

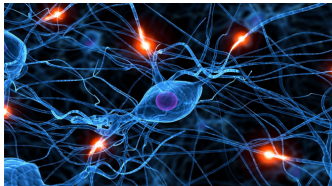
# Artificial Neural Networks: Introduction

James Kwok

# Mimicking the Brain

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

60's: Inspired by neurophysiology, biology and psychology



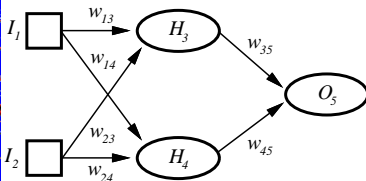
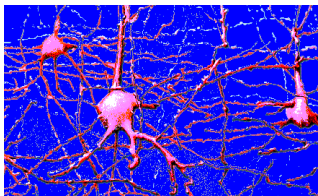
Google Brain



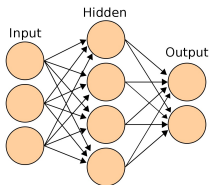
(link)

# Neural Networks

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

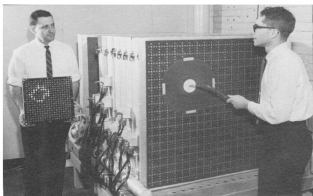


- unit types: **input** units, **hidden** units, **output** units



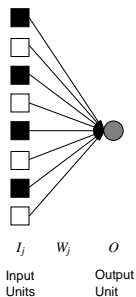
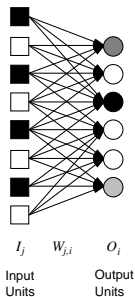
- learning usually takes place by updating the **weights**

# Perceptron



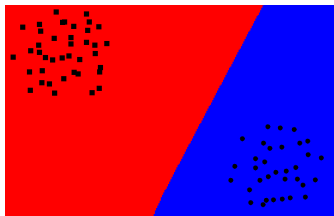
(Frank Rosenblatt, 1957)

network with **one** layer of weights connected to output units

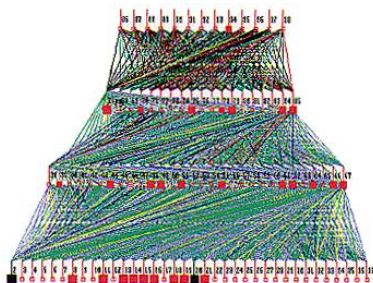
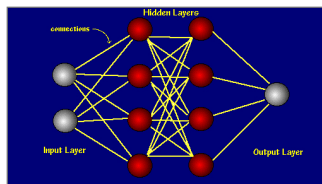


# Capability of the Perceptron

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



# More Powerful by Adding Hidden Units



- google brain: more than 1 billion connections

# Large Scale Visual Recognition Challenge (ILSVRC)

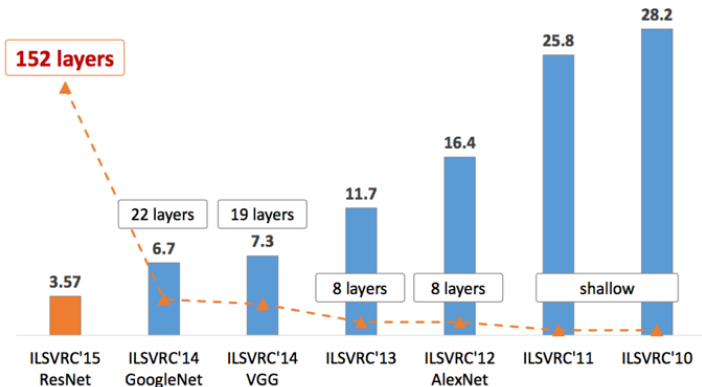
## ImageNet Challenge

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)

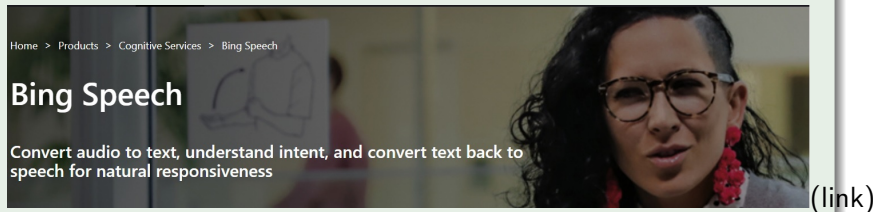


## Example (Bing Speech)

Home > Products > Cognitive Services > Bing Speech

# Bing Speech

Convert audio to text, understand intent, and convert text back to speech for natural responsiveness

A screenshot of the Bing Speech advertisement. It shows a woman with dark curly hair and glasses, wearing red beaded earrings, looking slightly to the side. The background is a blurred indoor setting. The text "Bing Speech" is prominently displayed in a large, bold, white font. Below it, a smaller line of text describes the service: "Convert audio to text, understand intent, and convert text back to speech for natural responsiveness". A "(link)" text is positioned to the right of the image.

# Deep Learning

successfully used in **conversational systems**

## Example (Amazon Transcribe)



(link)

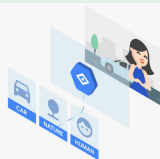
successfully used in **image data analytics**

## 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.



(link)