OVERVIEW OF DEEP LEARNING

Hao Liu
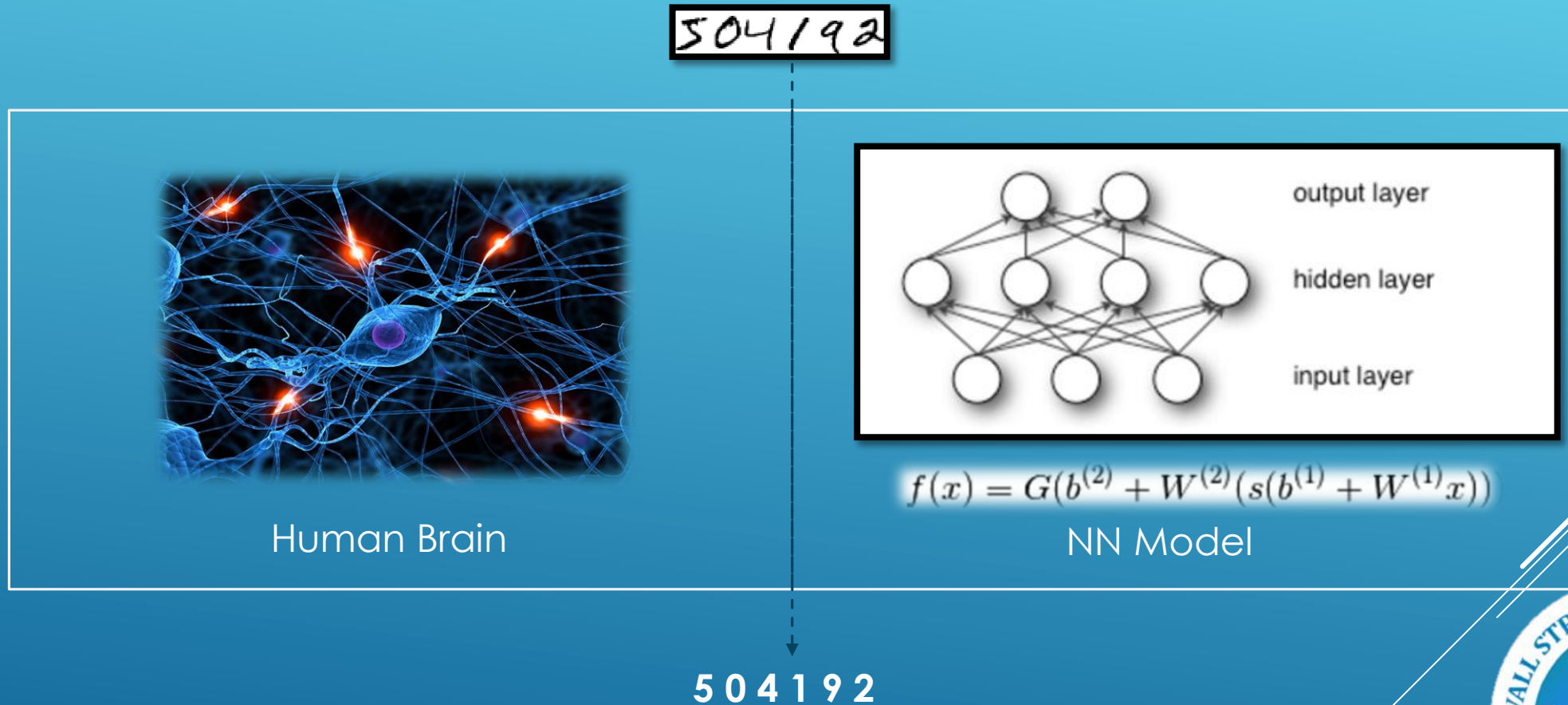
CONTENTS

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Neural Network

An Artificial Neural Network (ANN) is an information processing paradigm that is inspired by the way biological nervous systems, such as the brain, process information.

504192

Human Brain

output layer

hidden layer

input layer

$$f(x) = G(b^{(2)} + W^{(2)}(s(b^{(1)} + W^{(1)}x)))$$

NN Model

504192

WSFC
WALL STREET FINTECH CLUB
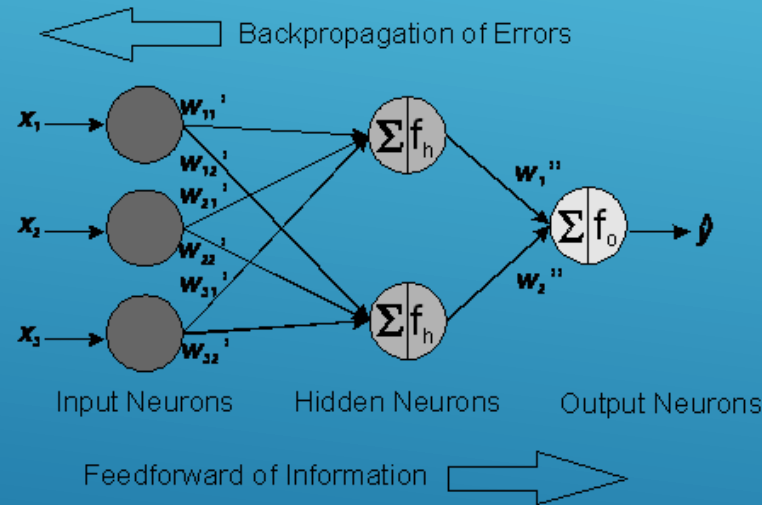- Est. 2016 New York -

Neural Network Training: SGD, Backpropagation, Feature Learning

Neural Network training is one of the biggest challenges, but many advanced techniques are invented to crack it down.
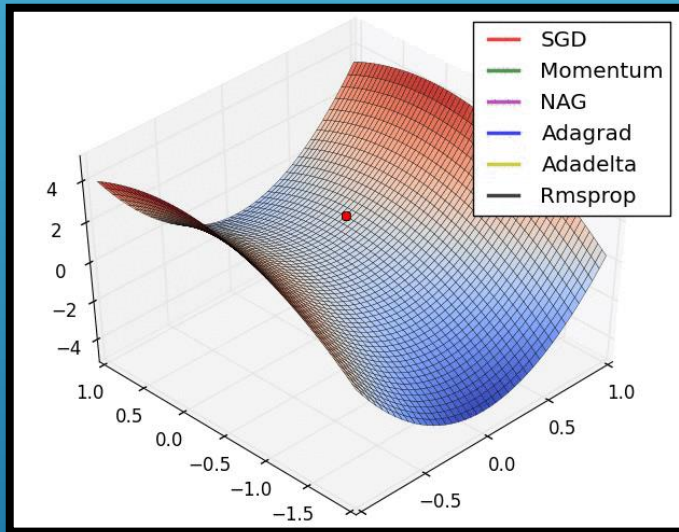
Stochastic Gradient Descent(SGD)s:
Momentum / Nesterov accelerated gradient
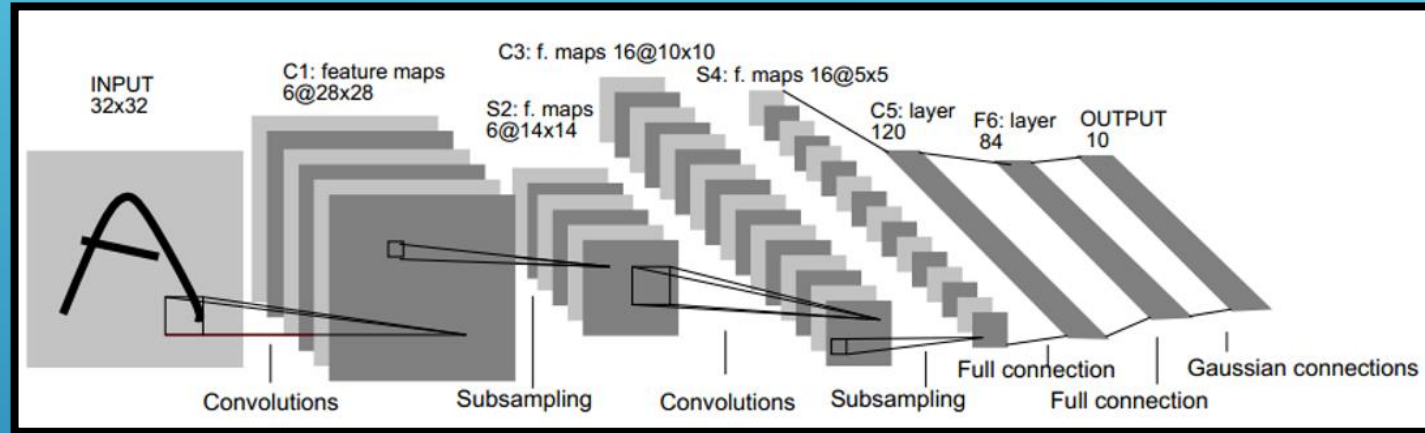Adagrad / Adadelta / RMSprop / Adam

Backpropagation

Unsupervised Feature Learning:
- Restricted Boltzmann Machines(RBM)
- Sparse Autoencoder
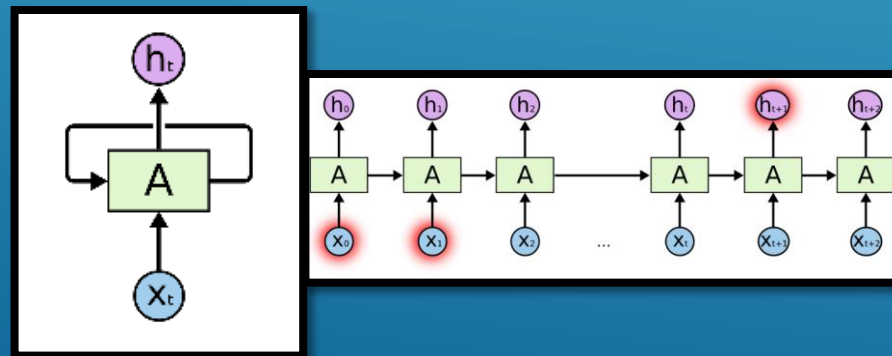- Manifold Learning: Isomap, t-SNE

Deep Neural Network

A **deep neural network** (DNN) is an artificial **neural network** (ANN) with multiple hidden layers of units between the input and output layers.
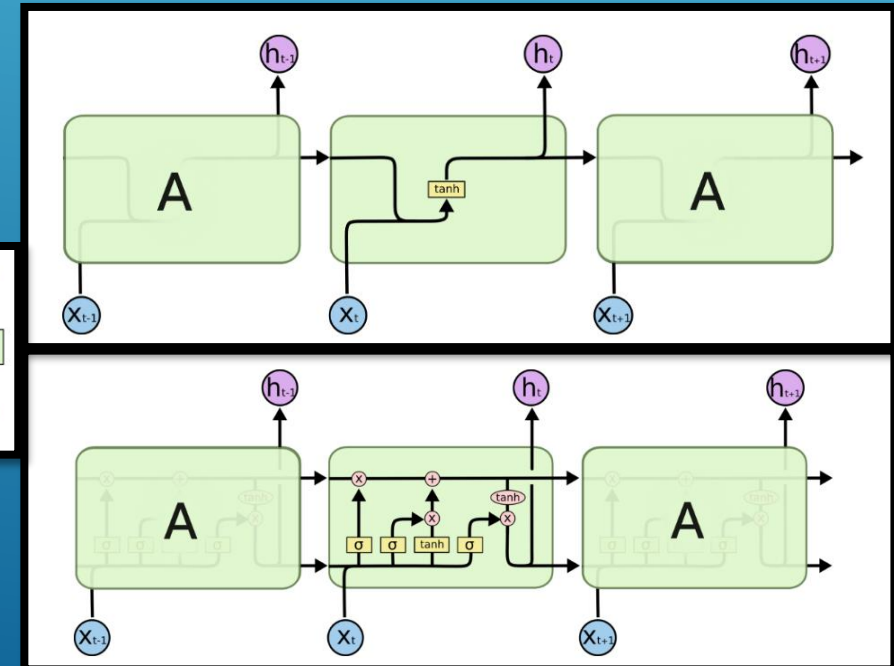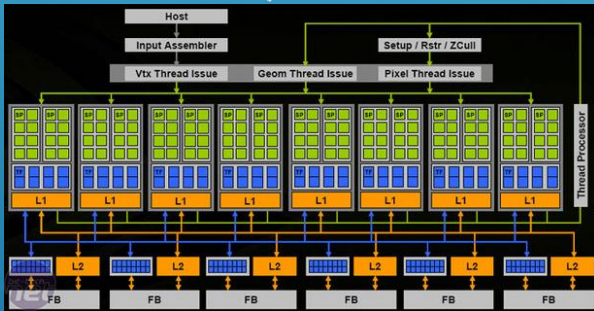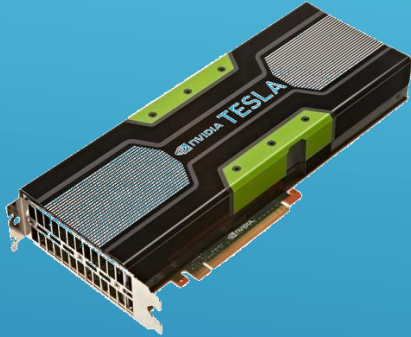
CNN(Convolution)

RNN(Recurrent)
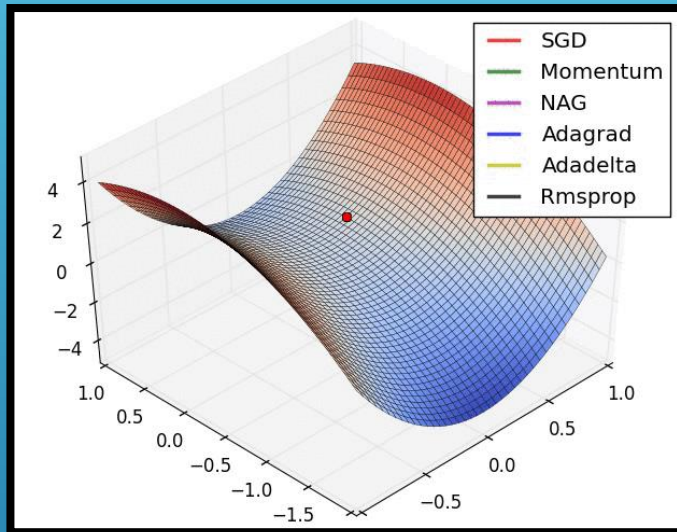
LSTM
(Long short term memory)
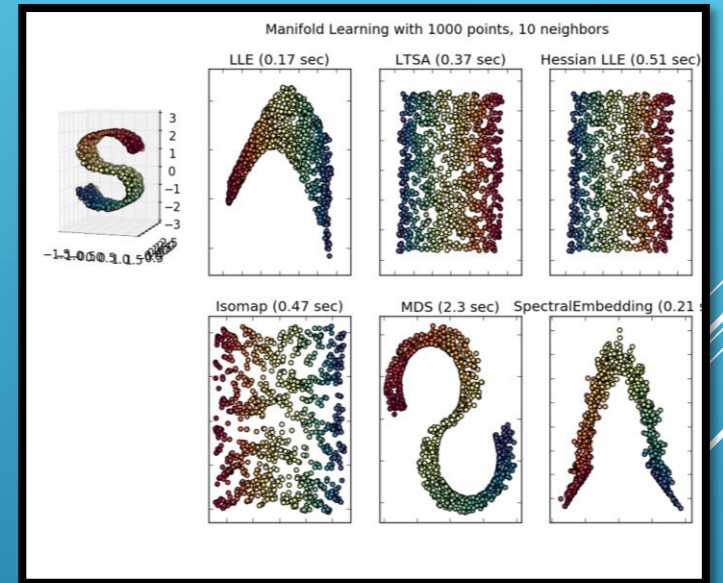
Behind the DNNs

Several breakthroughs are behind the rise of DNNs.

GPGPU


Better Optimization Methods

Feature/Manifold Learning

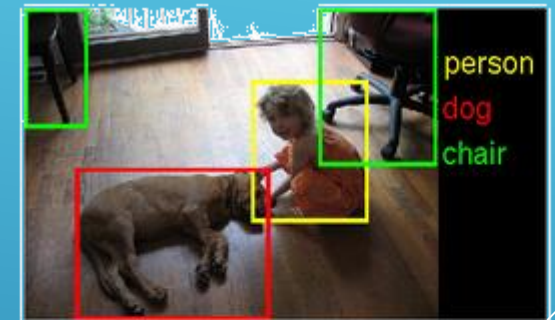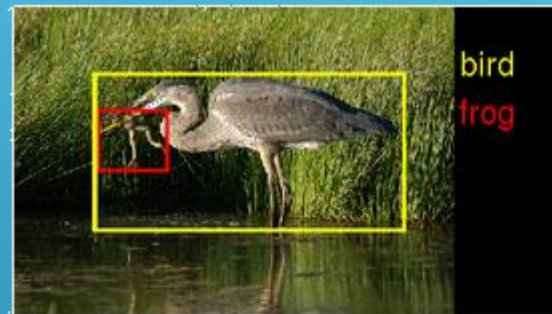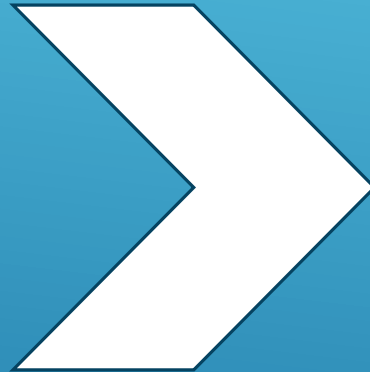# CONTENTS

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Deep Learning Applications

Computer Vision: **from** MNIST(Handwritten Digit Recognition) **to** ImageNet(Natural Image Labeling)
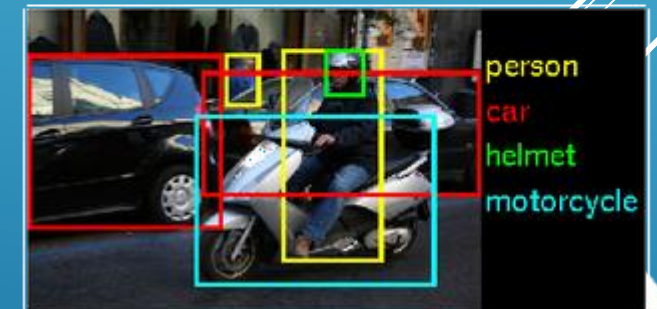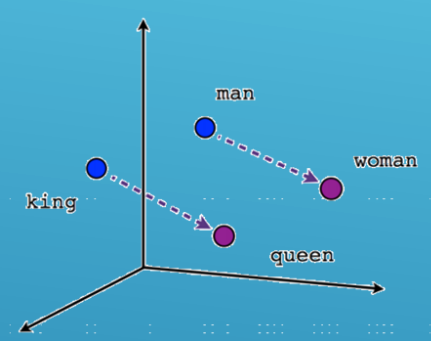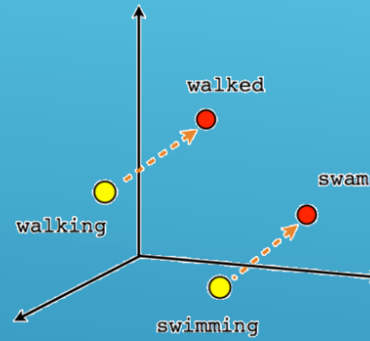

Deeper and more complex CNN.

Deep Learning Applications

Neutral Language Processing: deep learning is replacing large amount of labor feature engineering in the area.
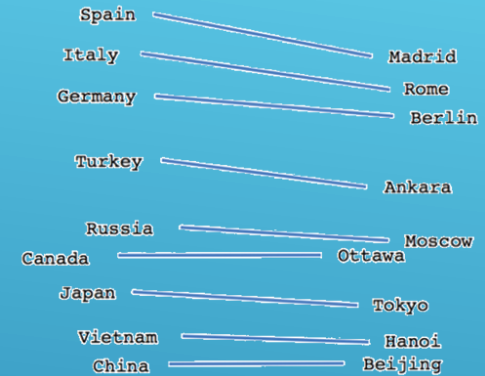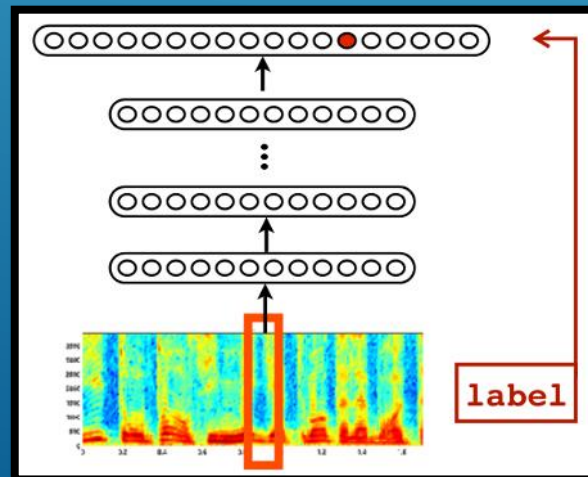
Word Embedding:

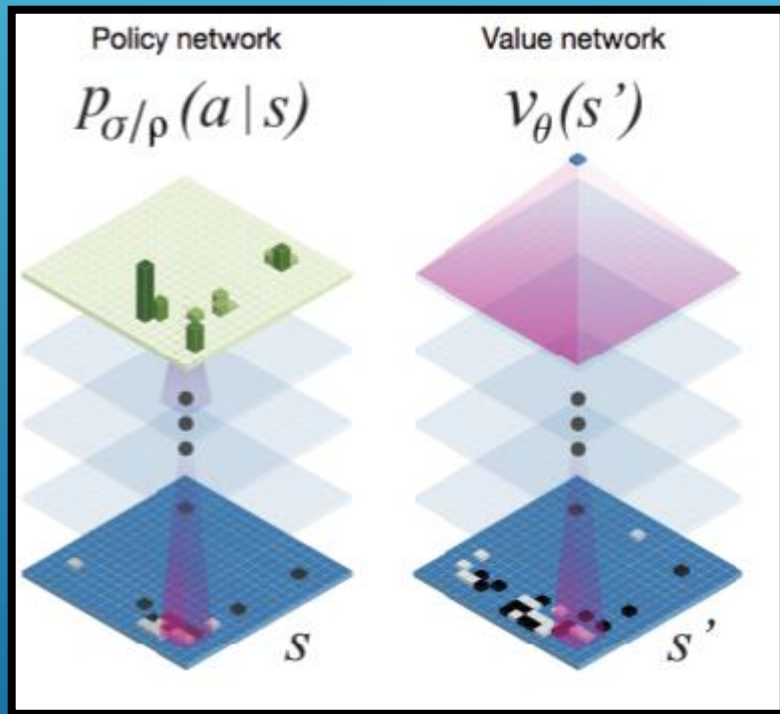Male-Female | Verb tense | Country-Capital

Speech Recognition :

and so on…..

Deep Learning Applications

Alpha GO: Deep Learning + Reinforce Learning.

Policy network $p_{\sigma/\rho}(a|s)$

Value network $v_{\theta}(s')$

- **Monte-Carlo tree search (MCTS):** sampling long sequences of actions for both players

- **Value Network:** evaluating positions, predicts the winner of game, trained by reinforcement learning

- **Policy Network:** sampling actions to search, first trained using expert human moves, then trained by reinforcement learning

Deep Learning Applications

Self Drive: Is it just an application of Image Recognition?