ENGR 4350:Applied Deep Learning

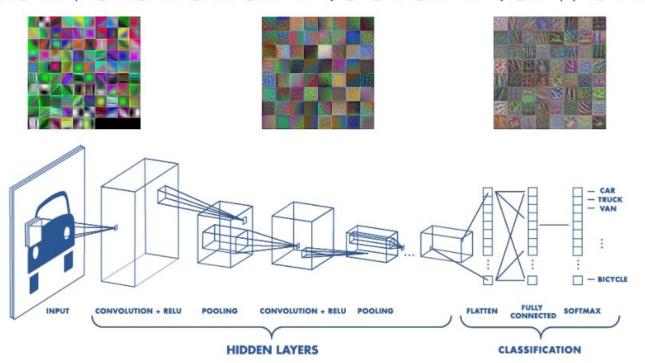
Convolutional Neural Network



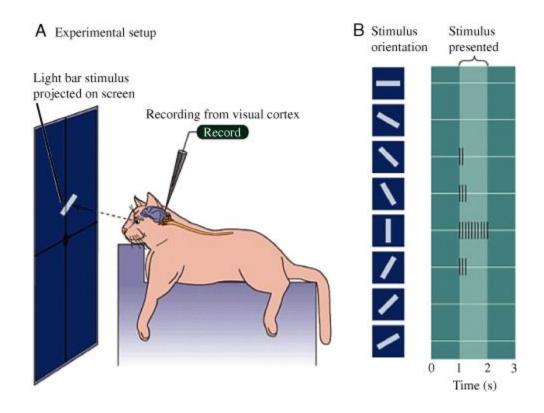
Outline

- Convolutional Neural Network Introduction
- Convolution Layer
- Examples of ConvNet
- Visualize Convolved Features

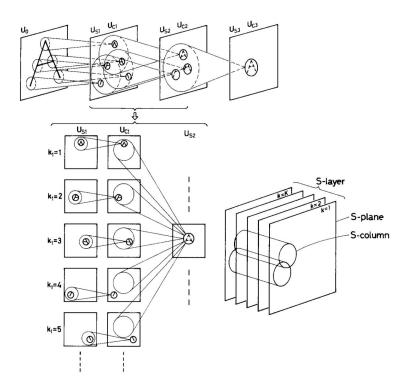
Convolutional Neural Network



Hubel & Wiesel's Cat Experiment

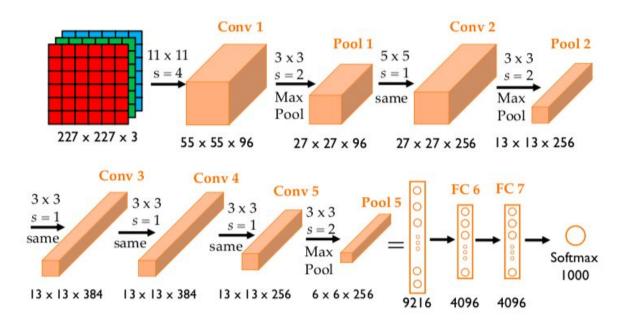


Early ConvNet

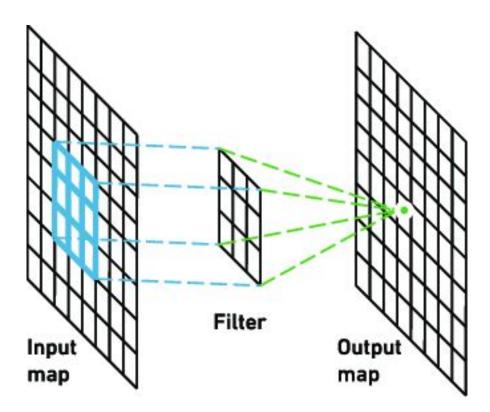


Fukushima K, Miyake S. Neocognitron: A self-organizing neural network model for a mechanism of visual pattern recognition. InCompetition and cooperation in neural nets 1982 (pp. 267-285). Springer, Berlin, Heidelberg.

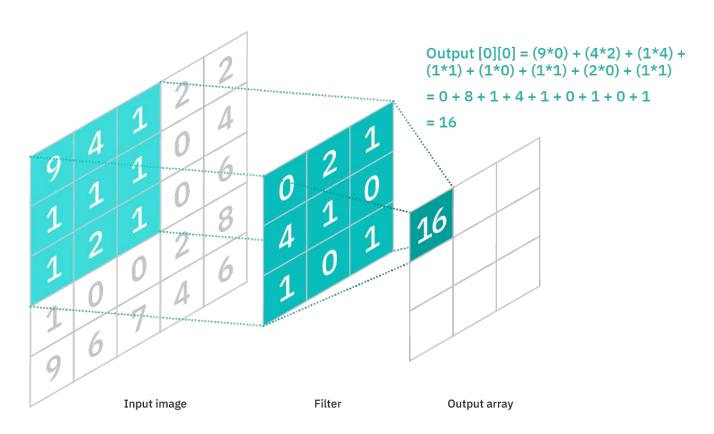
AlexNet



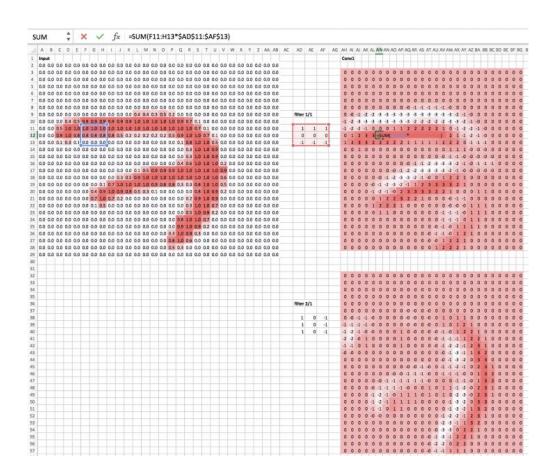
Convolution Layer



Convolution Operation



Convolve an MNIST IMAGE



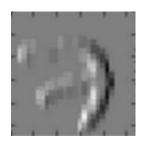
Pattern Detection



| -1 | -1 | -1 |
|----|----|----|
| 1 | 1 | 1 |
| 0 | 0 | 0 |



| -1 | 1 | 0 |
|----|---|---|
| -1 | 1 | 0 |
| -1 | 1 | 0 |

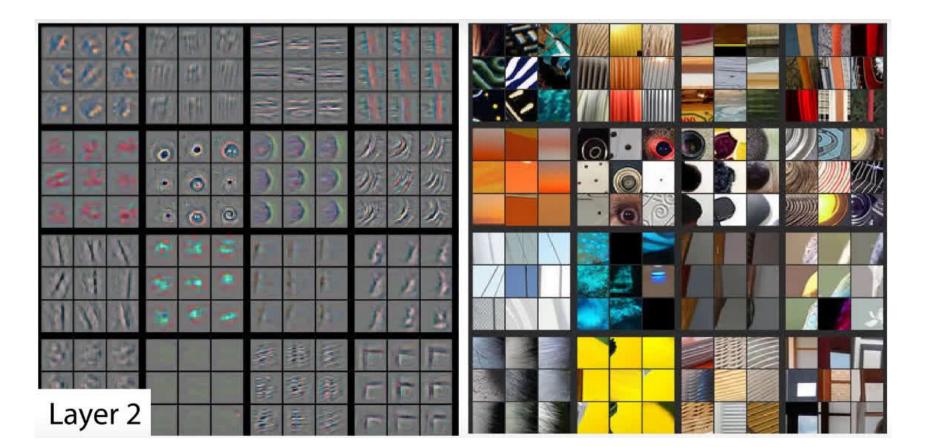




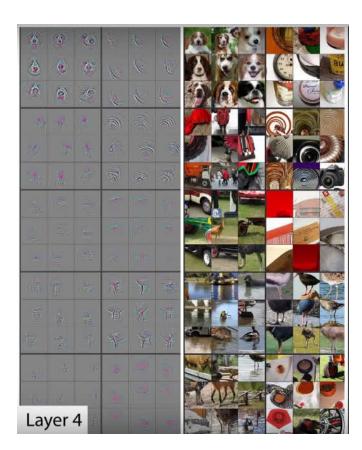
| 0 | 1 | -1 |
|---|---|----|
| 0 | 1 | -1 |
| 0 | 1 | -1 |



Low-Level Conv Layers



High-Level Conv Layers



Patterns in Conv Layers

