A Shallow Comparison of Neural Network Architectures and Deep Learning Software

... aka. popular models & tools @ a very high level.

Seasoned Pros, but Students in Deep Learning...

Frank Hinek

Deep Learning Student @ Udacity
Director of Engineering @ Presidio
On the side... Family
frankhinek @ Twitter / LinkedIn

John Stone

CS Grad Student @ GT
Engineer @ Bay Dynamics
On the side.. AI Kind & Full AI
yibter @ Twitter / LinkedIn

Atlanta Deep Learning Meetup

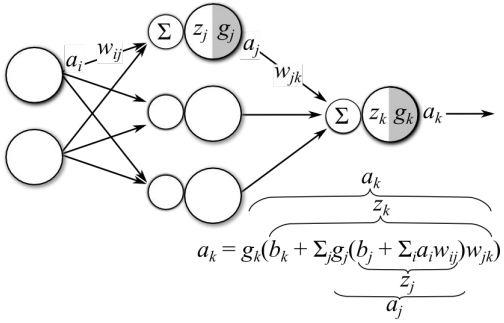
Chris Benson
Organizer, Atlanta Deep Learning Meetup

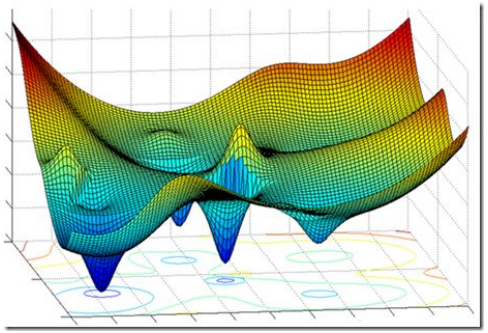
Last Month's Talk:

Introduction to Deep Learning by Chris...

- Neural Networks
- Activation Functions
- Backpropagation
- Gradient Descent
- Other cool stuff

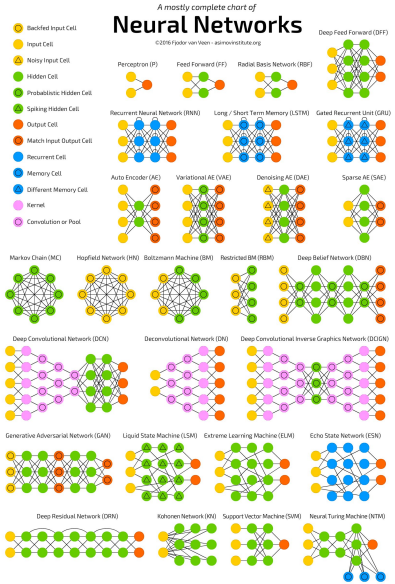
Message Chris to join slack or give a talk!





This month's talk... A Shallow Comparison of

Neural Network Architectures



w/ popular Use Cases

&

Deep Learning Software

KERAS
Microsoft CNTK
MatConvNet
TensorFlow
theano
torch
Caffe
Chainer
DL4J Deeplearning4j
MINERVA
mxnet
Purine

w/ leading Companies

Neural Network Architectures

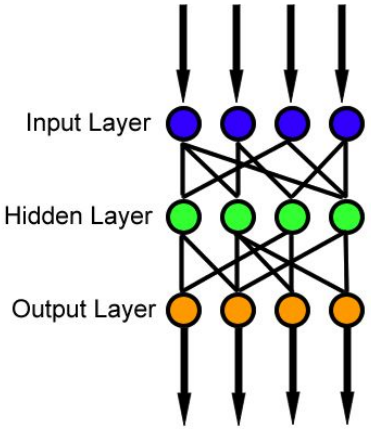
w/ popular Use Cases

- Feedforward
- Convolutional (CNNs)
- Long Short-Term Mem (LSTM)
- Recurrent (RNNs)
- Residual (ResNets)
- Generative Adversarial (GANs)
- Deep Reinforcement Learning
- Deep Random Forests

What do you use?

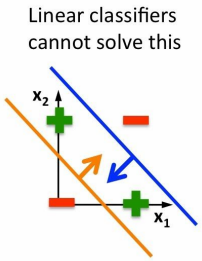
Feedforward Neural Networks

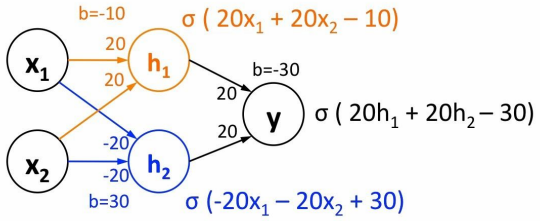
- One of the first and simplest Artificial Neural Networks (ANN) devised.
- Single Direction, does not form a cycle.



Solving XOR with a Neural Net

Linear classifiers cannot solve this





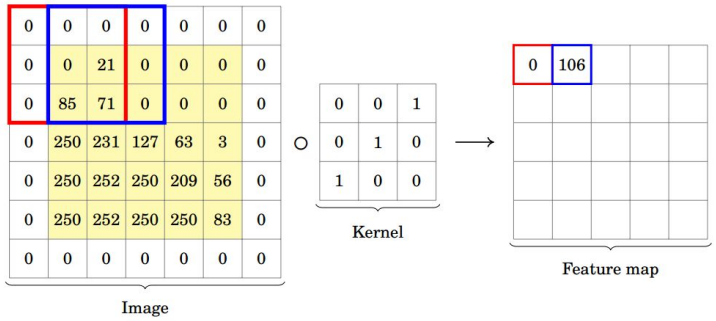
σ(20*0 + 20*0 – 10) ≈ 0
σ(20*1 + 20*1 – 10) ≈ 1
σ(20*0 + 20*1 – 10) ≈ 1
σ(20*1 + 20*0 – 10) ≈ 1

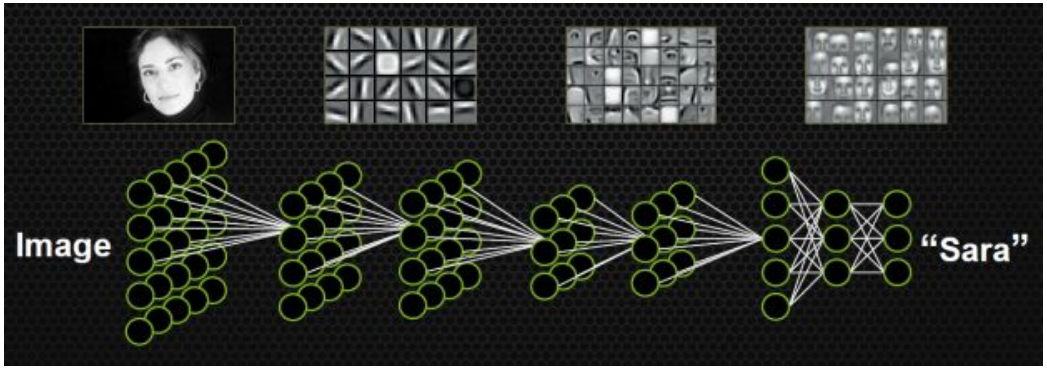
σ (-20*0 – 20*0 + 30) ≈ 1
σ (-20*1 – 20*1 + 30) ≈ 0
σ (-20*0 – 20*1 + 30) ≈ 1
σ (-20*1 – 20*0 + 30) ≈ 1

σ (20*0 + 20*1 – 30) ≈ 0
σ (20*1 + 20*0 – 30) ≈ 0
σ (20*1 + 20*1 – 30) ≈ 1
σ (20*1 + 20*1 – 30) ≈ 1

Convolutional Neural Networks (CNNs / ConvNets)

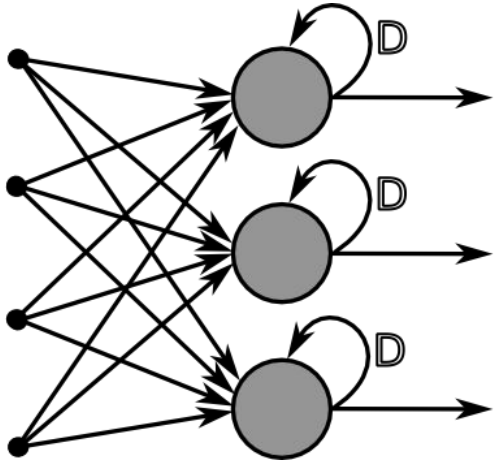
- Type of Feed-forward ANN
- Inspired by the animal visual cortex.
- Common Use Cases
  - Image Recognition
  - Video Recognition
  - Natural Language Processing (NLP)
  - Recommender Systems
  - Drug Discovery
  - Playing Go
- Terms
  - Kernel
  - Pooling
  - Rectified Linear Units (ReLU)





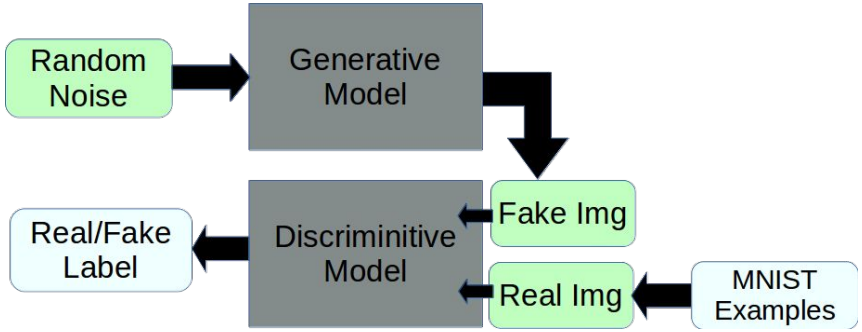
Recurrent Neural Networks (RNNs)

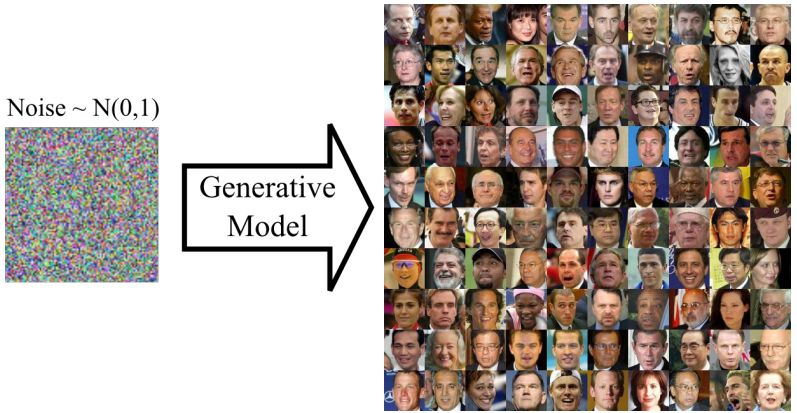
- Has directed cycles.
- Has memory, so it can have “context”.
- Common Use Cases
  - Handwriting Recognition
  - Speech Recognition
  - Natural Language Processing (NLP)
  - Video Content Recognition
- LSTM = RNN with Gates
  - Time lags of unknown size
  - Insensitive to gap length.
- Residual Neural Net (ResNet) = LSTM pros, but without Gates



Generative Adversarial Networks (GANs)

- Unsupervised Machine Learning
- Two Neural Networks compete against each other
- Use Cases
  - Generate Photographs that look Authentic to Humans
  - Reconstruct 3D Model from images
  - Synthetic Data (ex. Network Traffic)





And lots more!

Check out...

http://wiki/Types_of_artificial_neural_networks

And “The Neural Network Zoo” ➜

http://www.asimovinstitute.org/neural-network-zoo/

Applying Deep Learning to Novel Applications

https://arxiv.org/ftp/arxiv/papers/1704/1704.01568.pdf

Combine them too!

Be the first to make a Generalized Neural Network Architecture.