Artificial Neural Networks: Introduction

James Kwok

Mimicking the Brain

Deep learning: One of 10 Breakthrough Technologies 2013 (video)

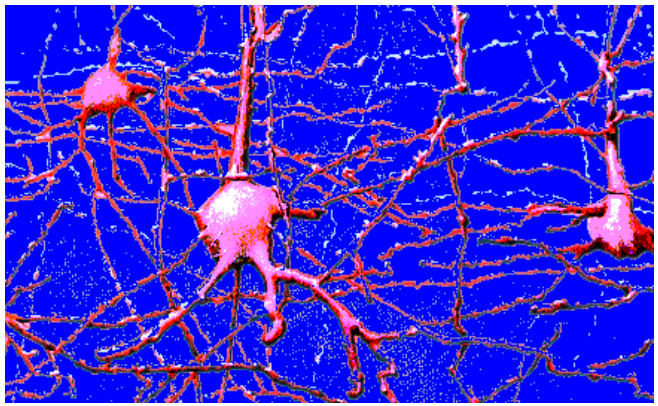
60's: Inspired by neurophysiology, biology and psychology

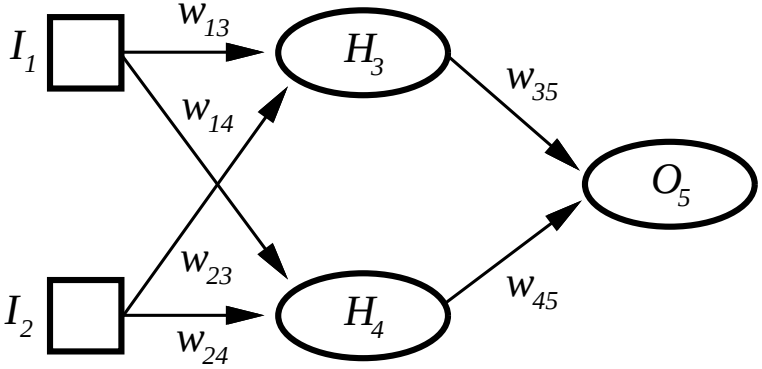
Google Brain

(link)

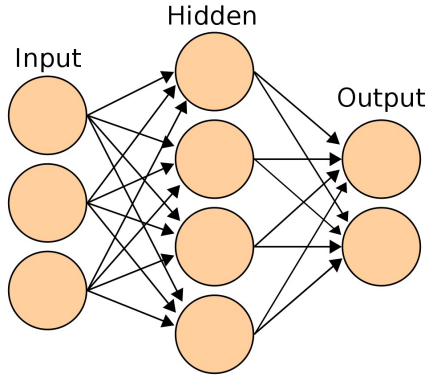
Neural Networks

- use complex networks of simple computing elements as mathematical models to mimic the functions of the brain



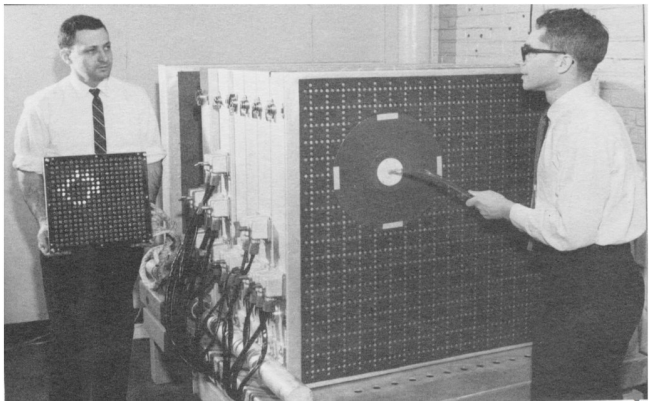


- unit types: input units, hidden units, output units

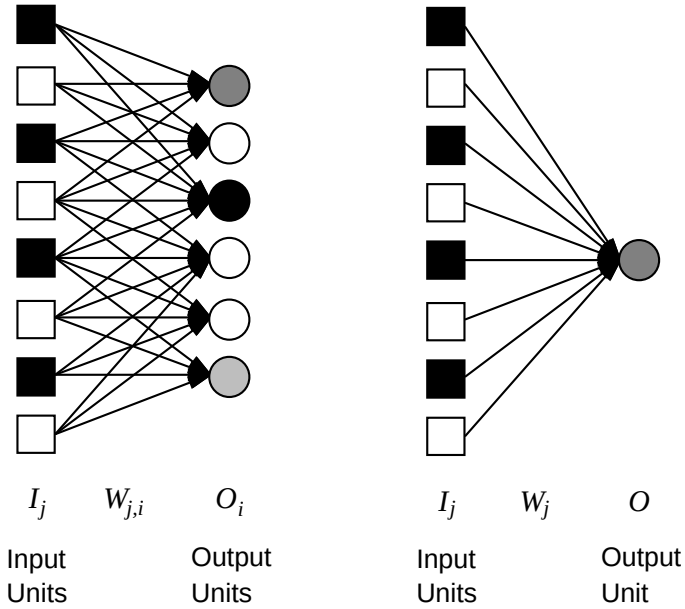


- learning usually takes place by updating the weights

Perceptron

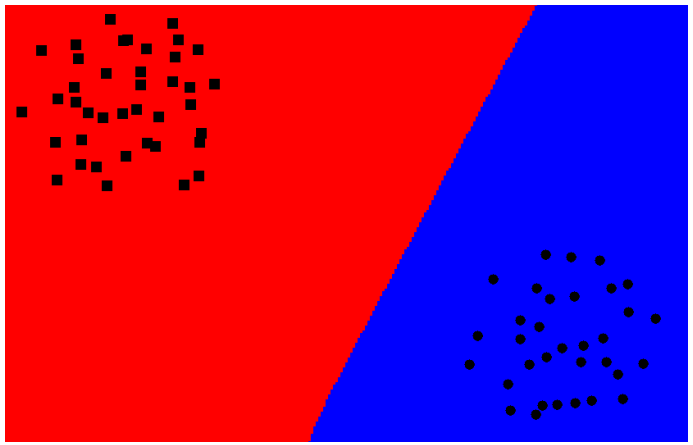

(Frank Rosenblatt, 1957)

network with one layer of weights connected to output units

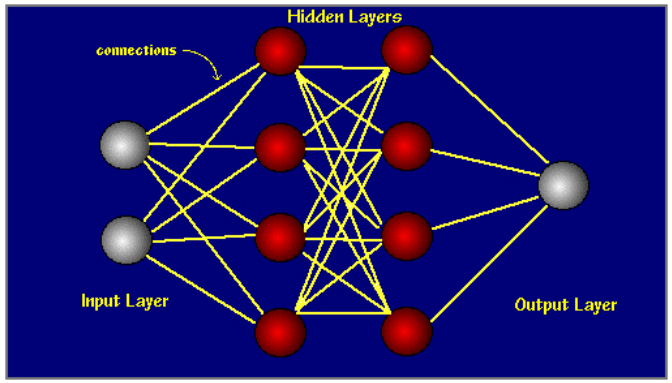


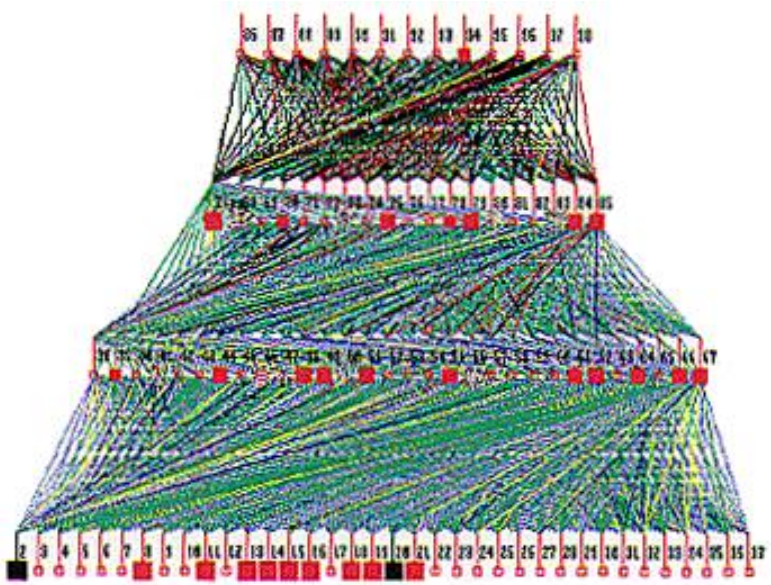
Capability of the Perceptron

- can only learn (simple) functions that are linearly separable



More Powerful by Adding Hidden Units



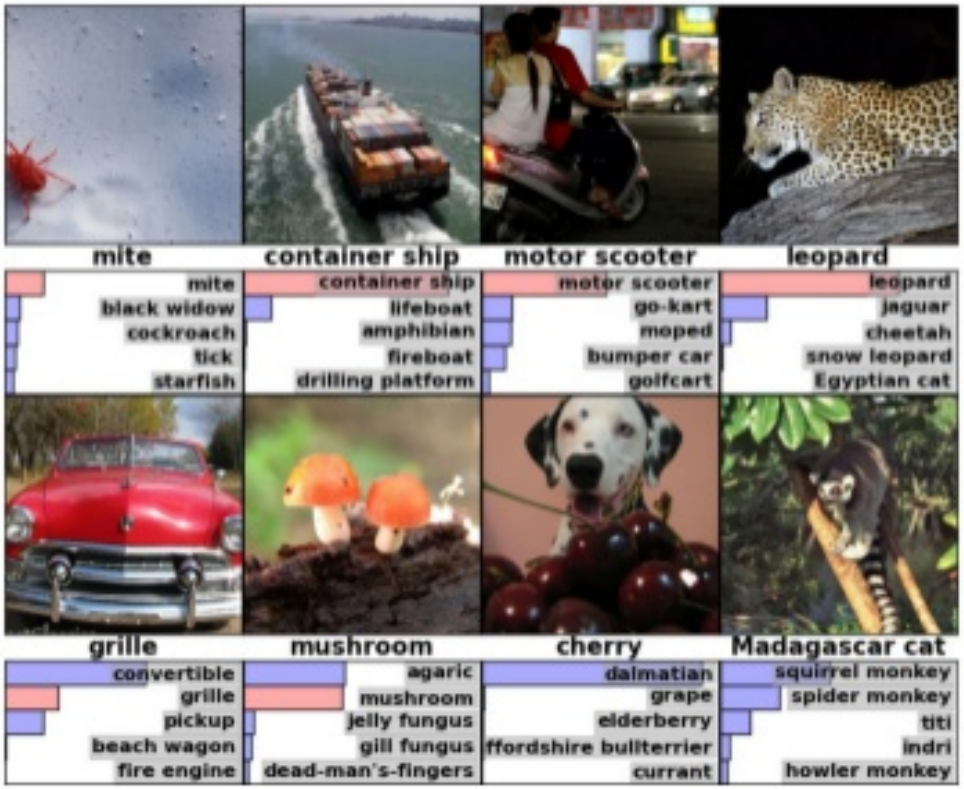


- google brain: more than 1 billion connections

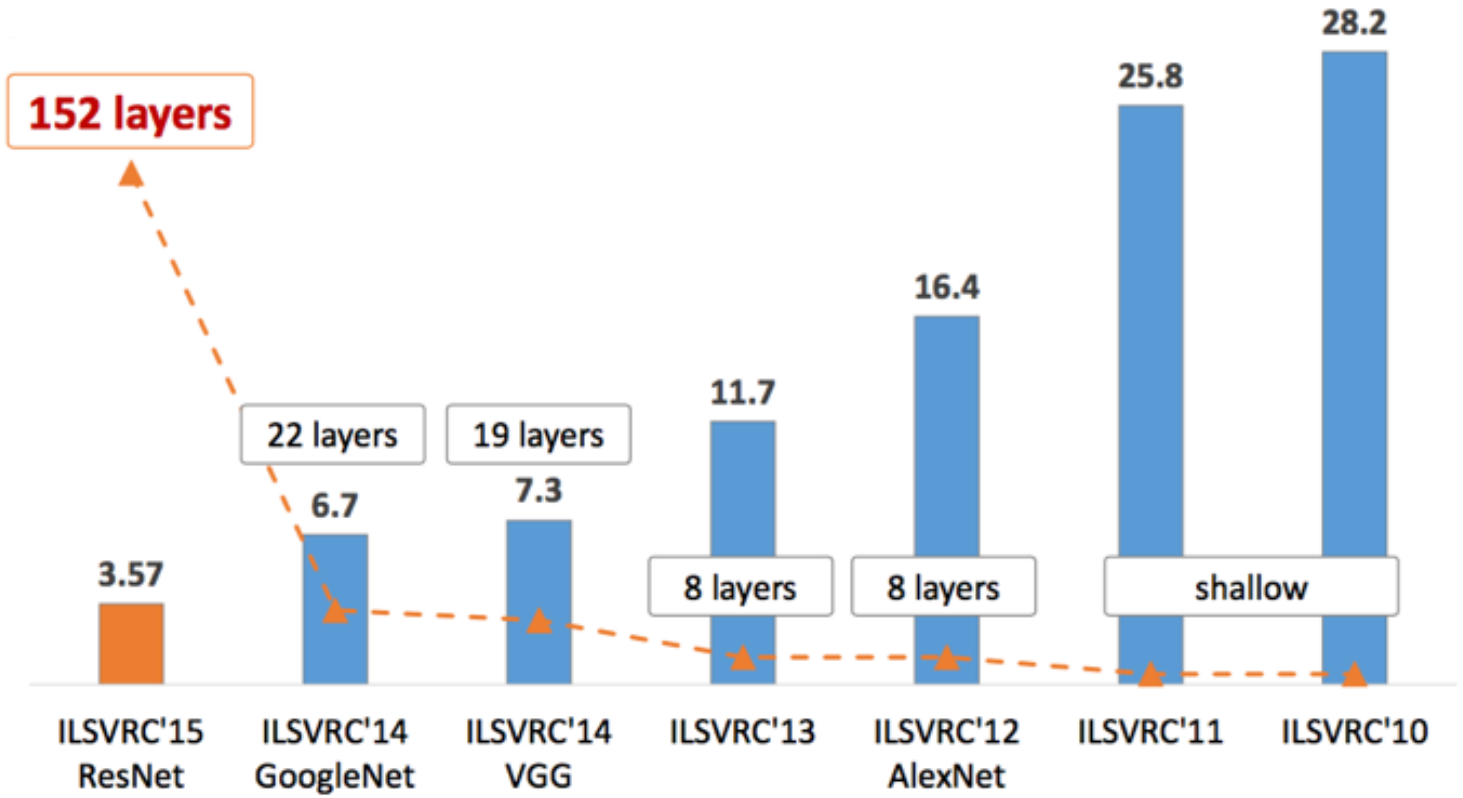
ImageNet Challenge

IMAGENET

- 1,000 object classes (categories).
- Images:
  - 1.2 M train
  - 100k test.



Deep Networks (Deep Learning)



in 2017: ResNet with 1001 layers

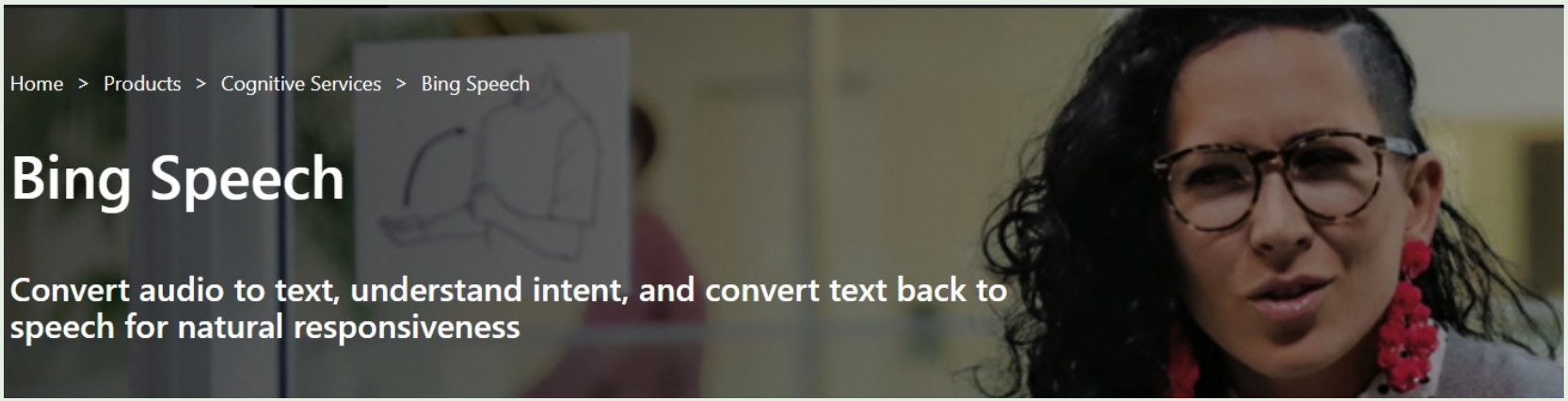
Deep Learning

successfully used in speech recognition

Example (Google Cloud Speech-to-Text)

(link)

Example (Bing Speech)



(link)

Deep Learning

successfully used in conversational systems

Example (Amazon Transcribe)

(link)

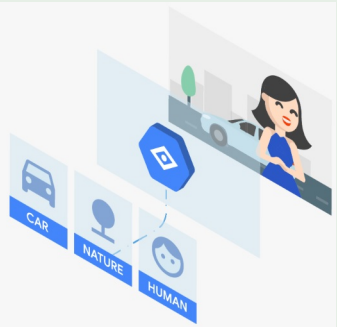
successfully used in image data analytics

Example (Google Cloud Vision)

Powerful image analysis

Cloud Vision offers both pretrained models via an API and the ability to build custom models using AutoML Vision to provide flexibility depending on your use case.

Cloud Vision API enables developers to understand the content of an image by encapsulating powerful machine learning models in an easy-to-use REST API. It quickly classifies images into thousands of categories (such as, "sailboat"), detects individual objects and faces within images, and reads printed words contained within images. You can build metadata on your image catalog, moderate offensive content, or enable new marketing scenarios through image sentiment analysis.



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