Module 1: Getting Started with OpenCV

1. Introduction to computer vision
   - Image Processing VS Computer Vision
   - Problems in Computer Vision

2. Introduction to images
   - How images are formed
   - Digital Image
   - Image as a Matrix
   - Manipulating Pixels
   - Displaying and Saving an Image
   - Display Utility Functions
   - Color Image
   - Image Channels
   - Splitting and Merging Channels
   - Manipulating Color pixels
   - Images with Alpha Channel

3. Basic image operations
   - How to create new images
   - Cropping an image Section
   - Coping a Region to another in an image
   - Resizing an image
   - Creating an image mask

4. Mathematical operations on images
Datatype Conversion
Contrast Enhancement
Brightness Enhancement

5. Sunglass filter: A simple application
   - Load Images
   - Use Naïve replacement
   - Use Arithmetic Operations

6. Bitwise operations
   - Different Bitwise Operations

7. Image Annotation
   - Draw a line over an image
   - Draw a Circle over an image
   - Draw a Rectangle over an image
   - Draw an Ellipse over an image
   - Draw text over an image

Assignment 1: Build QR code Detector

Module 2: Video IO and GUI

1. Video IO using HighGUI
   - Video I/O Jargon
   - Read and Display video
   - Properties of Video Capture
   - How to write a video

2. Callback functions
   - What are Callback functions
3. Keyboard as input device
   - How to take input from Keyboard

Assignment2: Image Annotation using mouse

Assignment3: Add Trackbar as controller

Module 3: Binary Image Processing

1. Thresholding
   - What is Thresholding
   - Thresholding in OpenCV

2. Erosion / Dilation
   - Overview on Erosion and Dilation
   - Erosion and Dilation in OpenCV

3. Opening and Closing
   - Overview on Opening and Closing
   - Opening and Closing on OpenCV

4. Connected Component Analysis
   - What is Connected Component Analysis
   - Connected Component Analysis in OpenCV

5. Contour Analysis
   - What are contours
   - Contour Analysis in OpenCV

6. Blob Detection
   - Blob Detection in OpenCV
Assignment 4: Implement different Morphological Operations

Assignment 5: Coin Detection

Module 4: Image Enhancement and Filtering

1. Color Spaces
   - RGB Color Space
   - HSV Color Space
   - Other Color Spaces
   - Application: Finding Dominant Color in an image
   - Application: Desaturation Filter

2. Color Transforms
   - Histogram Equalization
   - Advanced Histogram Equalization (CLAHE)
   - Color Adjustment using Curves

3. Image Filtering
   - Introduction to Image Filtering
   - What is Convolution
   - Convolution in OpenCV

4. Image Smoothing
   - Box Blur
   - Gaussian Blur
   - Median Blur
   - Median Blur in OpenCV
   - Bilateral Filtering
   - Bilateral Blur in OpenCV
   - Comparison: Median VS Bilateral

5. Image Gradients
Module 5: Advanced Image Processing and Computational Photography

1. Hough Transforms
   - What is Hough Transform
   - HoughLine: How to detect a line in an image
   - HoughCircle: How to detect a circle in an image

2. High Dynamic Range Imaging
   - What is High Dynamic Range Imaging
   - HDR in OpenCV

3. Seamless Cloning
   - What is Seamless Cloning
   - Seamless Cloning in OpenCV
   - Application: Face Blending

4. Image Inpainting
   - What is Image Inpainting

Assignment 6: Convert your images into different color spaces

Assignment 7: Implement Autofocus
Project 1: 1.1 Create your own Instagram Filter

1.2 Blemish Removal from face

1.3 Chroma Keying

Module 6: Geometric Transforms and Image Features

1. Geometric Transforms
   - Affine Transform
   - Homography
   - Geometric Transforms in OpenCV

2. Image Features
   - Image Feature: ORB
   - ORB Feature in OpenCV

3. Feature Matching
   - Different Feature Matching Algorithms in OpenCV
   - RANSAC

4. Application: Image Alignment
5. Application: Creating Panorama
6. Application: Finding Known Objects using OpenCV

Assignment 8: Create Panorama for multiple images

Assignment 9: Feature Matching based Image Alignment

Project 3: Document Scanner
Module 7: Image Segmentation and Recognition

1. Image segmentation using GrabCut
   - Grabcut Theory
   - Grabcut in OpenCV

2. Introduction to AI
   - Basic overview of AI

3. Image Classification
   - Histogram of Oriented Gradients (HOG)
   - Support Vector Machine (SVM)
   - Eyeglass Classifier in OpenCV

4. Object Detection
   - Pedestrian Detection in OpenCV
   - Face Detection using HAAR Cascade
   - Face Detection in OpenCV

Project 2: Create your own Selfie App with the following feature

1. Skin smoothing Filter
2. Sunglass Filter

Module 8: Video Analysis

1. Motion Estimation using Optical Flow
   - What is Optical Flow
   - Lucas-Kanade Optical Flow

2. Application: Video Stabilization
3. Object Tracking
• Different Object Tracking Algorithms

4. Object Trackers in OpenCV
   • Object Tracking in OpenCV
   • Comparison of different trackers

5. Multiple Object Tracking using OpenCV
   • How to track Multiple Objects in OpenCV

6. Kalman Filter
   • Kalman Filter Tracker

7. MeanShift and CamShift
   • Tracking using MeanShift and CamShift

Project 4: Detection and Tracking of an object

Module 9: Deep Learning with OpenCV

1. Image Classification
   • Image Classification using Caffe and Tensorflow

2. Object Detection
   • Single Shot Multibox Detector (SSD)
   • You Only Look Once Detector (YOLO)

3. Face Detection
   • SSD based Face Detector
4. Human Pose Estimation

- OpenPose