# IST 690 Independent Study Deep Learning: Convolutional Neural Networks

**by**

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Course 4 of Andrew Ng's Deep Learning Specialization is on convolutional neural networks, and we learn more about computer vision. This is where Andrew's lectures focus on the different aspects of building convolutional neural networks, which are the class of deep neural networks most commonly applied to image classification models.

He also teaches how to transform tensors, or the basic block of machine learning. They are a generalization of vectors and matrices understood as multidimensional arrays. This is also where we learn about Residual Networks (ResNet) and Inception architecture. ResNet's referring to the residual blocks in a network where each layer feeds into the next layer and directly into the layers about 2-3 steps away. Inception architecture is a widely used image recognition system that has shown to attain greater accuracy on image datasets.

A major component of the course is to teach about image recognition, by showing clear explanations with visualizations that made for an enjoyable way of learning about object detection. One important point taken from the course is that it isn't merely enough to build a complex model as we are taught with complex algorithms; the speed of prediction is also an important metric to consider.

From this course we get to work with different assignments relating to neural networks. One of the most instructive deals with the actual implementation of Convolutional Neural Network architecture on low level abstraction. The optional part on backpropagation helped to understand the concept more clearly on the reverse learning steps for it.

With these assignments I started to see how the culminating project of building a face recognition system will end up looking. On another assignment the topic of deep residual learning for image recognition is covered from a paper by Kaiming He, Xiangyu Zhang and Shaoqing Ren. With this assignment as you go through the logs, you see how the model learns and uses the styles of input over the epochs.

Deep Learning not only has improved facial recognition such as that of Facebook, but it has also made improvement in classifying X ray reports and being used in self driving car's systems. Andrew clearly builds upon the neural network built in week 1 to make it a deep convolutional model by adding more layers. This is how I started to learn about Keras; the deep learning framework on top of the TensorFlow library for Python. The Keras happy model as part of the assignment is set up so that only people who smile can enter into your home. I don't think this is very practical for a real world scenario but with modifications it can serve as a proper security measure.

In conclusion with the end of the course, I have a better idea of how convolutional neural networks work, as well as have hands on experience implementing all the building blocks of a neural network. Another important takeaway is learning about Keras for rapid prototyping, and for trail of different model architecture. Importantly, the 4 steps leading to the evaluation of a model are :

1. Create
2. Compile
3. Fit/Train
4. Evaluate/Test

Other points learned from course 4 are:

- Deep plain networks don't work due to the fact that they are hard to train because of vanishing gradients.
- Skip- connections help with vanishing gradient problems. They also help at making it easy for a ResNet block to learn identity functions.
- There are two types of blocks, identity and convolutional.
- Very deep Residual Networks are built on these blocks stacked together.