

Program

The goal of this program is to make you knowledgeable in computer vision using deep learning. The premise of this program is that you become an expert by the hard way: *reading research papers and implementing algorithms from scratch*.

To be honest, this program does not cover all of computer vision, only the part that is being solved by deep learning algorithms, which is actually a great deal these days; specifically we will study: *convolutional neural networks for object recognition, object detection and semantic segmentation*.

1. Basics

a. Video lectures:

- i. Lectures 1 to 7 from Stanford's [Lecture Collection | Convolutional Neural Networks for Visual Recognition \(Spring 2017\)](#) (less than 8 hours)
- ii. [Neural Networks and Deep Learning from DeepLearning AI](#) (less than 7 hours)
- iii. [Improving Deep Neural Networks from DeepLearning AI](#) (less than 5 hours)
- iv. Lectures 1 to 11 from DeepLearning AI [Convolutional Neural networks and Deep Learning](#) (less than 2 hours)
- v. [Neural Networks Foundations from DeepMind](#) (less than 2 hours)

b. Paper readings:

- i. [Dropout: A Simple Way to Prevent Neural Networks from Overfitting](#)
- ii. [Batch Normalization: Accelerating Deep Networks Training by Reducing Internal Covariate Shift](#)
- iii. [Layer Normalization](#)
- iv. [A guide to convolution arithmetic for deep learning](#)

c. Assignments:

- i. Complete [cs231n second assignment](#)

2. CNN's architectures for image classification

a. Video lectures:

- i. [CNN architectures \(Stanford's cs231n\)](#) (less than 2 hours)
- ii. Lectures 12 to 22 from DeepLearning AI [Convolutional Neural networks and Deep Learning](#) (less than 2 hours)

b. Paper readings:

- i. [Gradient-Based Learning Applied to Document Recognition](#)
- ii. [ImageNet Classification with Deep Convolutional Neural Networks](#)
- iii. [Very Deep Convolutional Neural Networks for Large Scale Image Recognition](#)
- iv. [Going Deeper with Convolutions](#)
- v. [Deep Residual Networks for Image Recognition](#)

c. Additional Material:

- i. [Structuring Machine Learning Projects from Deep Learning AI](#)
 - ii. [Deep Learning Software \(Stanford's cs231n\)](#)
 - iii. [Introduction to TensorFlow from DeepMind](#)
 - iv. [TensorFlow Estimator API Demo](#)
 - v. [TFRecords & Dataset API](#)
 - vi. [Estimator API](#)
 - vii. [TensorFlow's guide to estimators](#)
 - d. Assignments:
 - i. Implement the Inception Network as close to the paper as possible to tackle the [PASCAL VOC 2012 classification challenge](#)
 - ii. Implement ResNet as close to the paper as possible for the [PASCAL VOC 2012 classification challenge](#)
 - iii. Based on what you have study so far, make up your own deep architecture to tackle the [PASCAL VOC 2012 classification challenge](#)
- 3. Object detection
 - a. Video lectures:
 - i. [Detection and segmentation \(cs231n\)](#) (less than 2 hours)
 - ii. Lectures 22 to 31 from DeepLearning AI [Convolutional Neural networks and Deep Learning](#) (less than 2 hours)
 - b. Paper readings:
 - i. [Rich Feature Hierarchies for Accurate Object Detection and Semantic Segmentation](#)
 - ii. [Fast R-CNN](#)
 - iii. [Faster R-CNN: Towards Real-Time Object Detection with Region Proposal Networks](#)
 - iv. [You Only Look Once: Unified, Real-Time Object Detection](#)
 - v. [YOLO9000: Better, Faster, Stronger](#)
 - vi. [SSD: Single Shot MultiBox Detector](#)
 - c. Assignments:
 - i. Implement your own versions of Faster R-CNN, YOLO and SSD as close as possible to the paper for the [PASCAL VOC 2012 detection challenge](#)
- 4. Semantic Segmentation
 - a. ...
- 5. Face recognition and verification
 - a.
- 6. Neural Style Transfer
 - a. ...

Notes:

- All assignments should be implemented on your own, DO NOT look to some else's code. Discussions with friends should be the only way to get help.
- Apart from the first assignment (basics) all assignments should be implemented using TensorFlow's Estimator and Dataset APIs.
- There are other things that anyone willing to develop computer vision systems must be aware of:

- <https://www.amazon.com/Introduction-Mathematical-Statistics-Its-Applications/dp/0321693949>
- <https://www.programiz.com/dsa>
- <https://www.amazon.com/Fluent-Python-Concise-Effective-Programming/dp/1491946008>
- ...