**MDS573C: IMAGE AND VIDEO ANALYTICS**

**Total Teaching Hours for Trimester: 60**

**No of hours per week: 6(3+3)**

**Max Marks: 100 Credits: 3**

**Course Type: Elective**

**Course Description**

This course will provide a basic foundation towards digital image processing and video analysis. This course will also provide a brief introduction about various Object Detection, Recognition, Segmentation and Compression methods which will help the students to demonstrate real-time image and video analytics applications.

**Course Outcomes:** Upon completion of the course students will be able to

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| **No.** | **Course Outcomes** |
| **CO1** | Understand the fundamental principles of image and video analysis |
| **CO2** | Develop proficiency in image enhancement and segmentation |
| **CO3** | Develop skills in object detection and recognition |
| **CO4** | Apply the image and video analysis approaches to solve real world problems |

**Unit 1 Teaching Hours: 12**

**Introduction to Digital Image and Video Processing**

Digital image representation, Sampling and Quantization, Types of Images, Basic Relations between Pixels - Neighbors, Connectivity, Distance Measures between pixels, Introduction to Digital Video, Sampled Video, Video Transmission. Gray-Level Processing: Image Histogram, Linear and Non-linear point operations on Images, Image Thresholding, Region labelling, Binary Image Morphology.

**Lab Exercise**

1. Adjust the threshold of the image and analyze the area of a specific component in the image.

2. Program to implement contrast stretching.

**Unit 2 Teaching Hours: 12**

**Image and Video Enhancement and Restoration**

Spatial domain-Linear and Non-linear Filtering, Introduction to Fourier Transform and the frequency Domain– Filtering in Frequency domain, A model of The Image Degradation /Restoration, Noise Models and basic methods for image restoration.

**Lab Exercise**

1. Program to analyze and image to find total number, total area, average size of elements

2. Program to implement Non-linear Spatial Filtering using Built-in and user defined functions.

**Unit 3 Teaching Hours: 12**

**Image and Video Compression**

Fundamentals of Image Compression: Huffman Coding, Run length Coding, LZW Coding, Bit plane coding. Video Compression: Basic Concepts and Techniques of Video compression, MPEG-1 and MPEG-2 Video Standards.

**Lab Exercise**

1. Program to compare performance of various image compression methods.

2. Program to Extract frames from videos and analyze each frame.

**Unit 4 Teaching Hours: 12**

**Feature Detection and Description**

Introduction to feature detectors, Point, line and edge detection, Image Segmentation - Region Based Segmentation – Region Growing and Region Splitting and Merging, Thresholding – Basic global thresholding, optimum global thresholding using Otsu’s Method.

**Lab Exercise**

1. Find out the number of labeled components in an image. Also find the area and integrated density of the component.

2. Analyze the morphology of specific components in the given image.

**Unit 5 Teaching Hours: 12**

**Object Detection and Recognition**

Descriptors: Boundary descriptors - Fourier descriptors - Regional descriptors

Object detection and recognition in image and video: Minimum distance classifier, Applications in image and video analysis, object tracking in videos.

**Lab Exercise**

1. Extracting feature descriptors from the image dataset.

2. Implement object tracking in videos.

**Essential Reading**

1. Rafael C. Gonzalez and Richard E. Woods, Digital Image Processing, 4th Edition, Pearson Education, 2018.

2. Alan Bovik, Handbook of Image and Video Processing, Second Edition, Academic Press, 2005.

**Recommended Reading**

1. Anil K Jain, Fundamentals of Digital Image Processing, PHI, 2011.

2. Richard Szeliski, Computer Vision Algorithms and Applications, Springer,2011.

3. Oge Marques, Practical Image and Video Processing Using MatLab, Wiley, 2011.

4. John W. Woods, Multidimensional Signal, Image, Video Processing and Coding, Academic Press, 2006.