# 6.867 Final Project: Why Do We Need Complex Networks

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**Abstract**

Something here. Do I even need this?

## 1 Introduction

The advent of perceptrons in machine learning classification tasks were developed as a supervised learning method for classification of linearly separable datasets in the 1950s, with inputs from scientists in neuroscience and artificial intelligence [5]. The slow development from single-layer perceptrons to multi-layer perceptrons and kernel perceptrons [1] and the increasing popularity of kernelized support vector machines for non-linear classification meant that neural networks were put on the back burner of research for a few decades.

A neural network success story in the computer vision community is the development of a back-propagation convolutional neural network (CNN) for handwritten digit recognition [2]. The original data used was approximately 10,000 handwritten digits, classified into one of 10 categories. This original dataset was later expanded into the MNIST handwritten digit database with over 60,000 examples [3], [4]. The network used by LeCunn et. al. used the idea of convolution layers - described essentially as features extracted from parts of the image by kernels of varying sizes, generally getting smaller and smaller. The general idea is that these $n \times n$ kernels will 'find'

## 2 Method

* had to install caffe * mostly used resources online, except the built-in ATLAS on my OSX machine was not working, so had to add openblas to teh list of brew packages needed to be edited / installed / compiled

## 3 Experiments

## References


[1] Mark A Aizerman, E Braverman, and L Rozonoer. Theoretical foundations of the potential function method in pattern recognition learning. *Automation and Remote Control*, 25:821–837, 1964.

[2] Yann LeCun, B Boser, J.S. Denker, D. Henderson, R.E. Howard, W. Hubbard, and L.D. Jackel. Handwritten digit recognition with a back-propagation network. *NIPS*, 1990.

[3] Yann LeCun, Lon Bottou, Yoshua Bengio, and Patrick Haffner. Gradient-based learning applied to document recognition. *Proceedings of the IEEE*, 86(11):2278–2324, 1998.

[4] Li Deng. The MNIST database of handwritten digit images for machine learning research [best of the web]. *IEEE Signal Processing Magazine*, 29(6):141–142, November 2012.

[5] Frank Rosenblatt. The perceptron: a probabilistic model for information storage and organization in the brain. *Psychological review*, 65(6):386, 1958.