Evaluation Rubric/s:

| Score | Impression |
| --- | --- |
| 26-30 | Proficient |
| 19-25 | Good |
| 12-18 | Satisfactory |
| Below 12 | Need to  Improve |

**Assessment Description: ESE Componet-3**

| **Nature of Assignment** | Lab test for Designing and implementing a simple Computer Vision Model |
| --- | --- |
| **Date of Exam** | Week 12 |
| **Duration** | 3hrs |
| **Total Marks** | 40 Marks |
| **Assignment Description** | * A real-world problems will be given and design a simple computer vision model to solve the problem. * This component will assess students understanding about higher level computer vision techniques like recognition, classification, interpretation, analysis and understanding. Corresponding code for each concept should be submitted on Google class room. It is expected that students provide comprehensive descriptions in their code, specifying the purpose and usage of each function or package. |
|  | **Evaluation Rubrics**   * 1. Implementation Accuracy * a. task 1(concept clarity) – 15 Mark * 2. Usage of Built-in & User defined function- 5 Marks * 3. Demonstrating the flow of the algorithm (Preprocessing, Feature detection, extraction, matching, segmentation, classification e.t.c)- 15 Marks * 4. Visualization & Interpretation of results – 5 Marks |

Learning outcomes:

**LO1:** Demonstrate object recognition, classification, interpretation, analysis and understanding techniques.

**LO2:** Apply the higher lever computer vision techniques to real world problems.

Evaluation Rubric/s:

| Category | Excellent | Good | Satisfactory | Need to Improve |
| --- | --- | --- | --- | --- |
| Problem statement and Pre-processing techniques (3M) | 3 Marks | 2 Marks | 1.5 Mark | <1.5 Mark |
| Incorporating appropriate restoration techniques (3 M) | 3 Marks | 2 Marks | 1.5 to 1.9 Mark | <1.5 Mark |
| Feature detection, extraction and matching techniques implementation (7 M) | 6-7 Marks | 5 Marks | 3-4 Marks | 0 to 2 Marks |
| Selecting and implementing appropriate segmentation techniques (7 M) | 6-7 Marks | 5 Marks | 3-4 Marks | 0 to 2 Marks |
| Deployment & Accuracy (10 M) | 9-10 Marks | 7-8 Marks | 4-6 Marks | 0-3 Marks |
| Individual Contribution (3 M) | 3 Marks | 2 Marks | 1.5 to 1.9 Mark | <1.5 Marks |
| Documentation & Reporting (5 M) | 5 Marks | 4 Marks | 2-3 Marks | < 2 Marks |
| Timely submission (2 M) | On-time submission (2 marks)  Late submission (0 mark) | | | |

Mapping the Learning Outcomes of the assignment with components of the evaluation rubrics:

| Learning Outcome of the assignment | Method of assessment | Components of the evaluation rubrics |
| --- | --- | --- |
| **LO1:** Demonstrate object recognition, classification, interpretation, analysis and understanding techniques. | Implementation of object recognition, classification, interpretation. | Correctness, implementation, visualization and concept clarity. |
| **LO2:** Apply the higher lever computer vision techniques to real world problems. | Purpose and Function Documentation | Correctness, implementation, visualization and concept clarity. |

Reference of scheme of evaluation :

