Introduction to AI using Deep Learning

...

Divyansh Jha

Intel SA for AI

What is Intelligence?

Why are we Intelligent?

What does it mean something to be artificially intelligent?

Goal of Artificial Intelligence Community

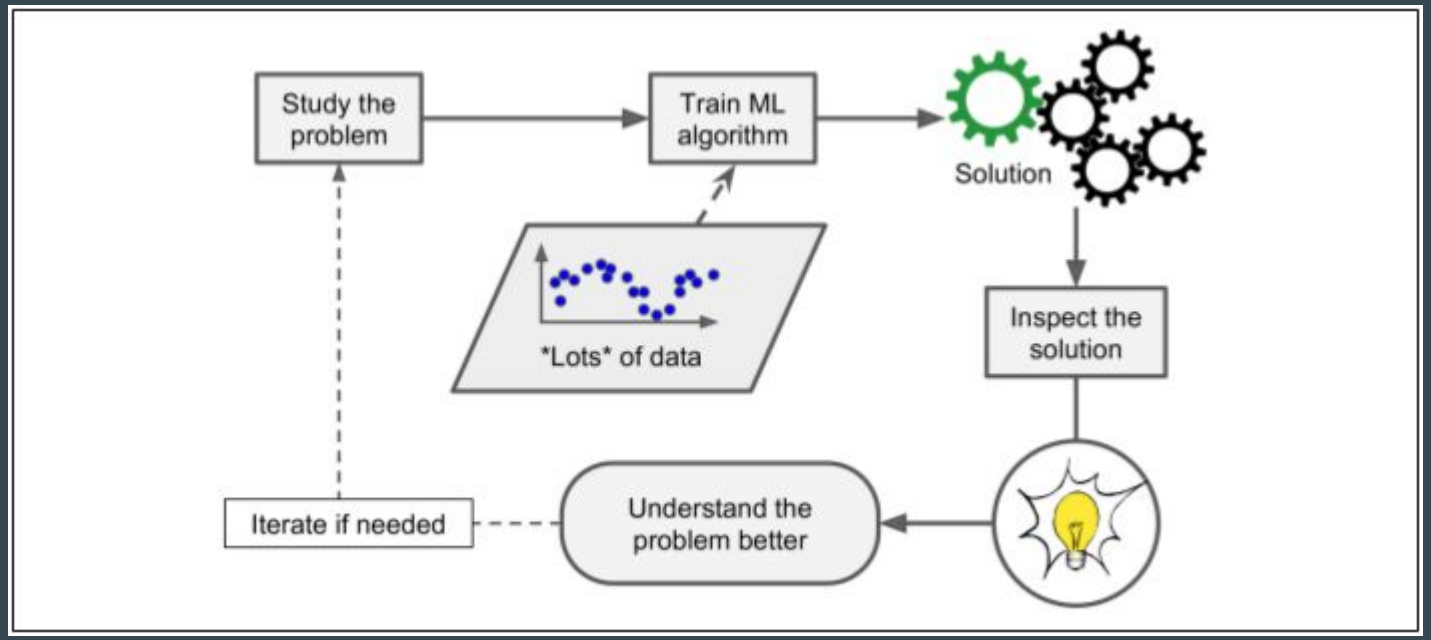
- Goal is to make machines artificially intelligent.(To see, understand, respond) (Alexa competition)
- Companies like Google, Microsoft, Facebook are working to achieve this.
- Various Researchers like Geoffrey Hinton, Yann LeCun, Yoshua Bengio

How can we create AI systems?

What is Machine Learning?

- Machine learning is an application of artificial intelligence (AI) that provides systems the ability to automatically learn and improve from experience without being explicitly programmed.

ML algorithms need data!

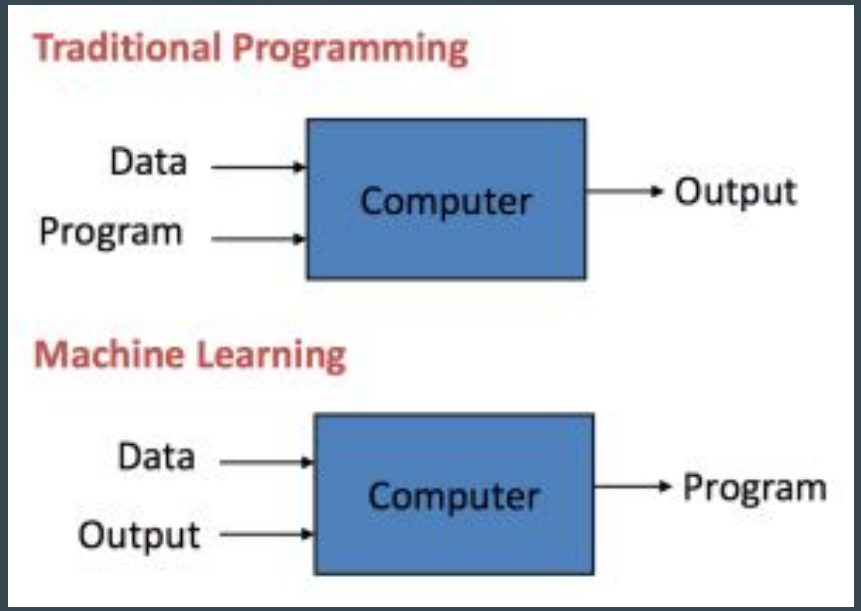



Step 1
Gathering data from various sources
Step 2
Cleaning data to have homogeneity
Step 3
Model Building- Selecting the right ML algorithm
Step 4
Gaining insights from the model's results
Step 5
Data Visualization- Transforming results into visuals graphs

ML is great for:

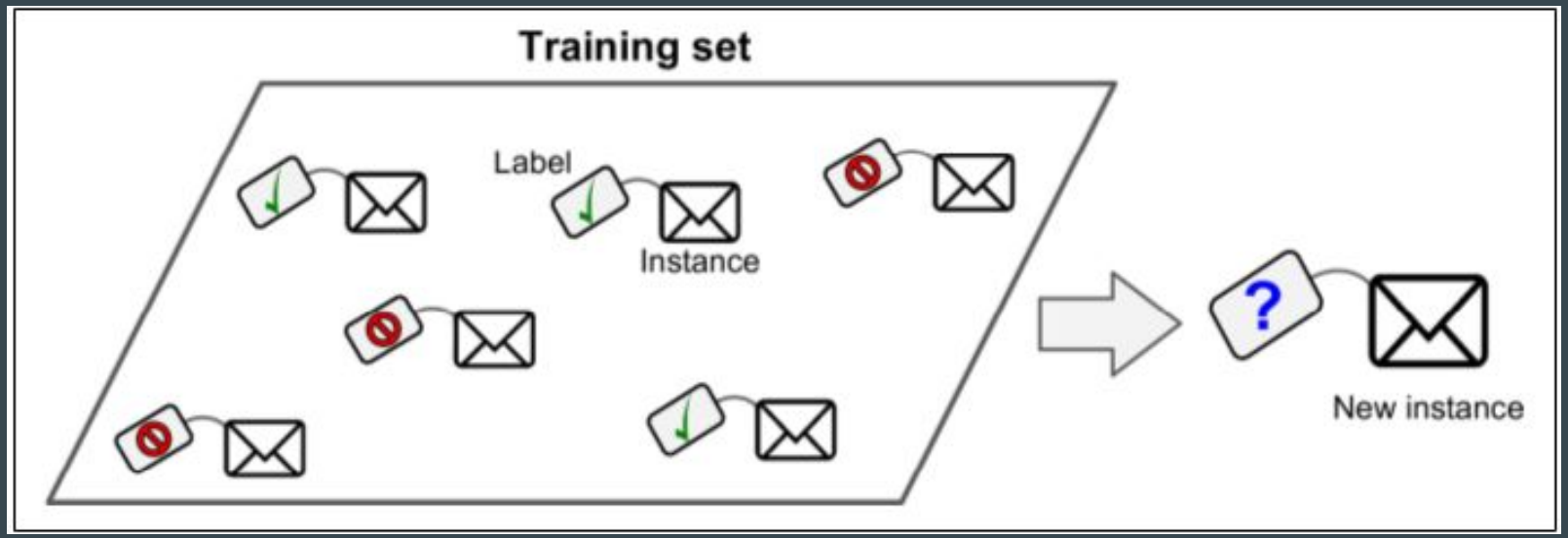
- Problems for which existing solutions require a lot of hand-tuning or long lists of rules: one Machine Learning algorithm can often simplify code and perform better.
- Complex problems for which there is no good solution at all using a traditional approach: the best Machine Learning techniques can find a solution.
- Fluctuating environments: a Machine Learning system can adapt to new data.
- Getting insights about complex problems and large amounts of data.

Supervised Learning



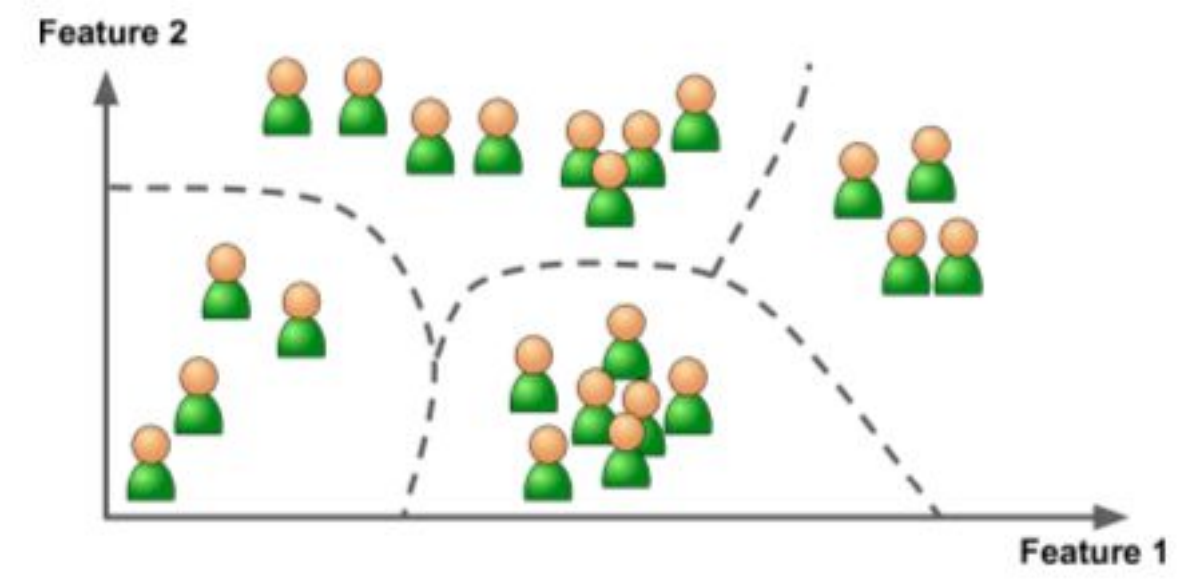
$$Y=f(X)$$

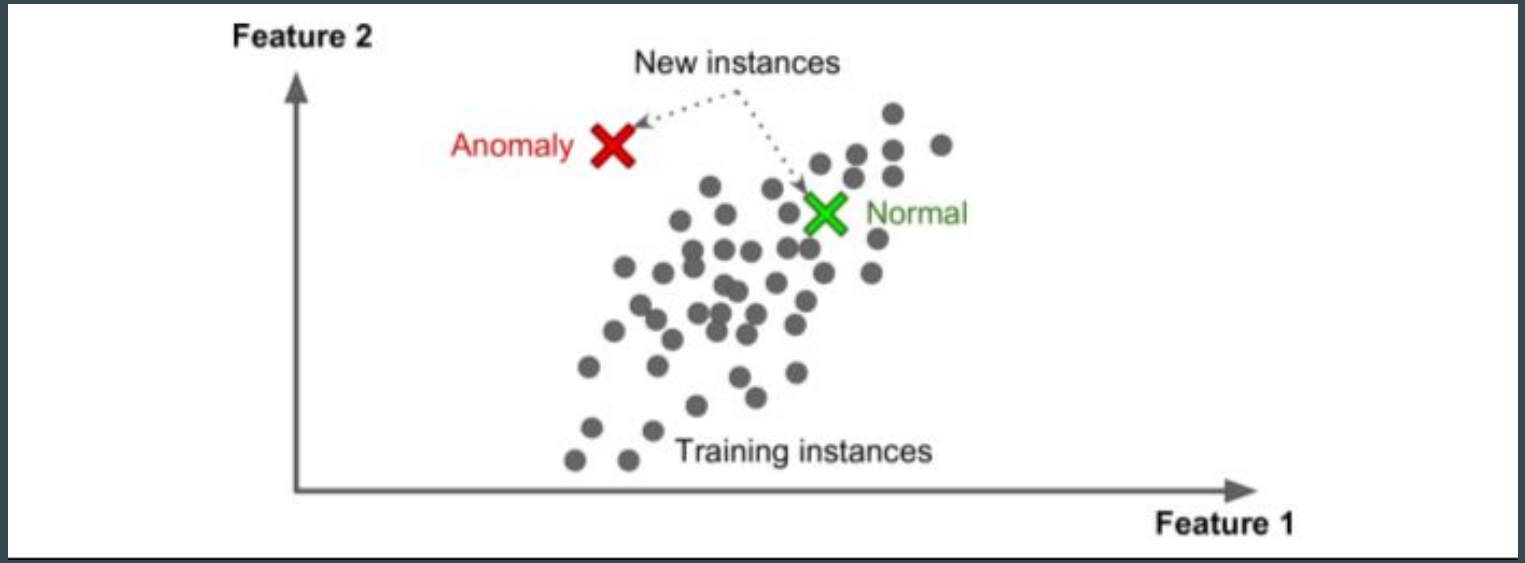
Classification

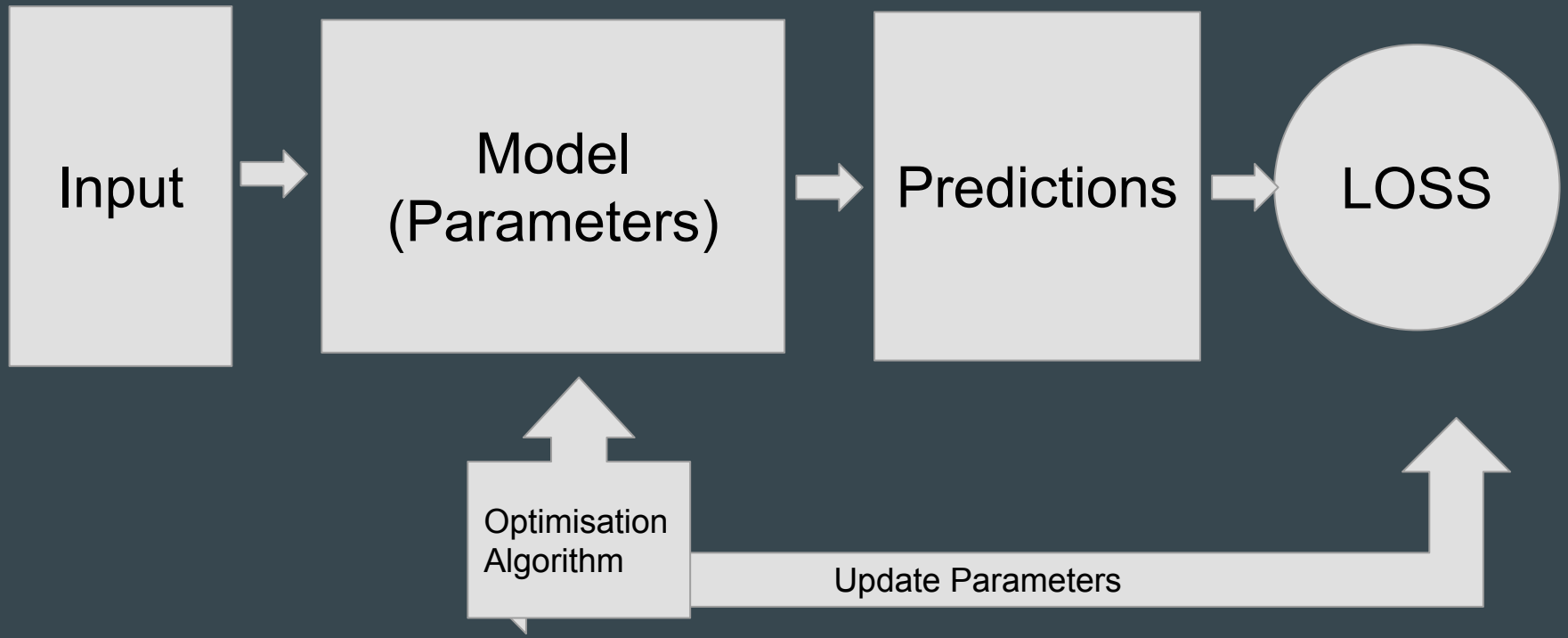


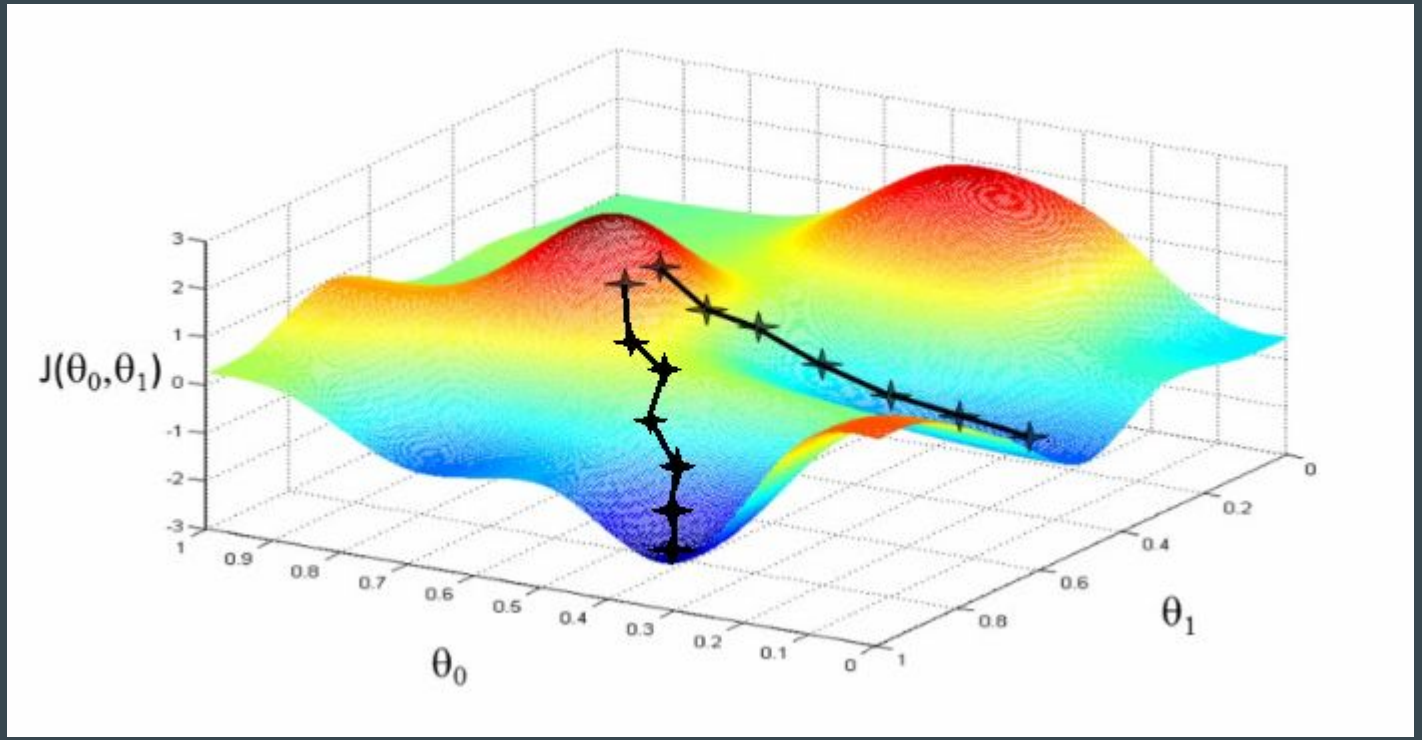
Regression

Unsupervised Learning



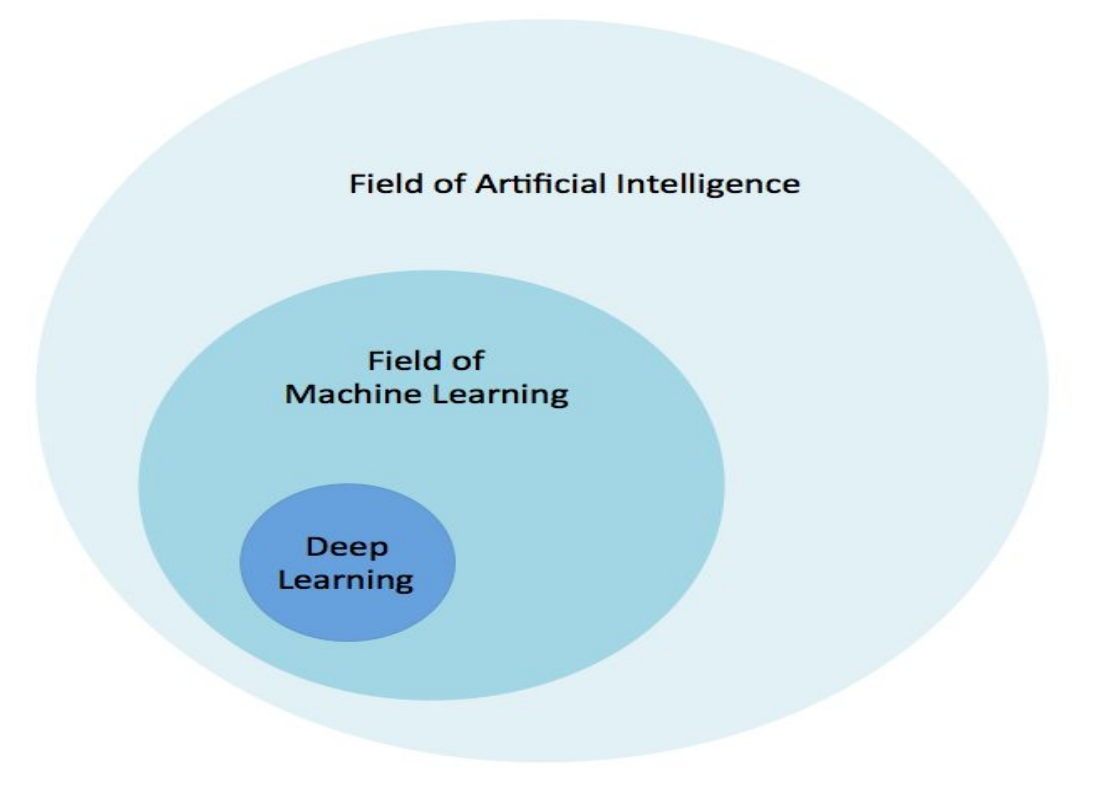

Feature 2
New instances
Anomaly
Normal
Training instances
Feature 1


Input
Model
(Parameters)
Predictions
LOSS
Optimisation
Algorithm
Update Parameters


J(θ0,θ1)
3
2
1
0
-1
-2
-3
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
θ0
0
0.2
0.4
0.6
0.8
1
θ1

What is Deep Learning?

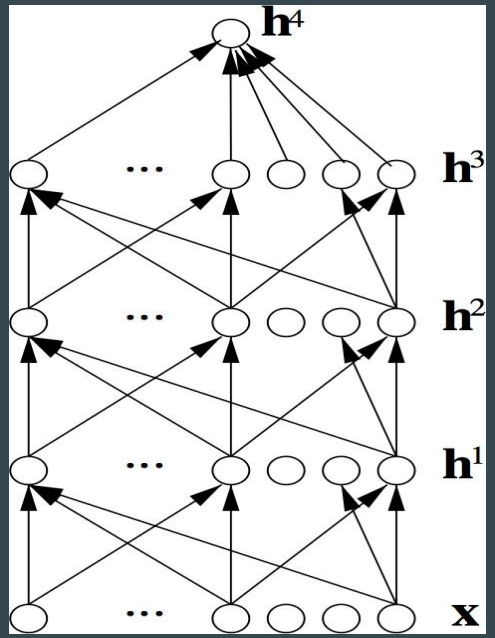
Subset of Machine Learning



- Deep learning algorithms attempt to learn (multiple levels of) representation and an output

  From “raw” inputs x

  (e.g., sound, characters, or words)

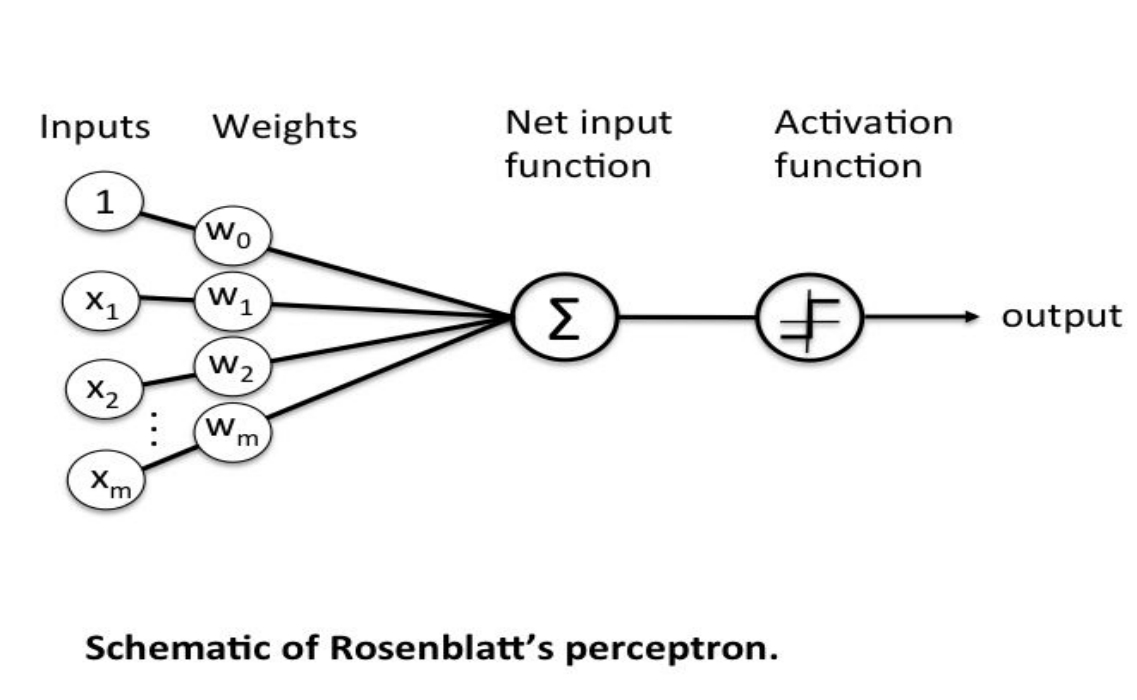


Why Deep Learning?

Most machine learning methods work well because of human-designed representations and input features

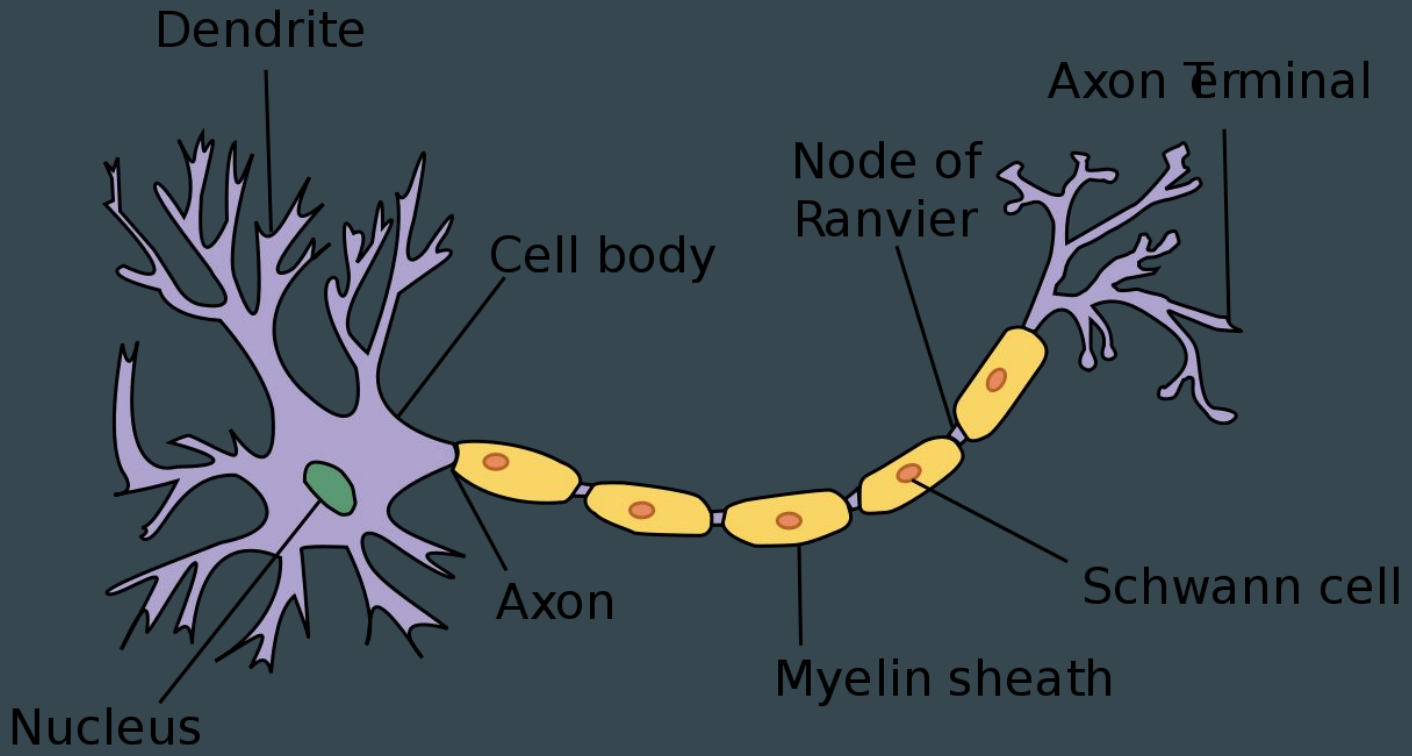
For example: features for finding named entities like locations or organization names (Finkel et al., 2010):

Perceptron/ Linear Model

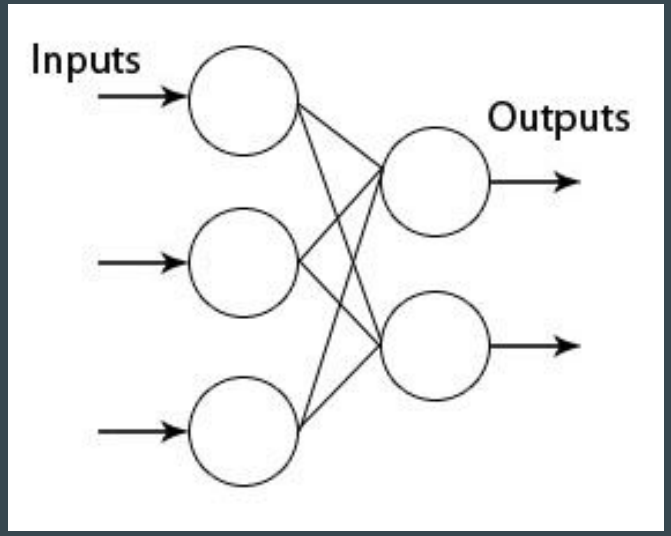


Schematic of Rosenblatt's perceptron.

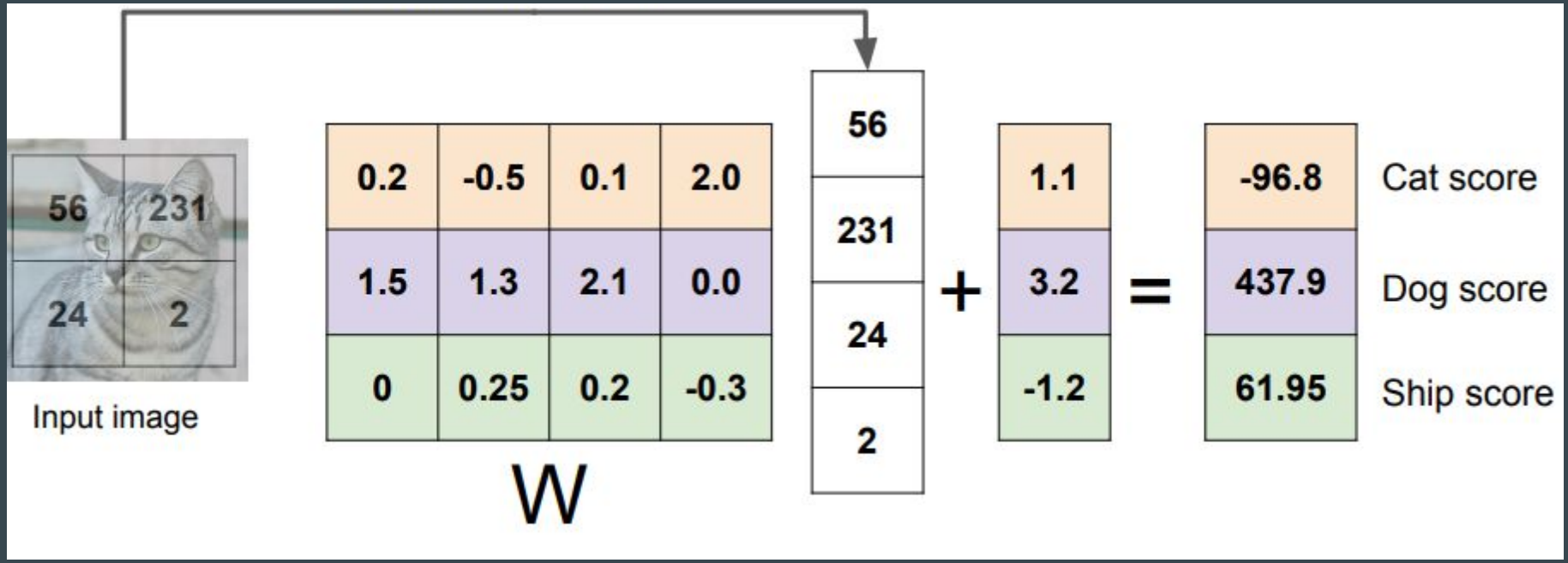
Inspired from the Human Neuron



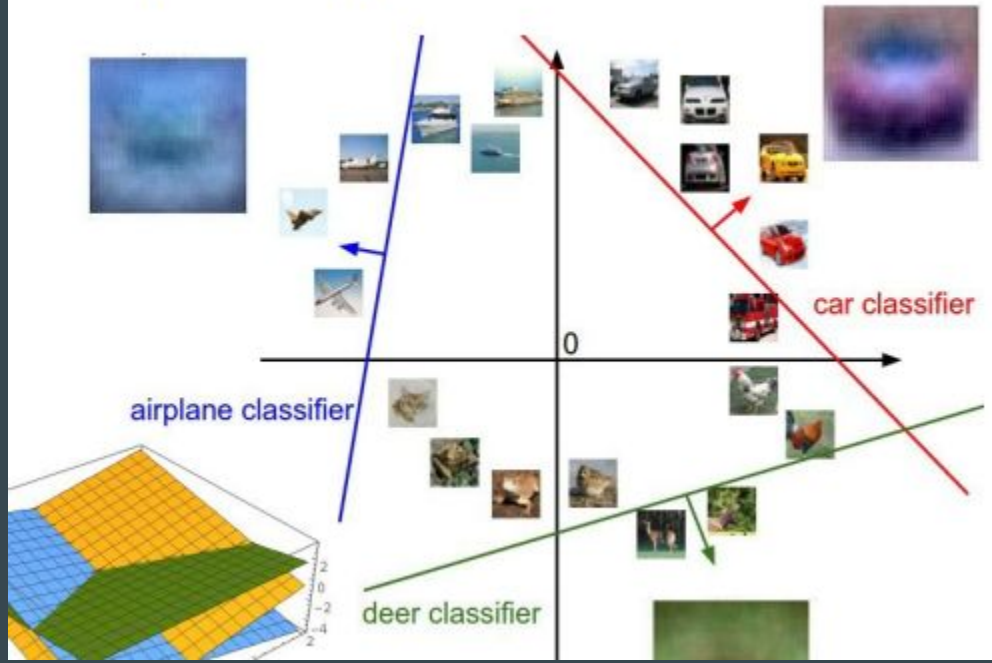
Linear Model Contd...



For eg. - Classification



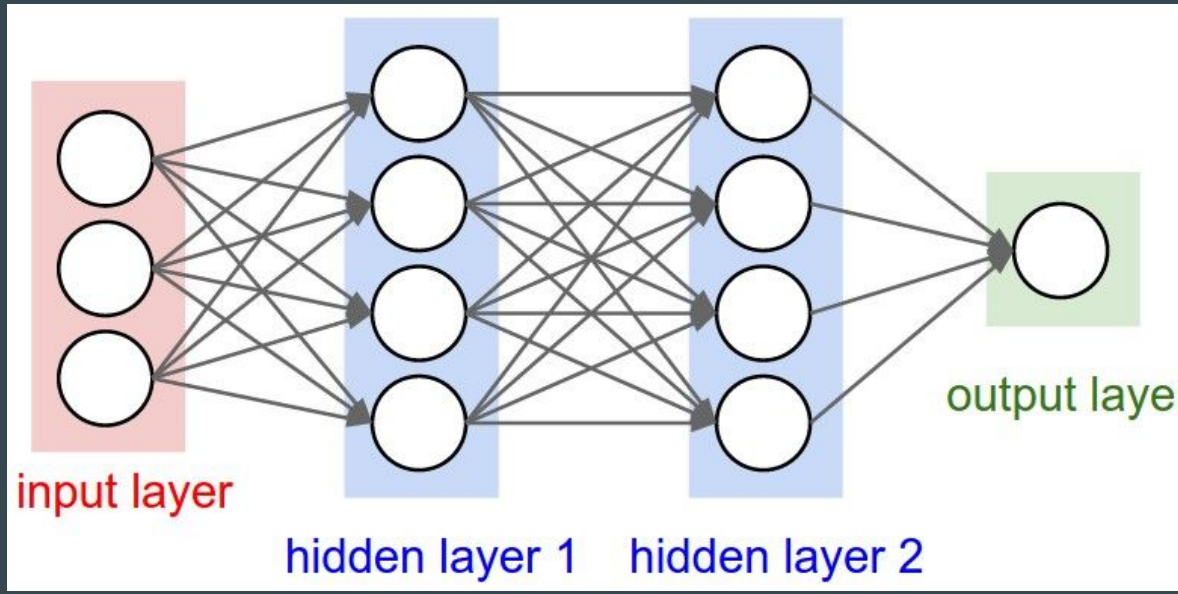
Interpreting a Linear Classifier



$$f(x,W) = Wx + b$$

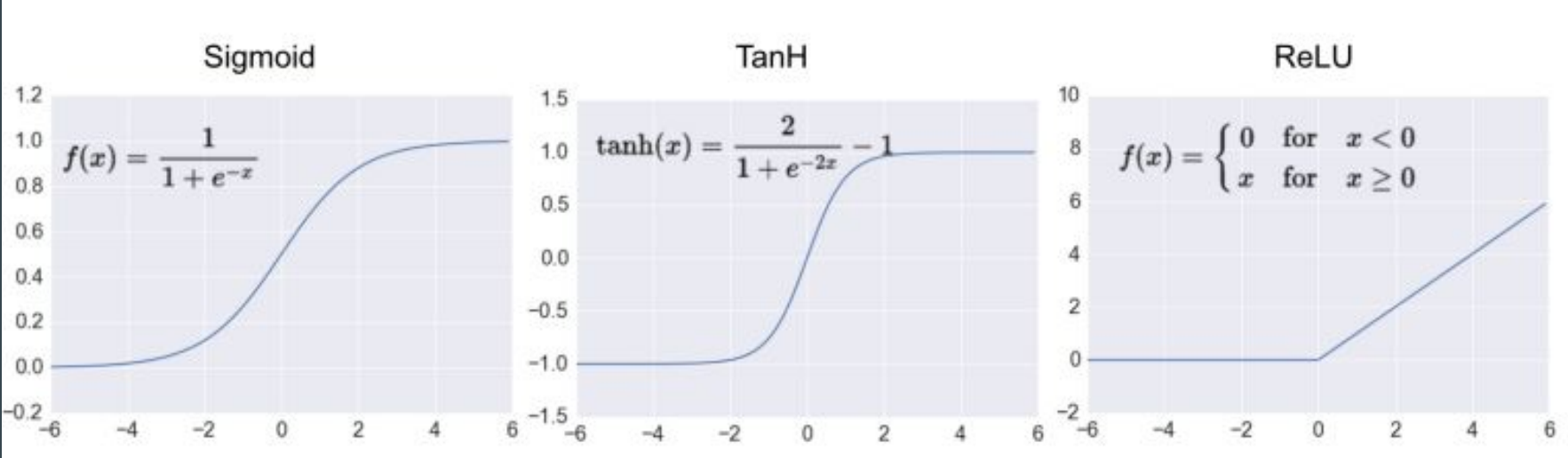
Array of **32x32x3** numbers
(3072 numbers total)

Multilayer Perceptron



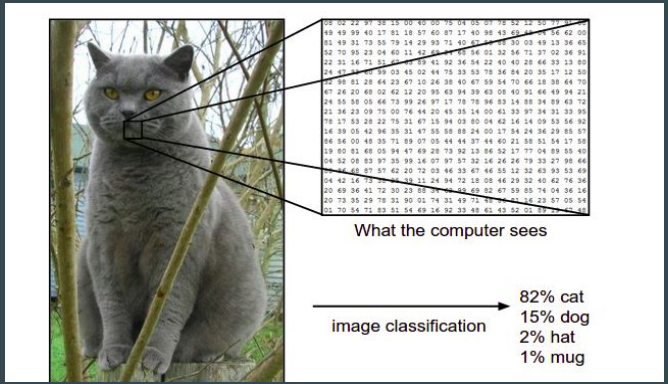

```
# forward-pass of a 3-layer neural network:
f = lambda x: 1.0/(1.0 + np.exp(-x)) # activation function (use sigmoid)
x = np.random.randn(3, 1) # random input vector of three numbers (3x1)
h1 = f(np.dot(W1, x) + b1) # calculate first hidden layer activations (4x1)
h2 = f(np.dot(W2, h1) + b2) # calculate second hidden layer activations (4x1)
out = np.dot(W3, h2) + b3 # output neuron (1x1)
```

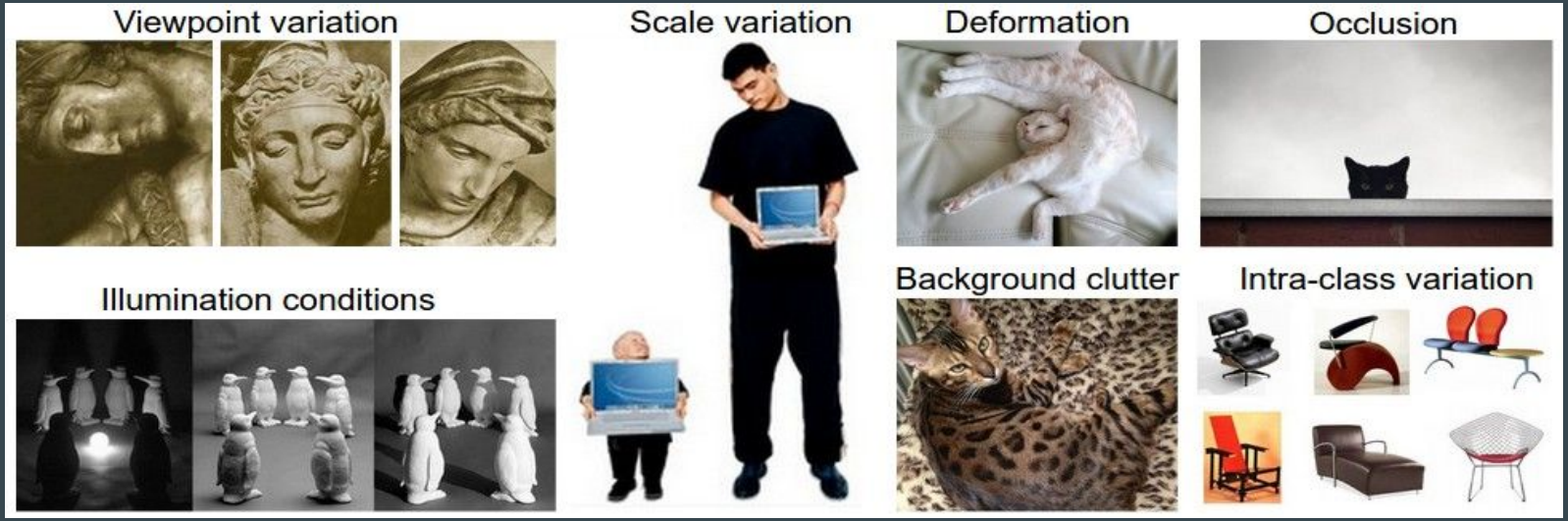
Activation Functions



Deep Learning for Image Classification

- Problems in Image Classification





Deep Learning Frameworks

Intel AI Academy

- Free access to DevCloud for members
- Free Machine Learning and Deep learning Courses
- Community Support by Intel DevMesh
- https://software.intel.com/en-us/ai-academy/basics

What is the Intel® Nervana™ AI Academy?

http://software.intel.com/ai

Learn

Online tutorials

Webinars

Student kits

Support forums

For beginners to advanced developers

Develop

Intel Optimized Frameworks

Exclusive access to Intel® Nervana™ DevCloud

For Developers, Students, Professors and Startups

Teach

Comprehensive courseware

Hands-on labs

Cloud compute

Technical Support

For Instructors Worldwide

Share

Project showcase opportunities at

Intel Developer Mesh,

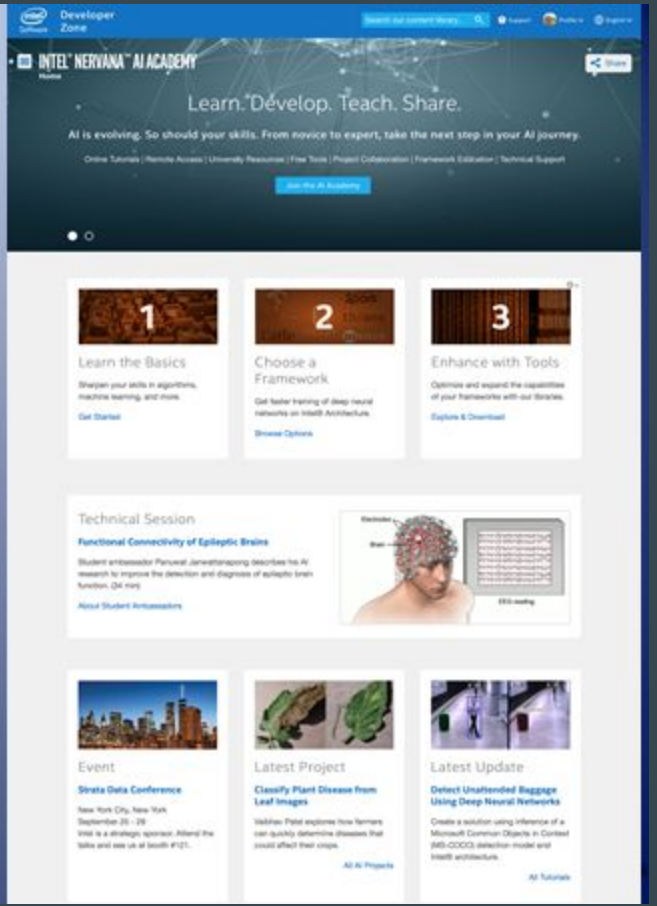
Industry

Academic events

For Developers, Student Ambassadors and Instructors

Join the Academy

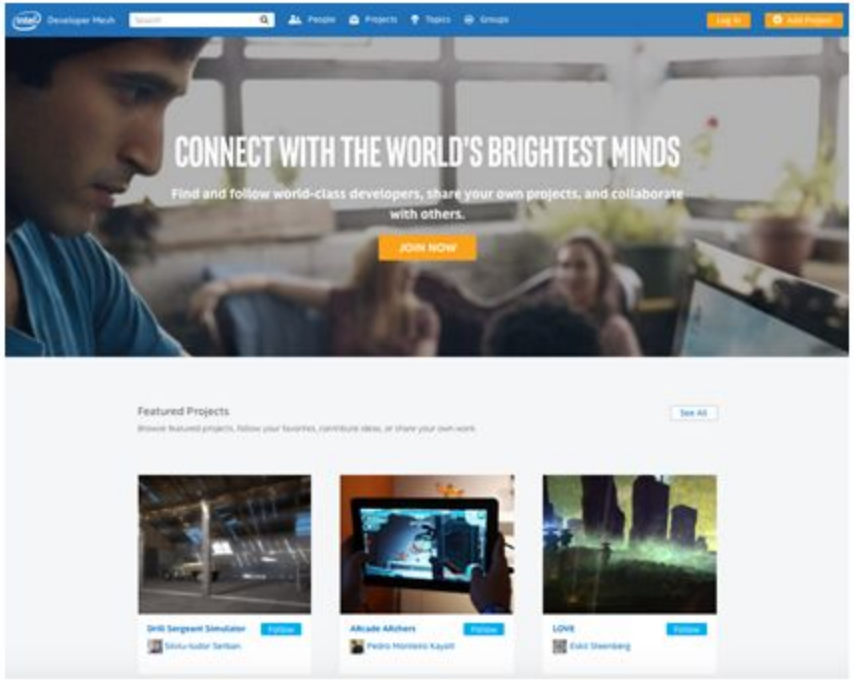
http://software.intel.com/ai



DevMesh

Tell us what you are working on – papers, research, projects – this site is a way for us to learn about amazing work and engage further!

Join the Student Group on DevMesh at **devmesh.intel.com**



Intel AI Devcloud

- Highly optimised python
- Intel Math Kernel Library
- Optimised DL frameworks

Let’s Build an Image Classifier in Keras using an MLP

Convolutional Neural Networks

It is the workhorse of Computer Vision

Four main parts

- Convolution
- Non-Linearity (Activation Function)
- Pooling
- MLP

What is Convolution?

http://setosa.io/ev/image-kernels/

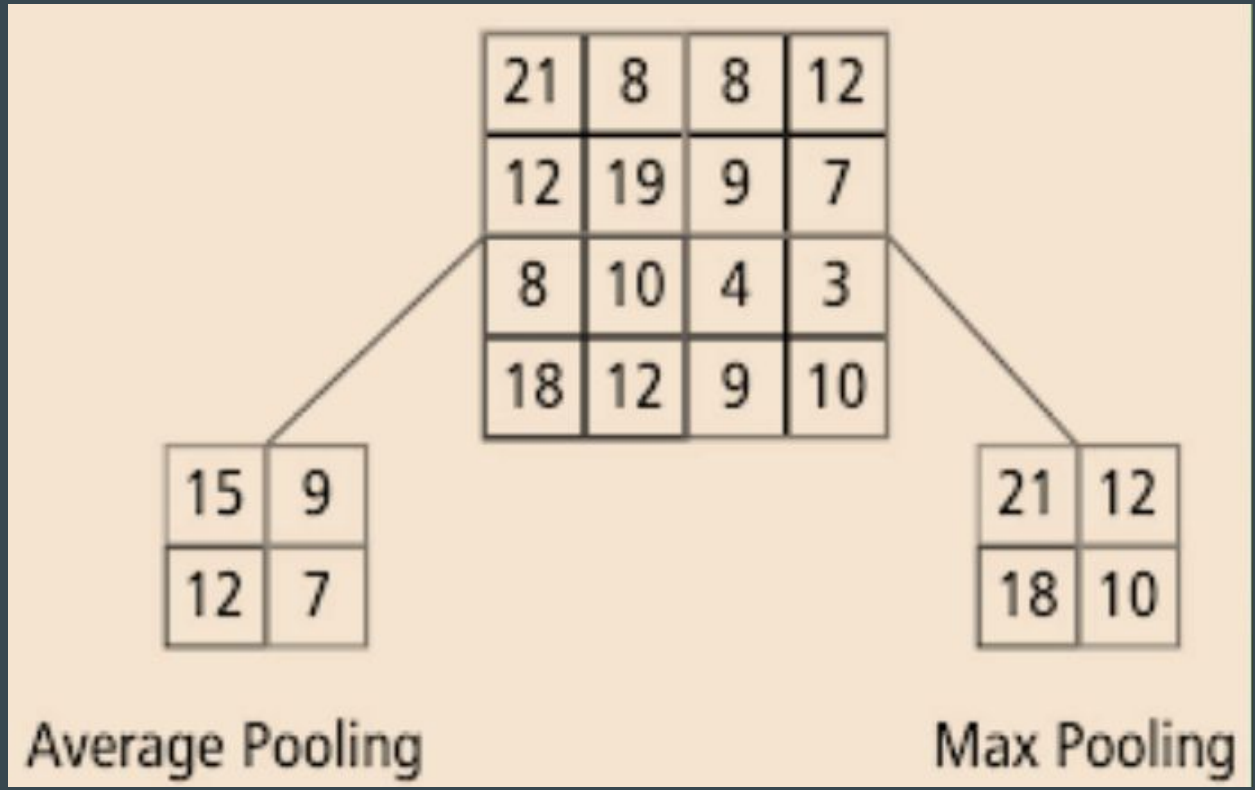
Strides and Padding

Stride: the step of the convolution operation.

When the stride is 1 then we move the filters one pixel at a time.

The nice feature of zero padding is that it will allow us to control the spatial size of the output volumes.

Pooling


21 8 8 12
12 19 9 7
8 10 4 3
18 12 9 10
15 9
12 7
21 12
18 10
Average Pooling
Max Pooling

Convolution

Max Pooling

A new image

Convolution

Max Pooling

A new image

Flattened

Fully Connected Feedforward network

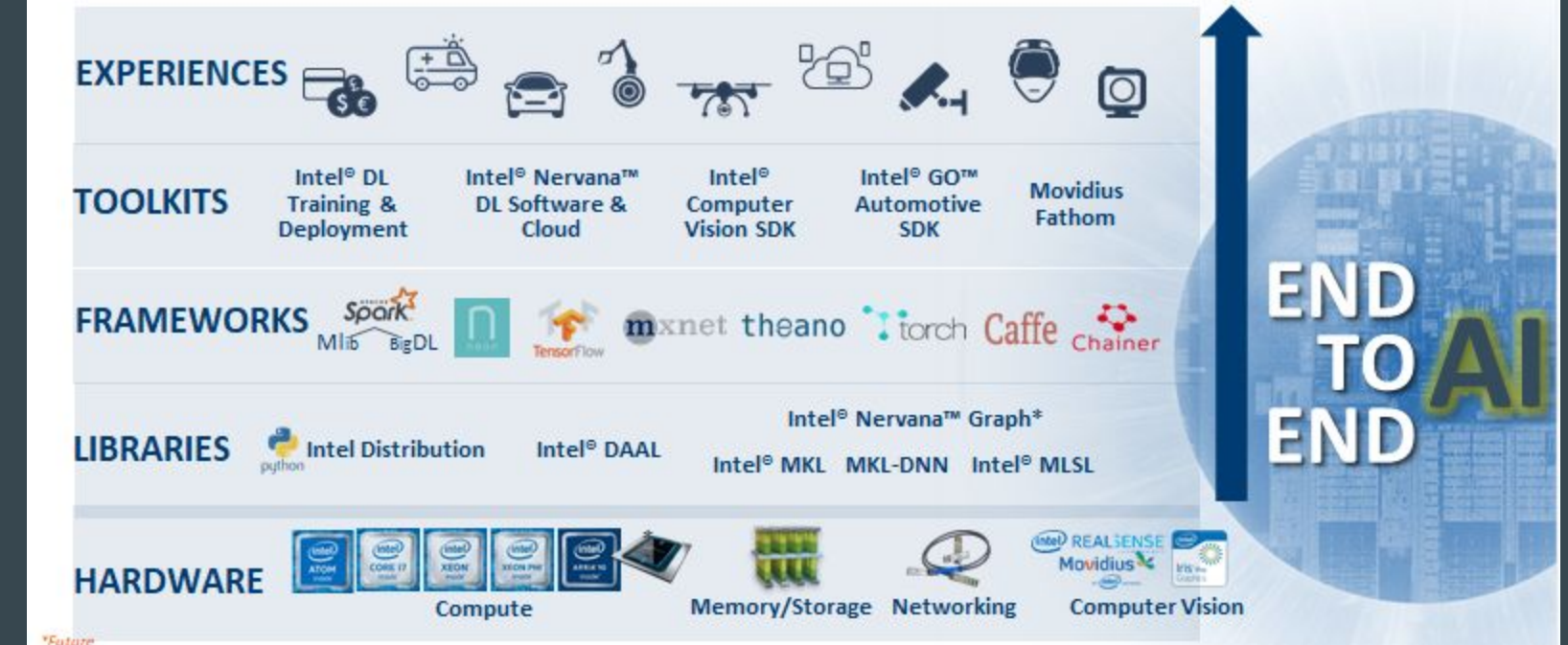
Cat/Dog ⋯

Let’s Build a ConvNet in Keras

Intel® Movidius™ Neural Compute Stick

Get started: https://developer.movidius.com/

INTEL® NERVANA™ PORTFOLIO



*Future

My Project Overview

AI Saturdays

Resources

- Intel AI academy
- Hand-on Machine learning book
- Deeplearning.ai Coursera course
- CS231n Course by Stanford
- Fast.ai