

Introduction to Deep Learning



Agenda

1. Motivation
2. What is Machine Learning?
3. Demo 1
4. Modern Deep Learning
5. Demo 2
6. Interesting Use-cases
7. Where should I start?

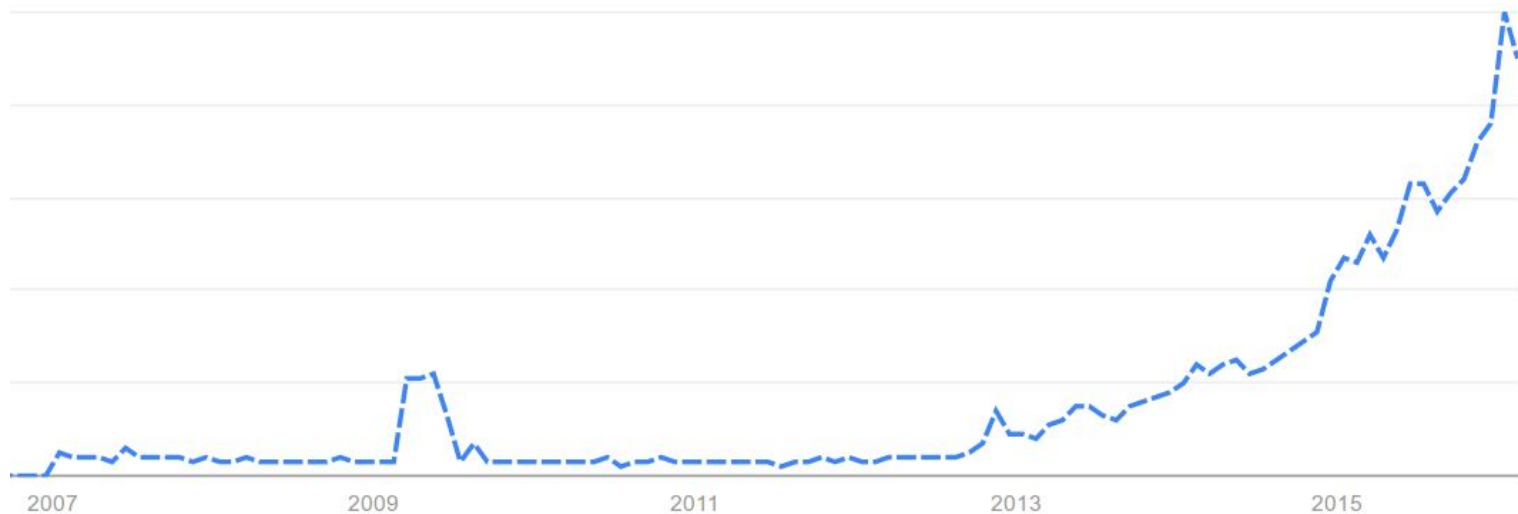


Motivation



Google Trends

Shows how often "deep learning" is entered relative to the total search-volume across various regions of the world, and in various languages



Deep Learning in News

Can Google's AlphaGo really feel it in its algorithms?

John Naughton

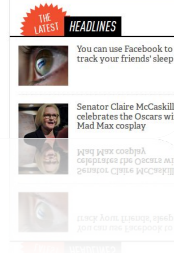
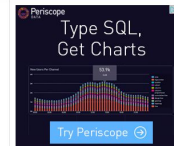
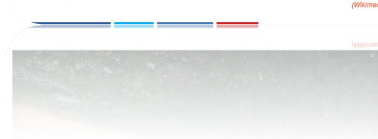
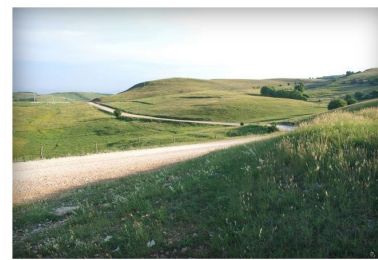
When the game-playing system AlphaGo defeated a master of the Chinese game go five games to nil, its creators could not explain why. Is this a sign of intuitive AI?



Google's latest AI doesn't need geotags to figure out a photo's location

The new deep-learning program churns through millions of photos to determine the best match.

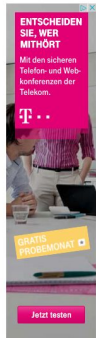
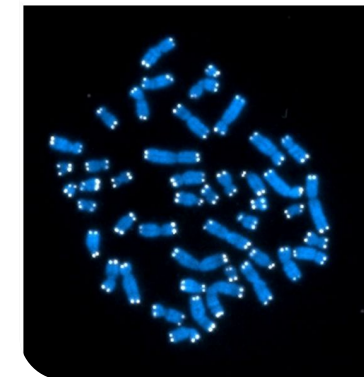
By Alex Brinkman on February 25, 2016 01:03 pm



Meet Deep Genomics, a start-up bringing the power of deep learning to genomics

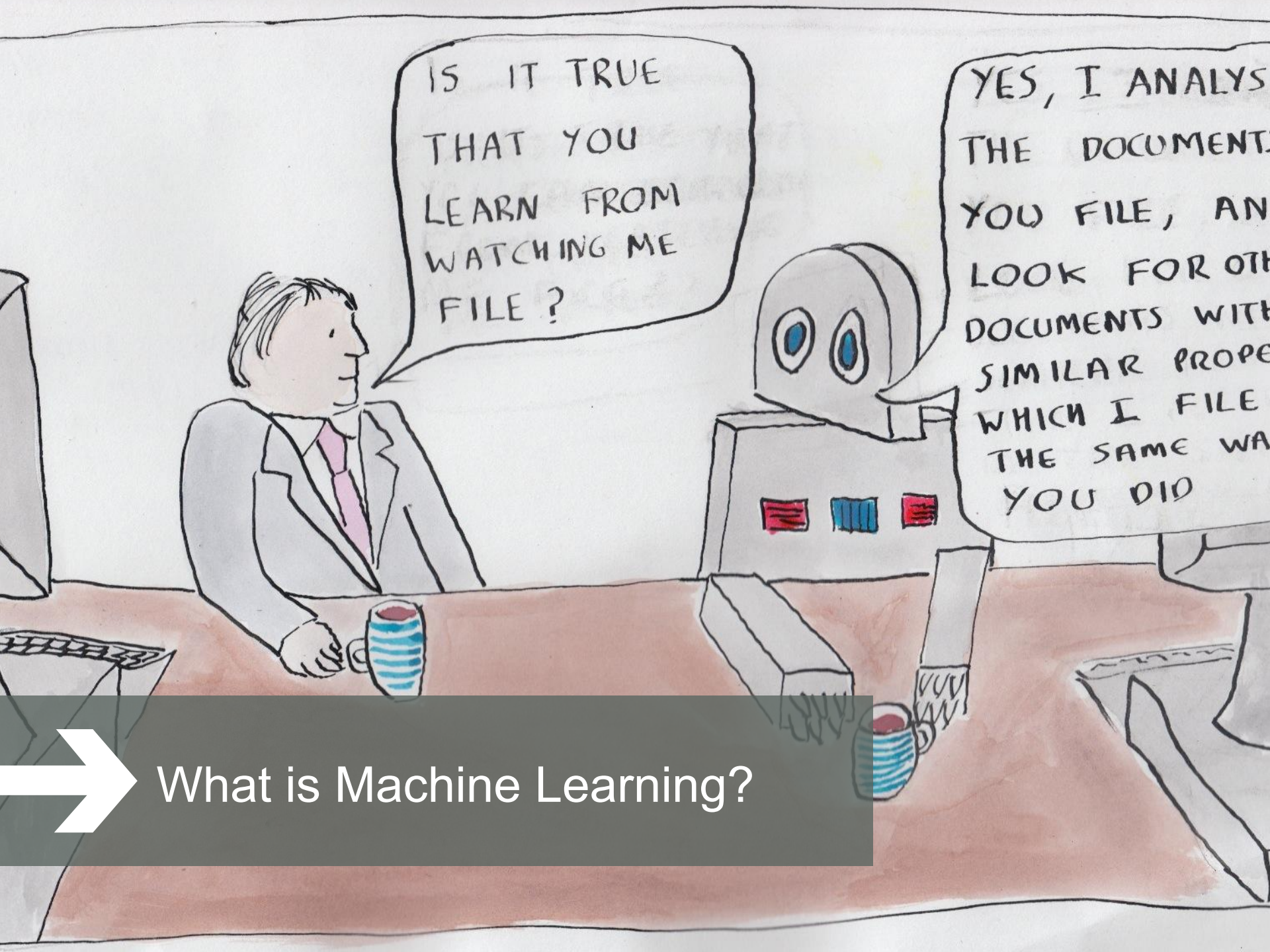
A Save for Later Reading List

By Matt McFarland July 22, 2015



Most Read





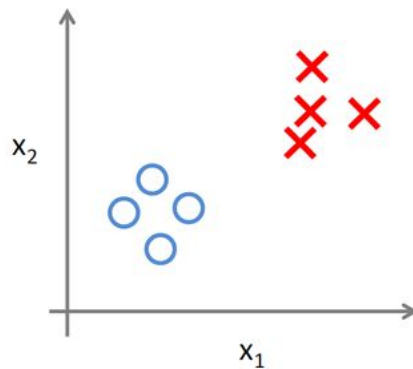
IS IT TRUE
THAT YOU
LEARN FROM
WATCHING ME
FILE ?

YES, I ANALYSE
THE DOCUMENTS
YOU FILE, AND
I LOOK FOR OTHER
DOCUMENTS WITH
SIMILAR PROPERTIES
WHICH I FILE
THE SAME WAY
YOU DID

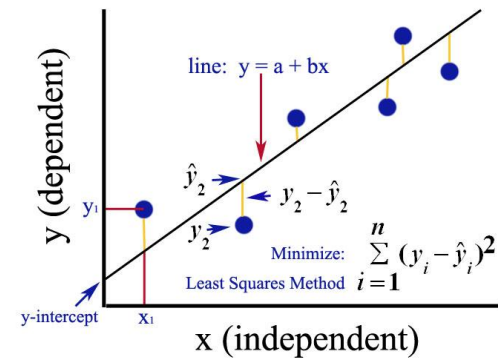
What is Machine Learning?

Tasks in Machine Learning

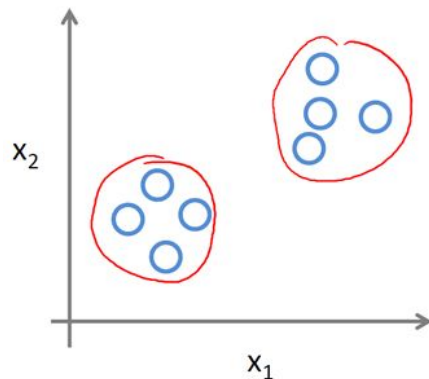
Classification



Regression



Clustering



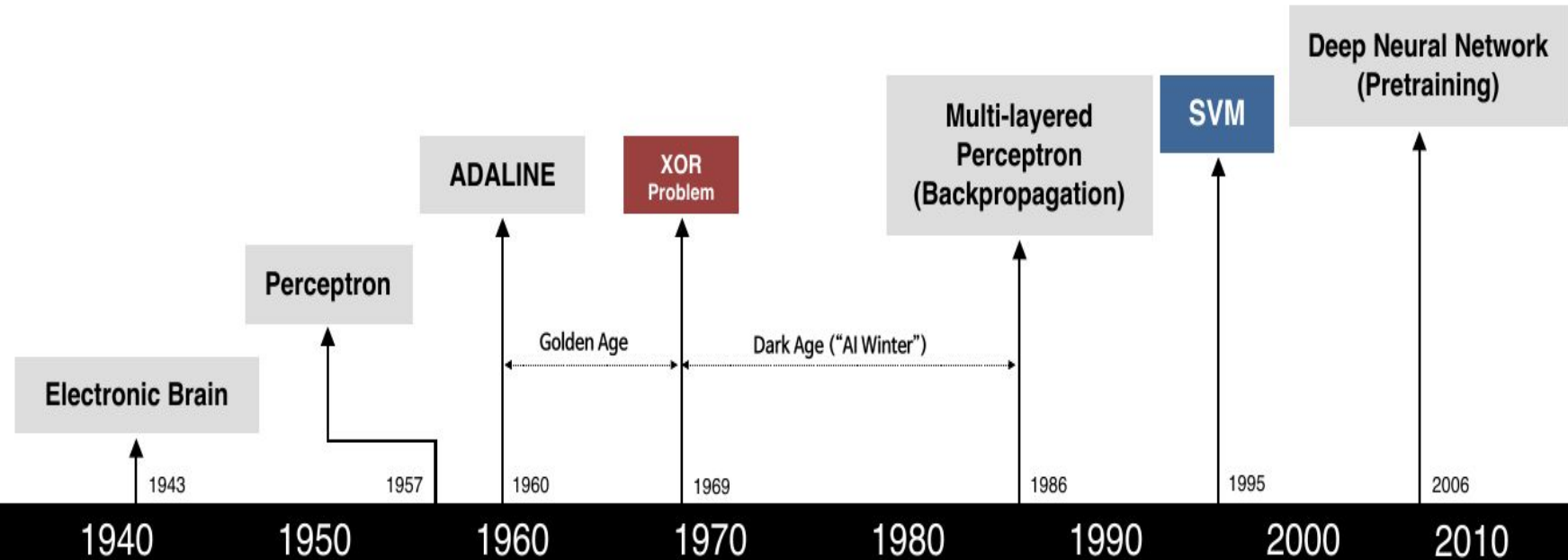
Association Rule Learning

TID	Items
1	Bread, Milk
2	Bread, Diaper, Beer, Eggs
3	Milk, Diaper, Beer, Coke
4	Bread, Milk, Diaper, Beer
5	Bread, Milk, Diaper, Coke

	Beer	Bread	Milk	Diaper	Eggs	Coke
T_1	0	1	1	0	0	0
T_2	1	1	0	1	1	0
T_3	1	0	1	1	0	1
T_4	1	1	1	1	0	0
T_5	0	1	1	1	0	1

Brief History of Neural Network

DEVIEW
2015



S. McCulloch - W. Pitts



F. Rosenblatt



B. Widrow - M. Hoff



M. Minsky - S. Papert



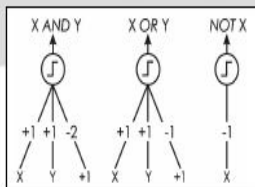
D. Rumelhart - G. Hinton - R. Williams



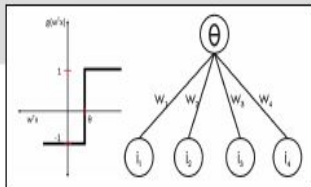
V. Vapnik - C. Cortes



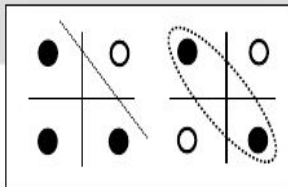
G. Hinton - S. Ruslan



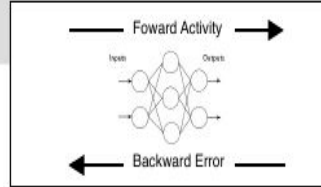
- Adjustable Weights
- Weights are not Learned



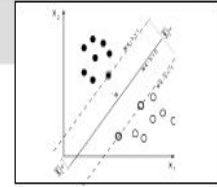
- Learnable Weights and Threshold



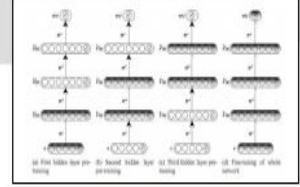
- XOR Problem



- Solution to nonlinearly separable problems
- Big computation, local optima and overfitting



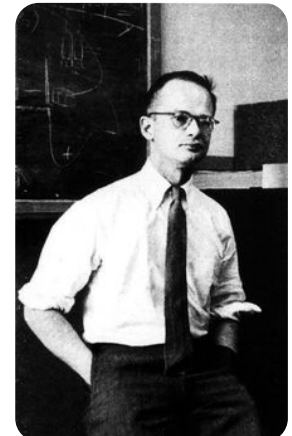
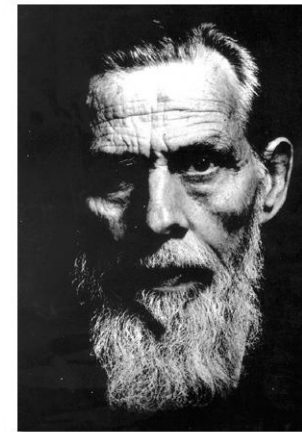
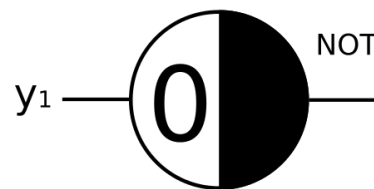
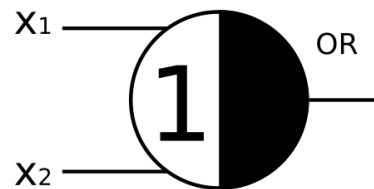
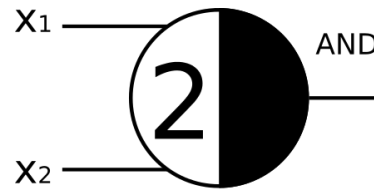
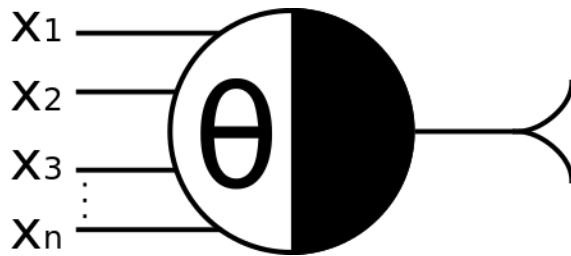
- Limitations of learning prior knowledge
- Kernel function: Human Intervention



- Hierarchical feature Learning

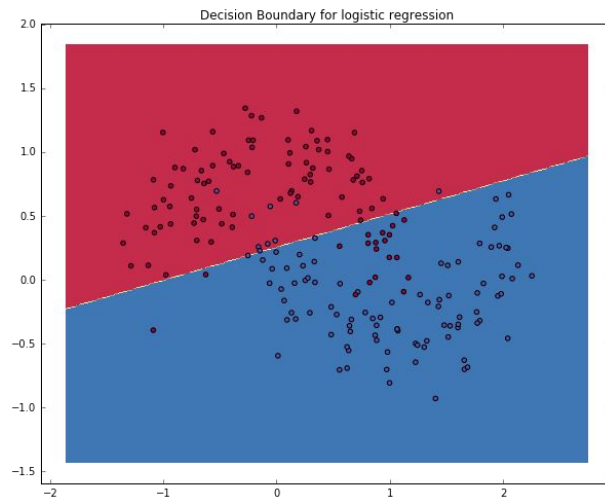
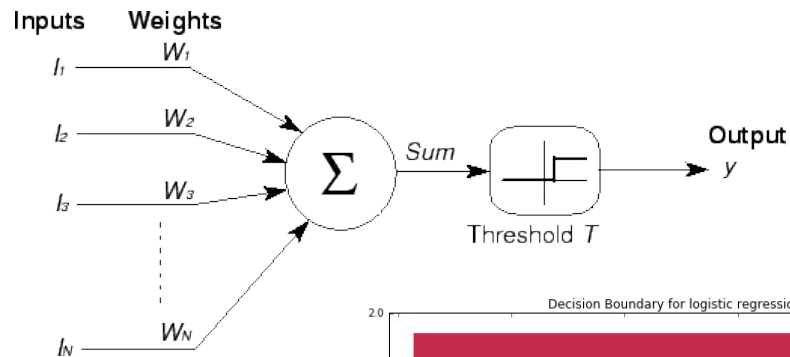
History of Deep Learning (1943)

McCulloch-Pitts Model of Neuron



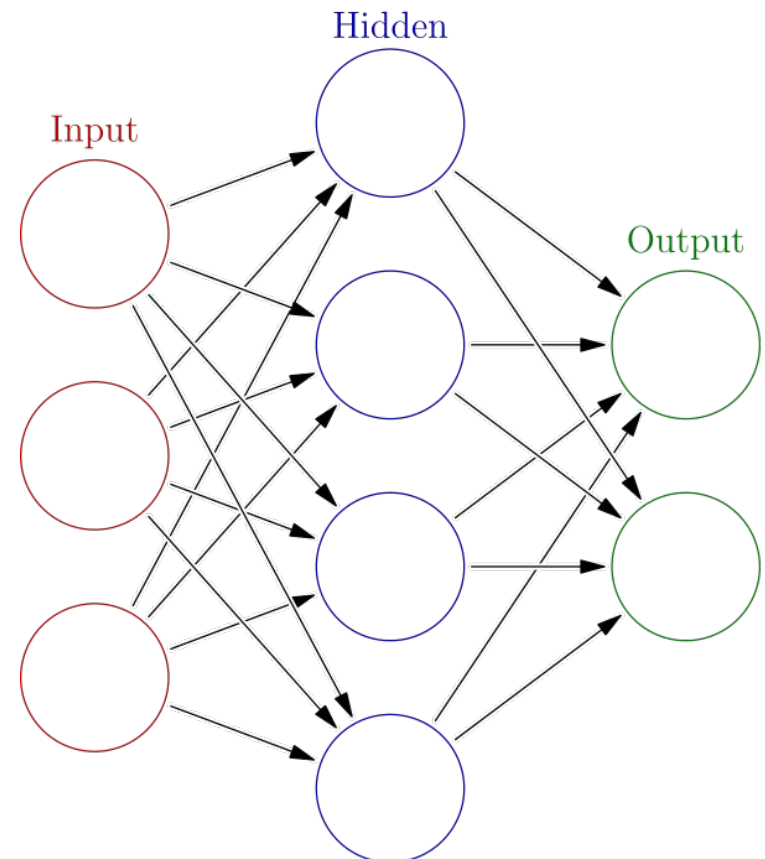
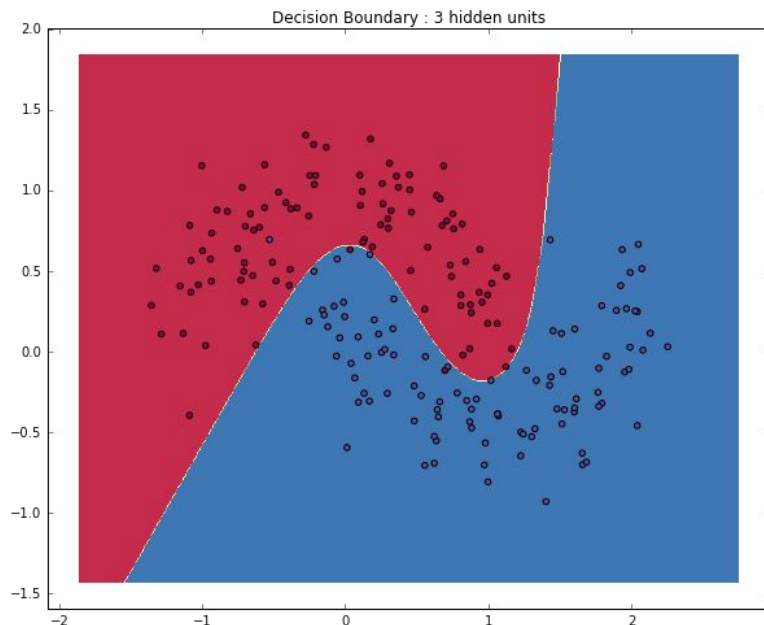
History of Deep Learning (1957)

Frank Rosenblatt: Perceptron Model (including learning algorithm)



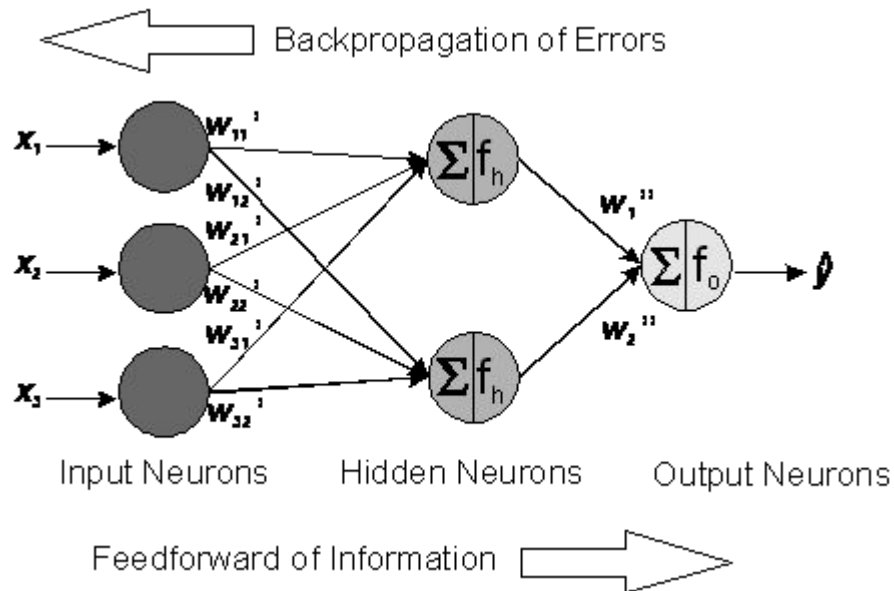
History of Deep Learning

Multi Layer Perceptron
(can approximate any continuous
function)



History of Deep Learning (1986)

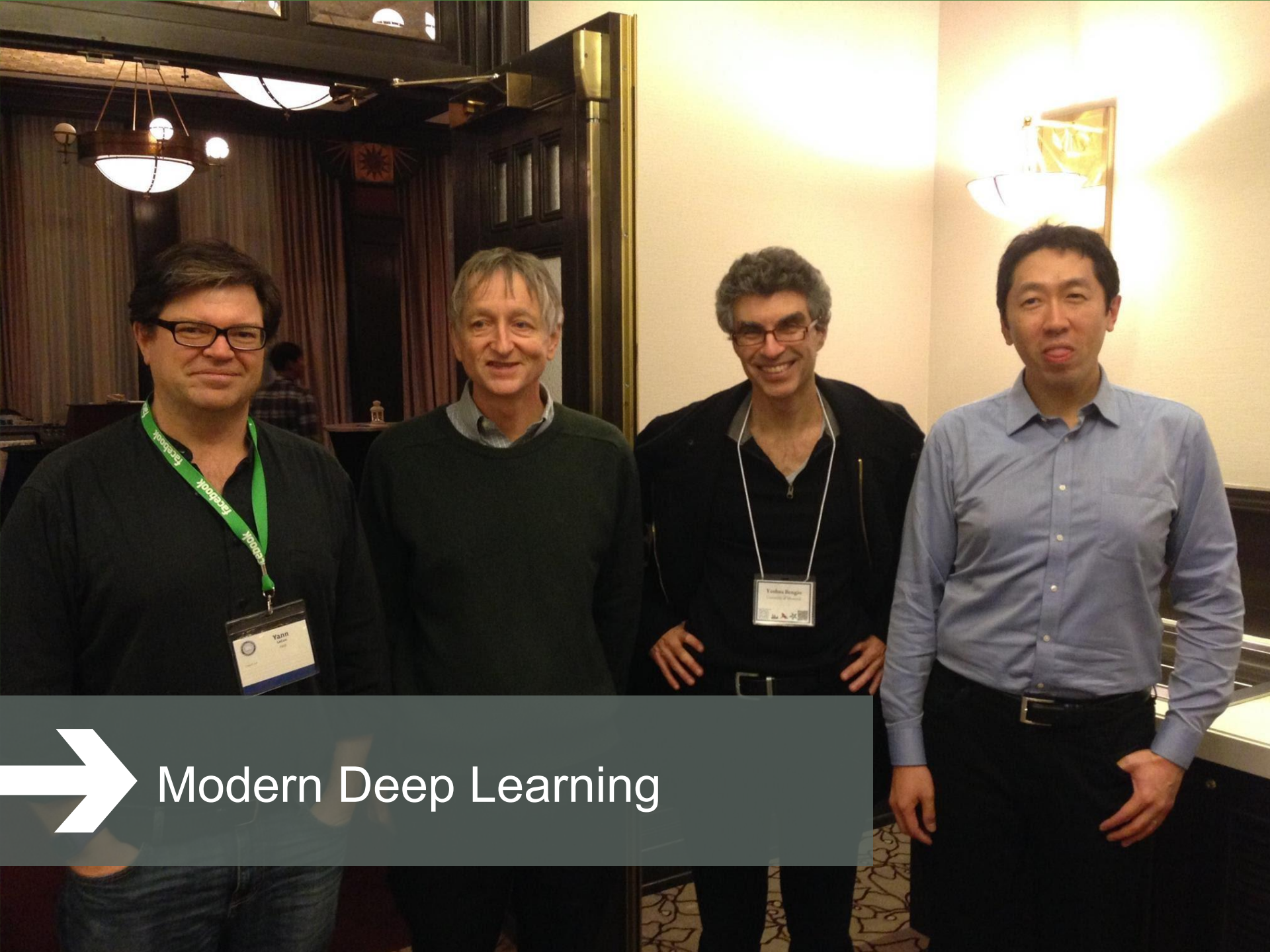
Backpropagation





Demo Time!

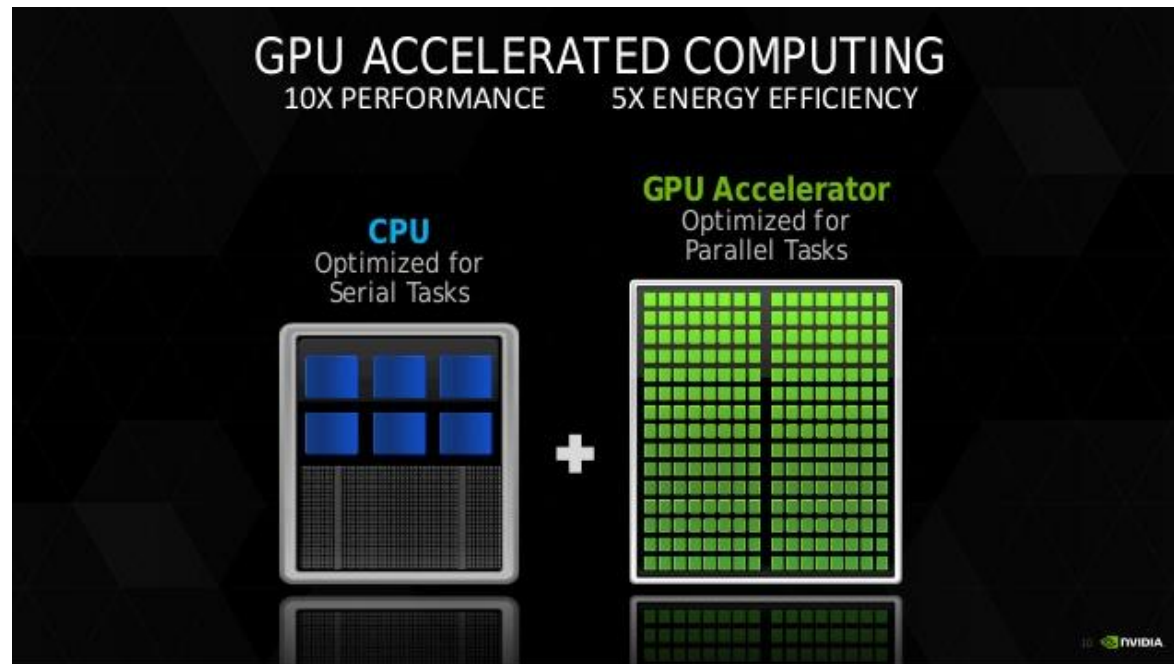
Lets train a neural network!



Modern Deep Learning

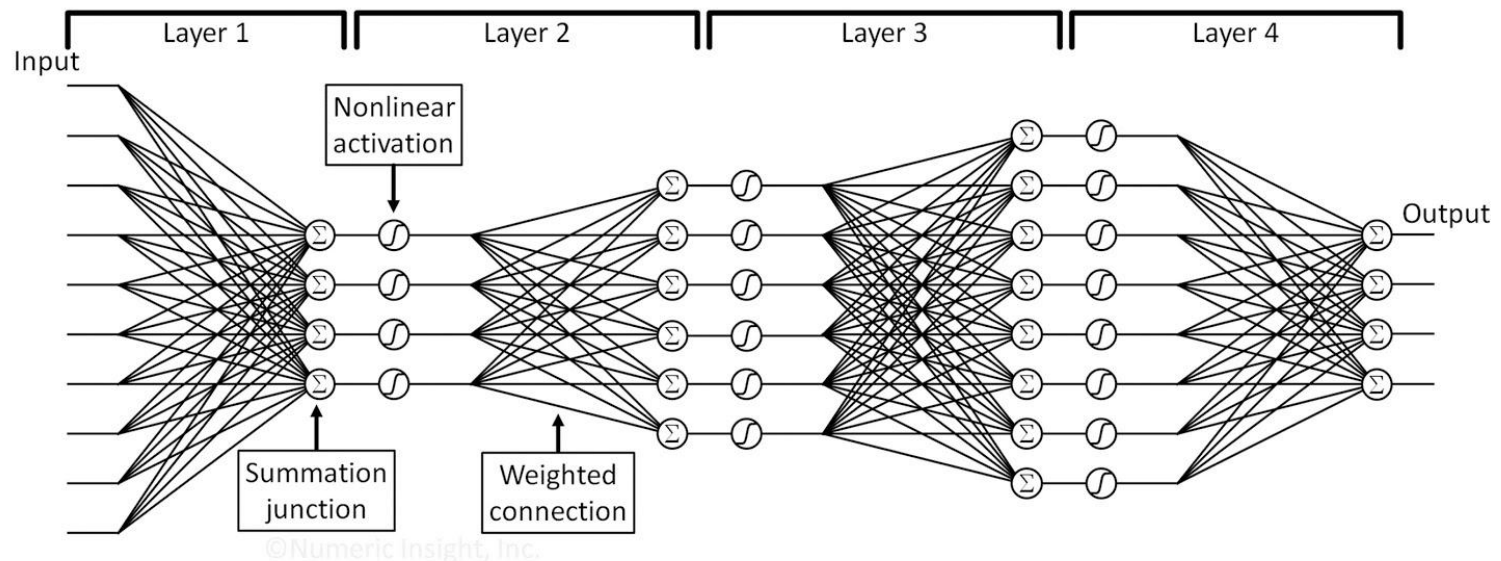
Increased Interest in Deep Learning

- Increased amount of data
- Increased computing power



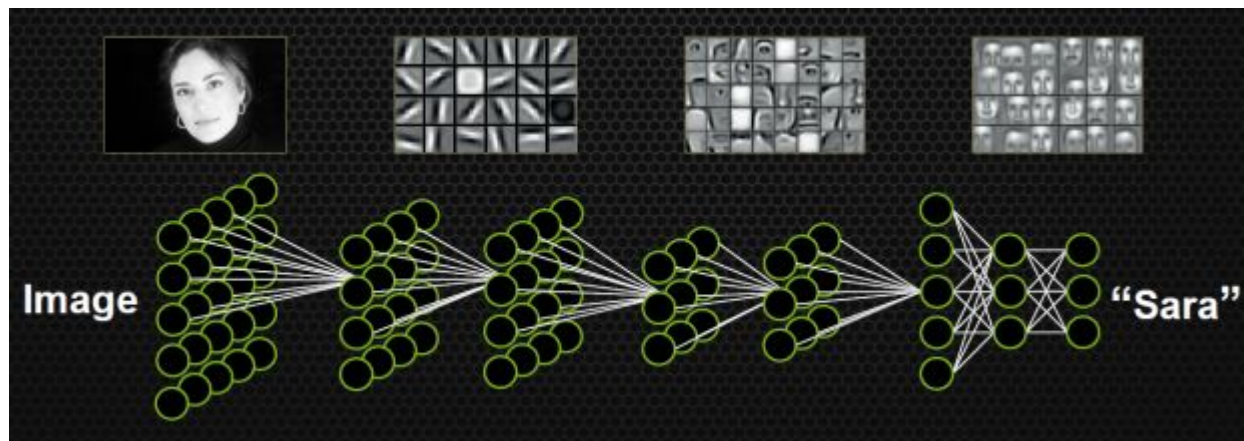
What does “deep” in DL mean?

- Multiple layers of non-linear information processing that are hierarchical in nature



Representation Learning

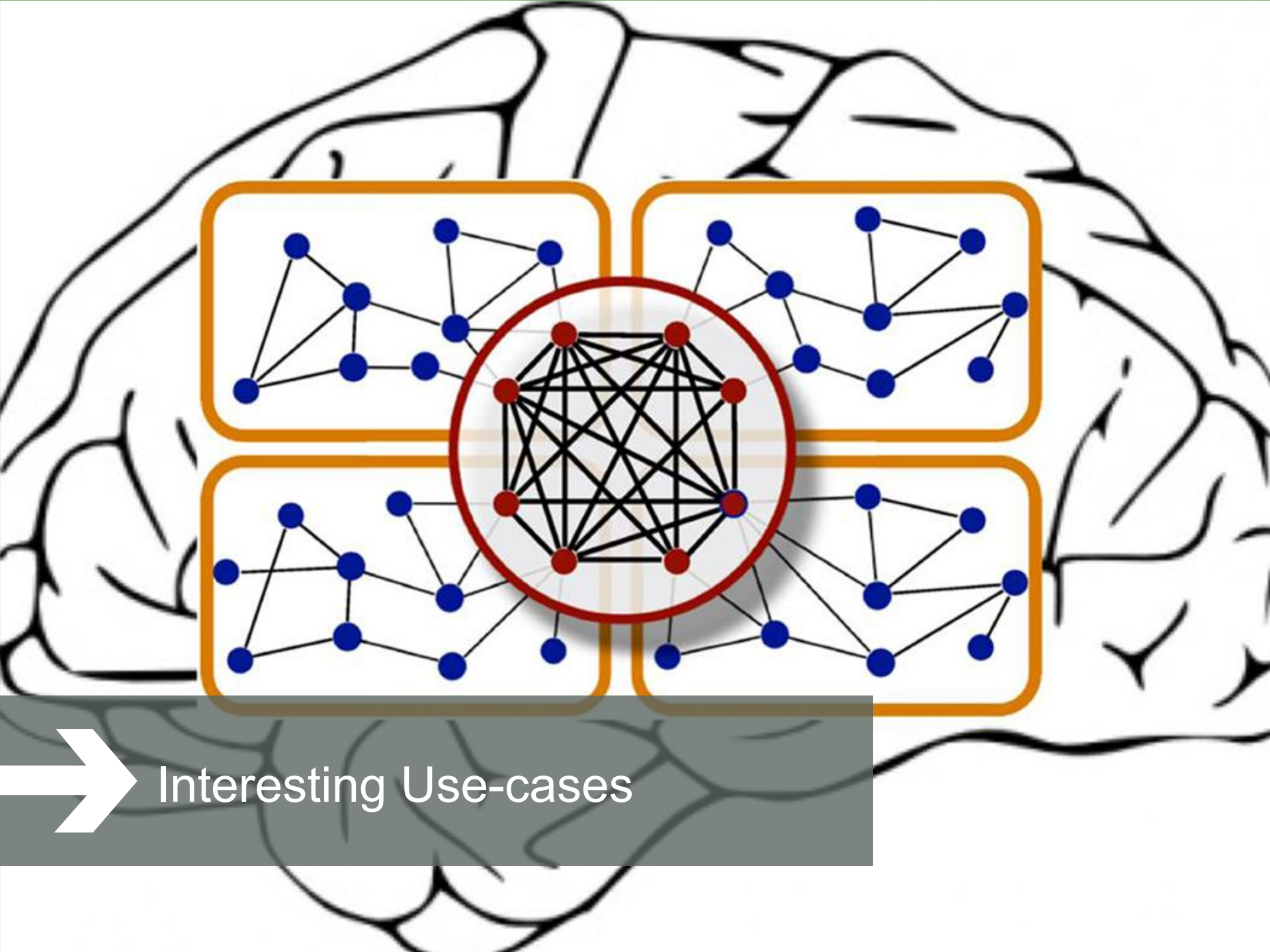
- Representation learning: Transformation of raw data input to a representation that can be effectively exploited
- Output of each layer can be viewed as a representation of the original data
- Each level uses the representation produced by previous level as input





Deep Learning Demo

WORD2VEC

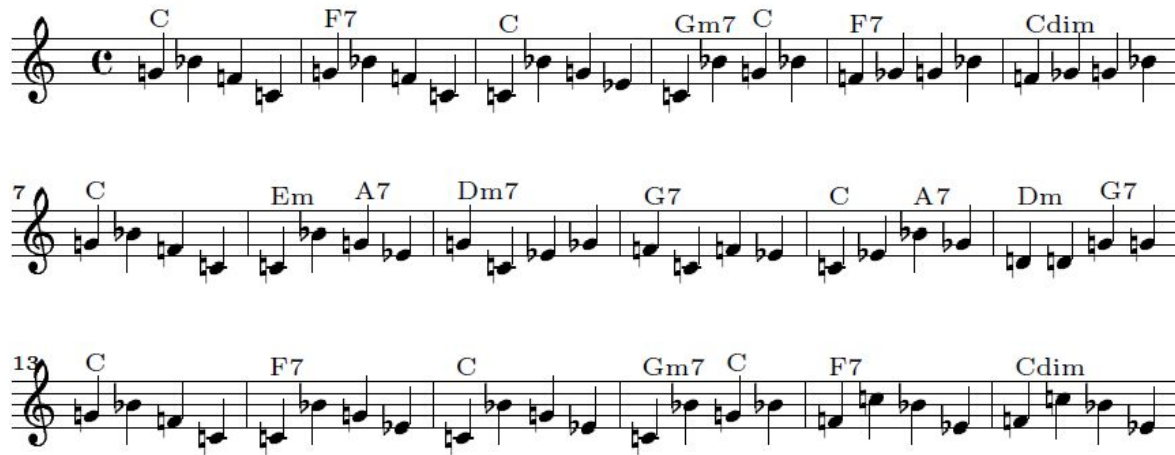


Interesting Use-cases

Composing Music

Recurrent Neural Networks (LSTM)

- Learns to compose blues music
- Network induces both local and global structure of the music
- Composition of novel and pleasing melodies

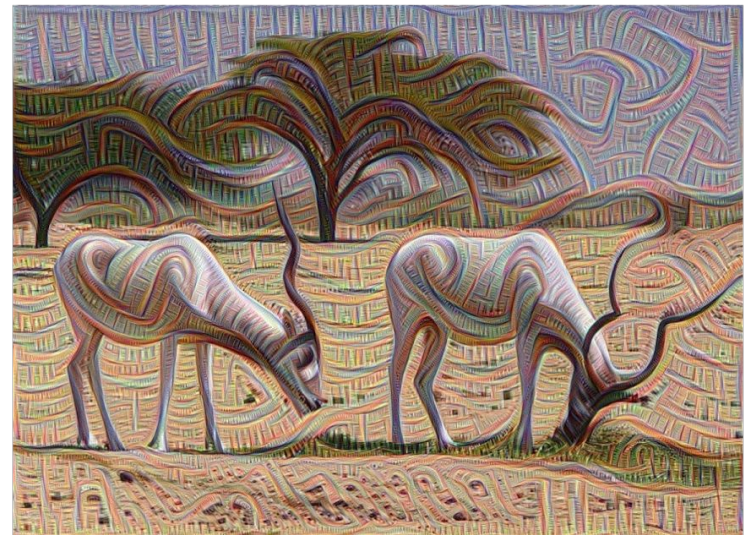


A First Look at Music Composition using LSTM Recurrent Neural Networks [Douglas Eck, Jürgen Schmidhuber]

Deep Dream

Deep Dream

- Originally for ImageNet Large Scale Visual Recognition Challenge
- Idea: Once a network can identify certain objects, it could then also recreate those objects on its own





Where should I start?



Deep Learning Resources

Online Courses

- Deep Learning (Yann LeCun - NYU)
- Deep Learning (Vincent Vanhoucke - Google)
- Neural Networks for Machine Learning (Geoffrey Hinton - Toronto)
- Machine Learning (Andrew Ng)

Blogs

- Colah's Blog
- WildML

Books

- Deep Learning (Yoshua Bengio, ...) MIT Press

Q + A

Thank You for Your DEEP Attention