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| **Programme:**  **M. Tech. (CSE)** | **Course Title:**  **Digital Image Analysis** | | | **Course Code:**  **CSE--** |
| **Type of Course:**  **Program Elective** | **Prerequisites:**  **NIL** | | | **Total Contact Hours:**  **40** |
| **Year/Semester:**  **I/Even** | **Lecture Hrs/Week:**  **3** | **Tutorial Hrs/Week:**  **0** | **Practical Hrs/Week:**  **0** | **Credits:**  **3** |

**Learning Objectives:**

The course aims to introduce digital image analysis by presenting techniques such as filtering, multiresolution and texture analysis, and object recognition. The focus of the course is for students to have a broad understanding of theory, algorithms and techniques behind image analysis methods which can be used in numerous applications viz. medicine, computer vision, surveillance, biometrics, etc. Introduction to explainable AI and interpretability will also be covered. Hands-on assignments will teach a broad functionality of OpenCV, Tensorflow, and Keras as an integral part of the course.

**Course outcomes (COs):**

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| **On completion of this course, the students will have the ability to:** | | **Bloom’s Level** |
| **CO-1** | * **Explain** basic concepts in digital images and analysis, such as discretization, image enhancement, segmentation and recognition | 2 |
| **CO-2** | **Implement** feature extraction and object recognition | 3 |
| **CO-3** | **Analyze** and **design** solution to solve a real-world image analysis problem | 4,5 |
| **CO-4** | **Understand** explainable AI in perspective of digital image analysis | 2 |

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| **Course Topics** | **Lecture Hours** | |
| **UNIT – I Introduction to digital images** |  | **8** |
| * 1. Basics of image processing | 1 |
| * 1. Image enhancement | 2 |
| * 1. Image morphology | 2 |
| * 1. Image segmentation | 2 |
| * 1. Colour models | 1 |  |
|  | | |
| **UNIT – II Image Transformations** |  | **6** |
| 1. Intensity transformations and spatial filtering | 3 |
| 1. Frequency domain transformations | 3 |
|  | | |
| **UNIT – III Multiresolution, Wavelet, Texture, Appearance, Edge Features** |  | **12** |
| * 1. Image Pyramids, Binary Gabor Pattern | 3 |
| * 1. Haar Transform, Discrete Wavelet Transform | 3 |
| * 1. Histograms, Gray Level Co-occurrence Matrix (GLCM), Local Binary Pattern (LBP) | 3 |
| * 1. SIFT, HoG | 3 |
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| **UNIT – IV Object Recognition** |  | **12** |
| * 1. Patterns and Pattern Classes | 2 |
| * 1. Recognition based on Decision Theoretic Methods | 4 |
| * 1. Structural methods | 2 |
| * 1. Applications – Medical image analysis, surveillance, biometrics | 4 |
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| **UNIT – V Explainable AI** |  | **2** |
| * 1. Explainable AI, Interpretability, Understanding model predications | 2 |

**Textbook references (IEEE format):**

**Text Books:**

1. R. Szeliski, *Computer Vision: Algorithms and Applications, second edition,* Springer, 2021

**Reference books:**

1. Rafael C. Gonzalez, and Richard E. Woods, *Digital Image Processing,* 4rdedition, Pearson/Prentice Hall, 2018.

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| **Evaluation Method** | |
| **Item** | **Weightage (%)** |
| Quizzes/Assignments | 25 |
| Seminar | 10 |
| Mid-Term | 25 |
| End-Term | 40 |

\*Please note, as per the existing institute’s attendance policy the student should have a minimum of 75% attendance. Students who fail to attend a minimum of 75% lectures will be debarred from the End Term/Final/Comprehensive examination.

**CO and PO Correlation Matrix**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **CO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PSO1** | **PSO2** | **PSO3** |
| **CO1** | 3 |  |  | 3 |  |  |  |  |  |  | 3 |  |  |
| **CO2** |  | 3 |  |  |  |  |  |  |  |  | 3 | 3 |  |
| **CO3** |  | 3 | 3 | 2 |  |  |  |  |  |  |  | 3 |  |
| **CO4** |  |  |  |  |  |  | 3 |  |  | 3 |  | 1 |  |

**Last Updated On: November 18, 2022**

**Updated By: Dr. Preety Singh**

**Approved By:**