Getting Started

1. Introduction to Artificial Intelligence
   - History of AI
   - Applications of AI
   - AI in Computer Vision
   - AI Terminology
   - Introduction to Deep Learning
   - Deep Learning Frameworks

2. Numpy Refresher
3. Introduction TensorFlow and Keras
4. What is inside an ML Algorithm
   - Machine Learning pipeline
   - Solving ML Problems
   - Gradient Descent for Optimization
   - Deep Learning Overview

5. Regression: A Classic Supervised Learning Problem

**Assignment1:** Implement Leaky ReLU, Softmax and Convolution using TensorFlow

**Assignment2:** TensorFlow Assignment

**Assignment3:** Implement Gradient Descent for two variables
Module 2: Neural Networks

1. Understanding Neural Networks
   - Feature Vectors and Normalization
   - What is Neural Network
   - Demystifying Neural Networks

2. Building Neural Network in Keras
   - Data Processing
   - Linear Regression with Keras
   - Binary Classification with Keras

3. Building Blocks of a Neural Network
   - Loss Function for Regression
   - Loss Function for Classification
   - Types of Activation Functions
   - How does Neural Network learn

4. Multi-class Classification using Keras
   - Classifying MNIST digits with a Multi Layer Perceptron (MLP)

5. Model Complexity, Generalization and Handling Overfitting
   - Bias Variance Trade-off
   - How to Prevent Overfitting

6. Image Classification using Multilayer Perceptron
7. Understand and Implement the building blocks like the different Activation Functions, Loss Functions, Hidden Layers.

**Assignment 4:** MLP Assignment
Convolutional Neural Network

1. Image Classification
   - Image classification using CNN

2. CNN
   - CNN Building Blocks
   - The Convolution Operation
   - Layers in CNN
   - Implementing LeNet in Keras

3. Building custom models from scratch using your own data.
   - Keras Image _Dataset_from_Directory
   - Overfitting and Data Augmentation

4. Working with pretrained Networks
   - Important CNN Architectures
   - Pretrained Models for Keras Applications
   - Training VGGNet from Scratch on Balls Dataset

5. Transfer Learning and Fine-Tuning
   - Transfer Learning with VGGNet as Feature Extractor on Balls Data
   - Transfer Learning with VGGNet as Feature Extractor on ASL Data
   - Fine Tuning VGGNet using ASL Data

**Assignment5:** Sequential vs Functional API

**Assignment 6:** Image Classification using CNN

**Project1:** Implement an Image Classifier from scratch
Semantic Segmentation

1. Introduction to Semantic Segmentation
   - Introduction to Semantic Segmentation
   - Overview of Semantic Segmentation

2. Custom Data Loader
   - Semantic Segmentation Datasets
   - Introduction to Segmentation Datasets and Custom Data Loader

3. Transposed Convolution
4. Fully Convoluted Networks
   - FCN Architecture

5. Evaluation Metrics for Semantic Segmentation

6. UNet
   - UNet Architecture
   - UNet on Road Data: Metrics and CE Loss
   - UNet on Aerial Data: Metrics and CE Loss

7. Custom Losses for Semantic Segmentation
   - UNet on Aerial Data: Metrics and Losses

8. Dilated Convolution

9. DeepLabV3
   - DeepLabv3 Architecture
   - DeepLabv3+ on Road Data: Metrics and CE Loss
   - DeepLabv3+ on CamVid Data

Project2: Kaggle Competition on Image Classification for American Sign Language Classification
Object Detection

1. Introduction to Object Detection
   - History of Object Detection
   - Object Detection Datasets

2. Hands on with Object Detector
   - Inference using Object Detection Models from TensorflowHub

3. Classification to Detection
   - Image Classification vs Object Detection
   - Revisiting Classification Pipeline
   - Encoding Bounding Boxes using Anchors
   - IoU
   - Encoding of Ground Truth
   - Multiple Anchors

4. Non-Maximum Suppression (NMS)
   - Introduction to NMS
   - NMS vs Soft NMS

5. Evaluation Metrics
   - Why we need Evaluation Metrics
   - Building Blocks of mAP
   - Precision vs Recall

6. Popular Object Detection Architectures
   - Traditional Object Detector
   - Two Stage Object Detector
   - YOLO: You Only Look Once
   - SSD: Single Shot MultiBox Detector
   - RetinaNet
Assignment 6: Encoding and Decoding of Ground Truths for Anchor box implementation

Module 7: Pose Estimation

1. Real time Pose Estimation using mediapipe
2. Create your own Gym Trainer

Project 2: Sports Classification using Transfer Learning and Fine Tuning.
Project 3: Flood Aerial Imagery Segmentation
Project 4: Safety Kit Detection using Object Detection