AI Courses by OpenCV
COMPUTER VISION I

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

Assignment1: 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

Assignment4: Implement different Morphological Operations

Assignment5: 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

- Introduction to Image Gradients
- First Order Derivative Filters
- Why smoothing is important before Gradient
- Second Order Derivative Filters
- Application: Sharpening Filter
- Canny Edge Detection
- Canny Edge Detection in OpenCV

Assignment6: Convert your images into different color spaces

Assignment7: Implement Autofocus

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 us 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

Project1: 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

Assignment8: Create Panorama for multiple images

Assignment9: Feature Matching based Image Alignment

Project3: 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

   Project2: 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

Project4: 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