Module 1: Facial Landmark Detection

1. Different Face Processing Applications
2. Facial Landmarks Detection using dlib
   - Introduction to Dlib
   - Facial Landmark Detection using Dlib
3. Application - Face Alignment
4. Improving Facial Landmark Detector
   - Improve in Speed
   - Improve in Stability
   - Landmark Stabilization in OpenCV
   - Optical flow
   - Lucas-Kanade Optical flow
5. Facial Landmark Detection Theory
   - Machine Learning Basics
   - Paper Review
6. Train a custom Facial Landmark Detector
   - How to Train a Custom landmark Detector

Module 2: Applications of Facial Landmarks

1. Alpha Blending
• Alpha Blending in OpenCV

2. Image Warping
   • Affine Transform
   • Geometric Transform
   • Triangle Warping

3. Delaunay Triangulation
   • Theory of Delaunay Triangulation

4. Face Averaging
   • Face Averaging using OpenCV

5. Face Morphing
   • Face Morphing using OpenCV

6. Application: Bug Eyes
   • Create a Bug eye app

7. Head Pose Estimation
   • Head Pose Estimation in OpenCV

Assignment1: Smile Detection

Module 3: Snapchat Filters

1. Face Swap
   • How Face Swapping can be achieved
   • Seamless Cloning
   • Seamless Cloning in OpenCV
   • Face Swapping in a video
2. Application: Beard Filter
3. Application: Aging filter
4. Non-linear Deformations
   - Moving Least Square
   - Application: MLS based Happify and Fatify Filters

**Project1**: Virtual Makeup

**Module 4**: Face Recognition

1. Introduction to Face Recognition
   - Introduction to Face Recognition
2. Eigen Faces
3. Fisher Faces
4. Local Binary Patterns Histograms
5. Face Recognition API in OpenCV
6. Deep Learning based Face Recognition

**Project2**: DoppelGanger- Find Celebrity Look-Alike

**Module 5**: Introduction to Deep Learning

1. Basics of Neural Networks
   - What is Neural Network
   - How does Neural Network Learn
2. Introduction to TensorFlow Keras(python) and LibTorch(C++)
   - Deep Learning Frameworks
   - The Keras Framework(Python)
   - Linear Regression using Keras(Python)
   - Introduction to LibTorch(C++)
3. LibTorch Installation and Usage (C++)
   - How to run LibTorch code on your Local System
   - How to run LibTorch code on Google Colab
   - Linear Regression using LibTorch

4. Feed Forward Neural Network
   - Importance of Hidden Layer in a Neural Network
   - Training a Neural Network using Backpropagation
   - Example: Image Classification using MLP

5. Convolutional Neural Network (CNN)
   - What is CNN
   - Example: Image Classification using CNN
   - Data Augmentation (Python)

**Assignment 2:** Improve CNN Training

**Module 6: Leveraging Pre-Trained Model**

1. Introduction to Pre-trained model (Python)
   - Pre-Trained models in Keras

2. How to get Free GPU
   - Introduction to Google Colab
   - Introduction to Kaggle Kernels

3. Transfer Learning and Fine Tuning in Keras (Python)
   - How to use Custom Dataset in Keras
   - Introduction to Kaggle Datasets
   - Fine-Tuning an Image Classifier using Google Colab
   - Fine-Tuning an Image Classifier using Kaggle Kernel
4. Troubleshooting using Tensorboard (Python)
   - Using Tensorboard with Keras

5. From PyTorch to LibTorch (C++)
6. Fine Tuning using LibTorch (C++)
7. Fine Tuning using Caffe
   - Introduction to Caffe
   - Fine-Tuning in Caffe using Colab (C++)
   - Inference of Trained Caffe model using OpenCV (C++)
   - Train an Image Classifier using Fine-Tuning in Caffe (Python)

Module 7: Object Detection

1. Object Detection Overview
   - What is Object Detection
   - Traditional Object Detection Pipeline

2. Two Stage Object Detectors
   - Different two-stage Detectors
   - Faster R-CNN in OpenCV (C++)

3. Single Stage Object Detectors
   - SSD Object Detector in OpenCV

4. YOLO
   - What is YOLO
   - YOLO object Detection in OpenCV

5. Measure Performance of Object Detectors
• Evaluation Metrics for Object Detection

Module 8: Train a Custom Object Detector using YOLO

1. Problem Description
   • Which Object to Detect
   • Where to get the data for Training

2. YOLO and DarkNet
   • What is DarkNet
   • Build DarkNet
   • Run YOLO on DarkNet

3. Stepwise explanation of how train your detector on Colab
   • How to link your Google Drive
   • Compile DarkNet
   • Download and Prepare Dataset
   • How to start Training
   • Run Inference on New Images

Project 3: Train a Face Mask detector

Module 9: Text Detection and Recognition

1. Overview of OCR
   • What is OCR
   • The OCR Pipeline
   • Challenges
   • Datasets and Competitions

2. Graphic Text Recognition using Tesseract
• What is Tesseract
• Introduction to OCR using Tesseract
• Tesseract OCR Failure Cases
• Improving Tesseract OCR failures

3. Text Detection

• Text Detection using EAST
• Text Detection using CRAFT(Python)

4. Modified Pipeline for scene Text Recognition using Tesseract(Python)
5. Scene Text recognition using Keras OCR(Python)

• Text Recognition using CRNN

6. Comparing Keras-OCR and Tesseract(Python)

Assignment 3: OCR on invoice

Case Study: Automatic Number Plate Recognition (Python)

1. ALPR system using YOLO-Net

• YOLO-Net: License Plate Detector using YOLOv3
• ALPR using YOLO-Net and Tesseract
• ALPR using YOL-Net and YOLO-OCR

2. ALPR system using WPOD-Net

• ALPR using WPOD-Net and Tesseract
• ALPR using WPOD-Net and YOLO-OCR
Module 10: Deploy Applications on Cloud

1. Create a Web Application using Flask
   - What is Flask
   - A minimal Flask Application
   - Using HTML Templates
   - A complete Flask Application

2. Deploy Web App on Heroku [Paas]
   - What is Heroku
   - How to create an account on Heroku
   - Prepare Application for Deployment
   - How to Deploy using Heroku CLI
   - How to Deploy using Heroku website

3. Deploy Web App on Google GCP [Iaas]
   - What is Google Cloud Platform (GCP)
   - Create account on Google Cloud Platform
   - Create and Configure a VM instance
   - Setup VM and Deploy App
   - Change Firewall settings and Check Deployment

Assignment 4: Deploy your Web App on Heroku