

# Deep Learning: Tensorflow, CNTK

**Jen Stirrup**  
**Data Whisperer**  
**Data Relish**  
Level: Intermediate

*The Ultimate Education Destination*



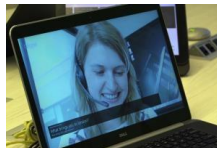
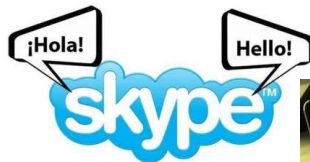
**2018**  
**Orlando**

# Agenda

- What is deep learning?
- Tensorflow
- CNTK

# Deep learning at Microsoft

- Microsoft Cognitive Services
- Skype Translator
- Cortana
- Bing
- HoloLens
- Microsoft Research





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# Uber to require selfie security check from drivers

Using Microsoft Cognitive Services, Uber hopes to make riders feel safer by verifying the ID of drivers before rides are given.



By [Jake Smith](#) for [iGeneration](#) | September 23, 2016 -- 19:59 GMT (03:59 GMT+08:00) | Topic: [Innovation](#)



f 23

in 3



Uber [announced](#) on Friday a new security feature called Real-Time ID Check that will require drivers to periodically take a selfie before starting their driving shift.

The feature, which begins rolling out to US cities on Friday, uses Microsoft Cognitive Services to reduce fraud and give riders an extra sense of security.

Uber says Microsoft's feature instantly compares the selfie to the one corresponding with the account on file. If the two

## RECOMMENDED FOR YOU

Software Defined Networking Service (Japanese)

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## SHARING ECONOMY



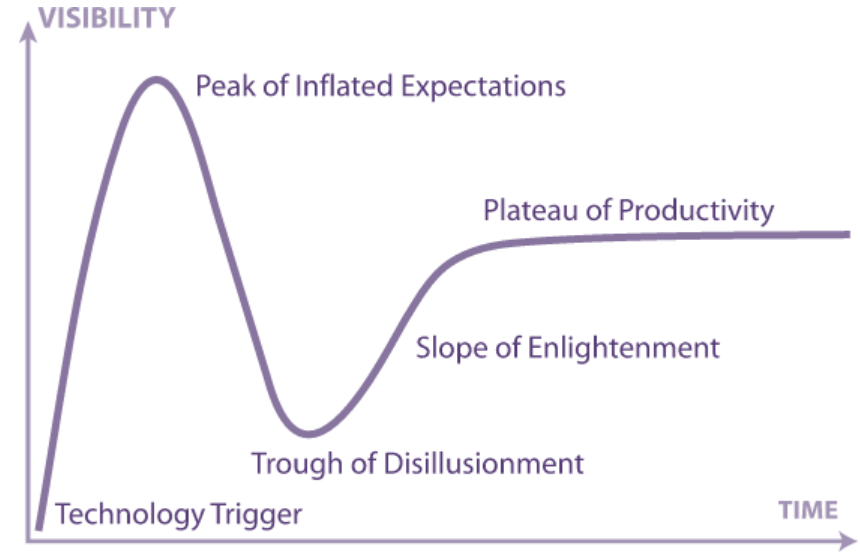
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Innovation  
**Victoria partners with Bosch for self-driving vehicle development**

*“We tend to overestimate the effect of a technology in the short run and underestimate the effect in the long run”*

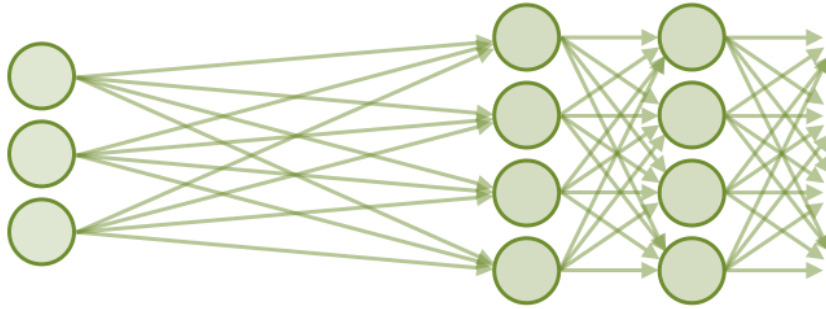
*- Roy Amara*



# What is Deep Learning?

# What is a Neural Network?

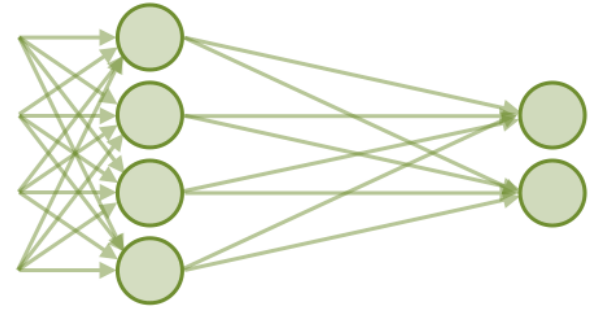
- Neural networks are a class of models that are built with layers.
- Commonly used types of neural networks include convolutional and recurrent neural networks.



Input layer

Hidden layer 1

...



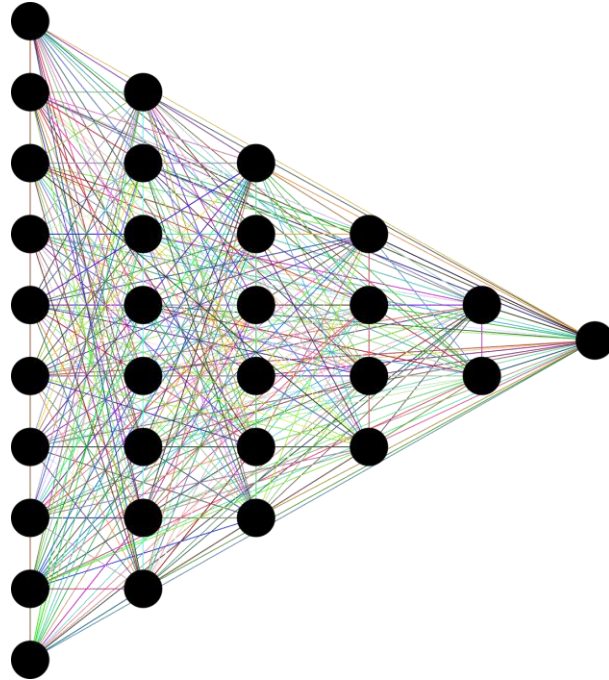
...

Hidden layer  $k$

Output layer



# Deep Learning and Big Data



CONSUMER STORAGE  
COMPUTERS MARKETING SAMPLE  
BYTES **BIG DATA** RESEARCH  
BEHAVIOR ANALYTICS TECHNOLOGY  
INFORMATION SIZE INTERNET

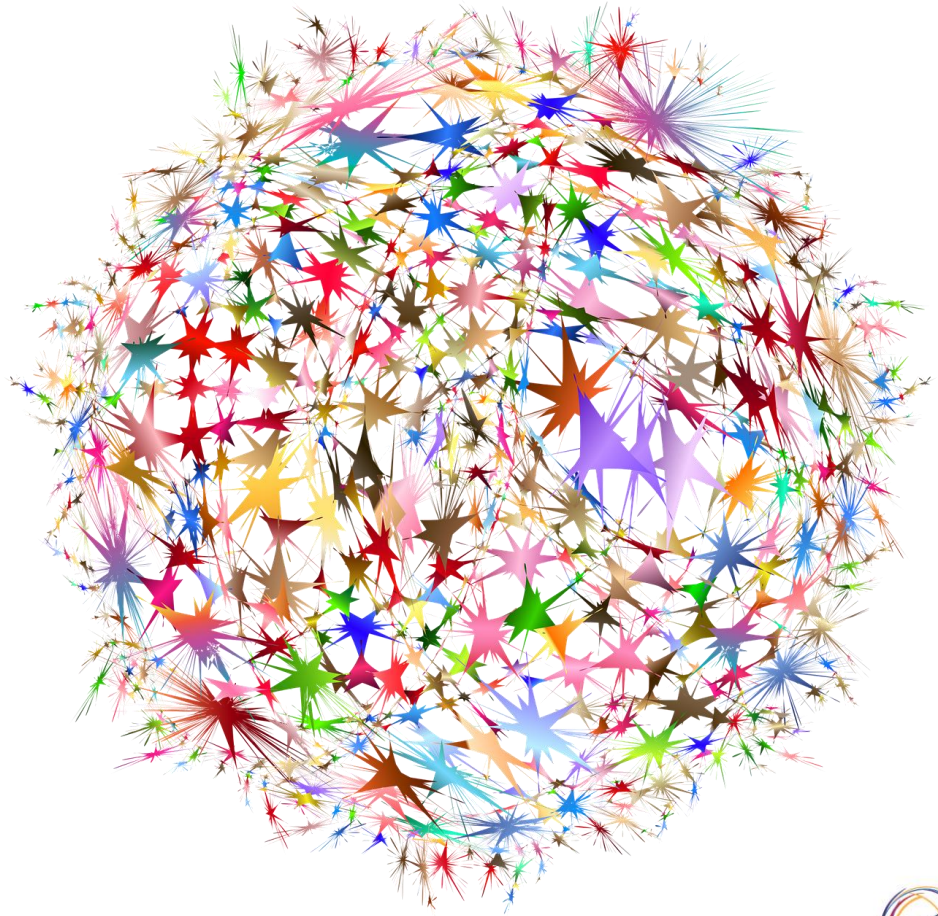
## Size of Data?

How much data do you need for deep learning?

Why is it different?

Interpreting  
text, images  
and video

Automate  
Object  
Detection



# Deep Learning at Microsoft

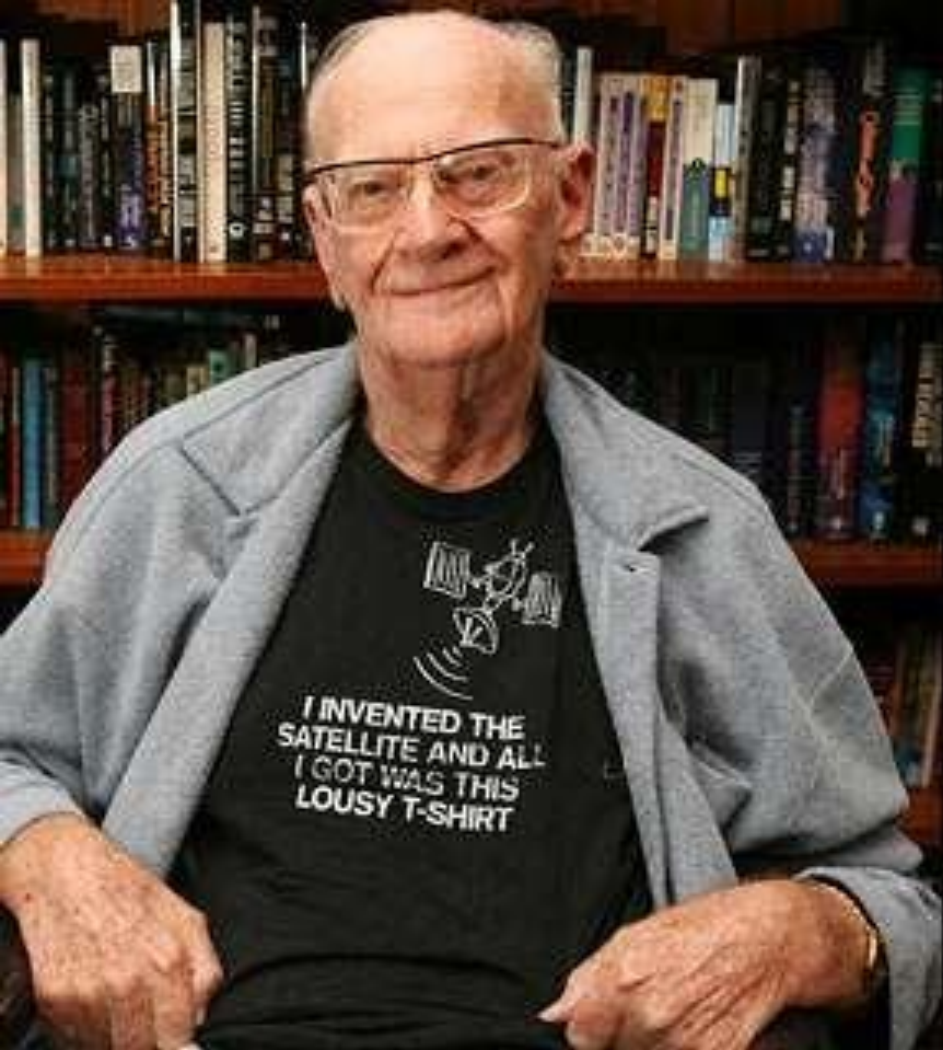


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The Deep Learning group advances the state-of-the-art in deep learning to achieve general intellig and unsupervised learning, deep reinforcement learning, and neural-symbolic reasoning, and then processing, multimodal intelligence, time series analysis, and other relevant areas.

# Machine Learning?





"Any sufficiently advanced technology is indistinguishable from magic."

-Arthur C. Clarke



# Artificial Intelligence: The Clever Ways Video Games Are Used To Train AIs



**Bernard Marr** Contributor ⓘ

# Training Robots with Games



## Minecraft

Minecraft offers its users endless opportunities for simple and more complex tasks.

Building blocks of Intelligence

## Grand Theft Auto

Autonomous Cars learn to drive using GTA

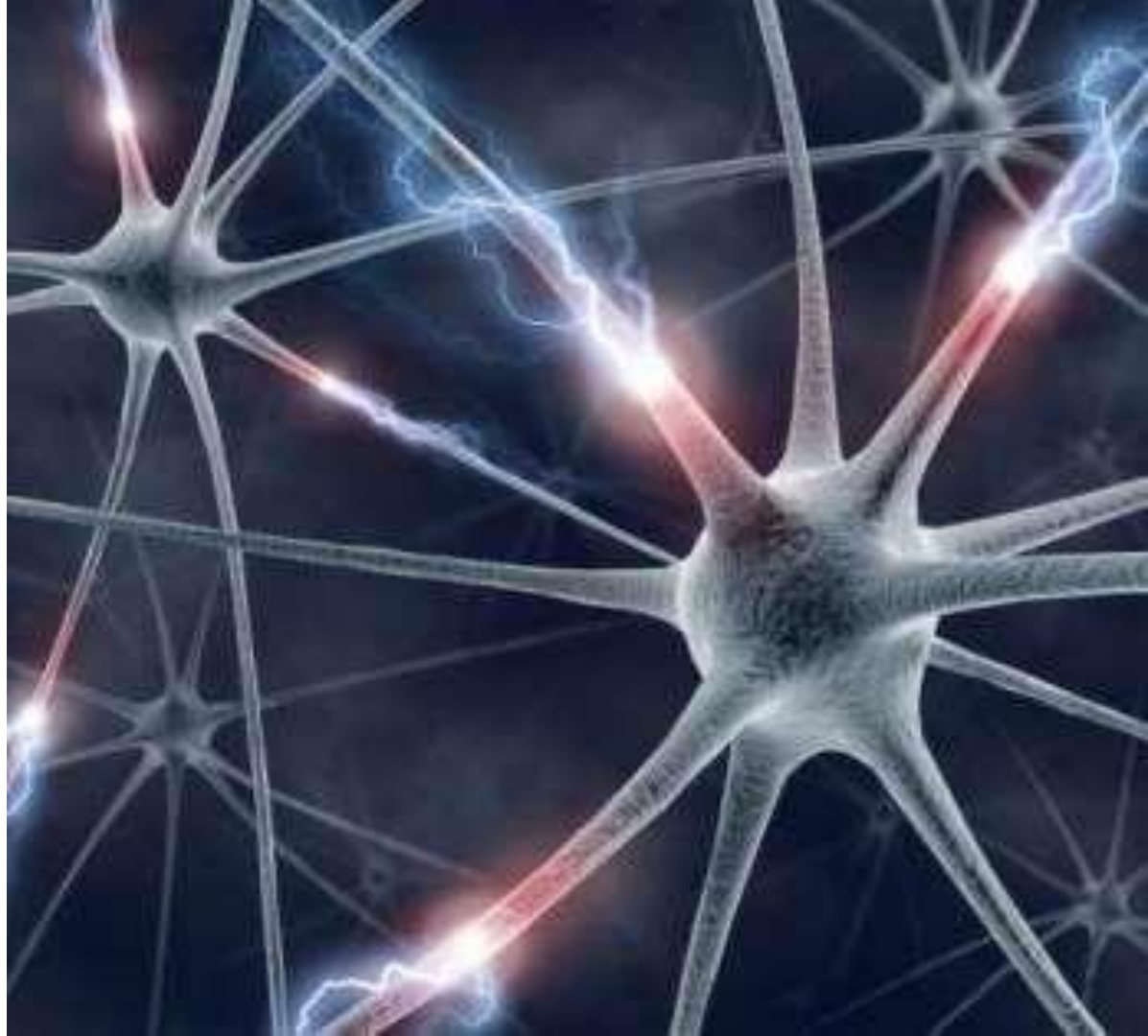
## Assassin's Creed

Used to train robots in synthetic environments

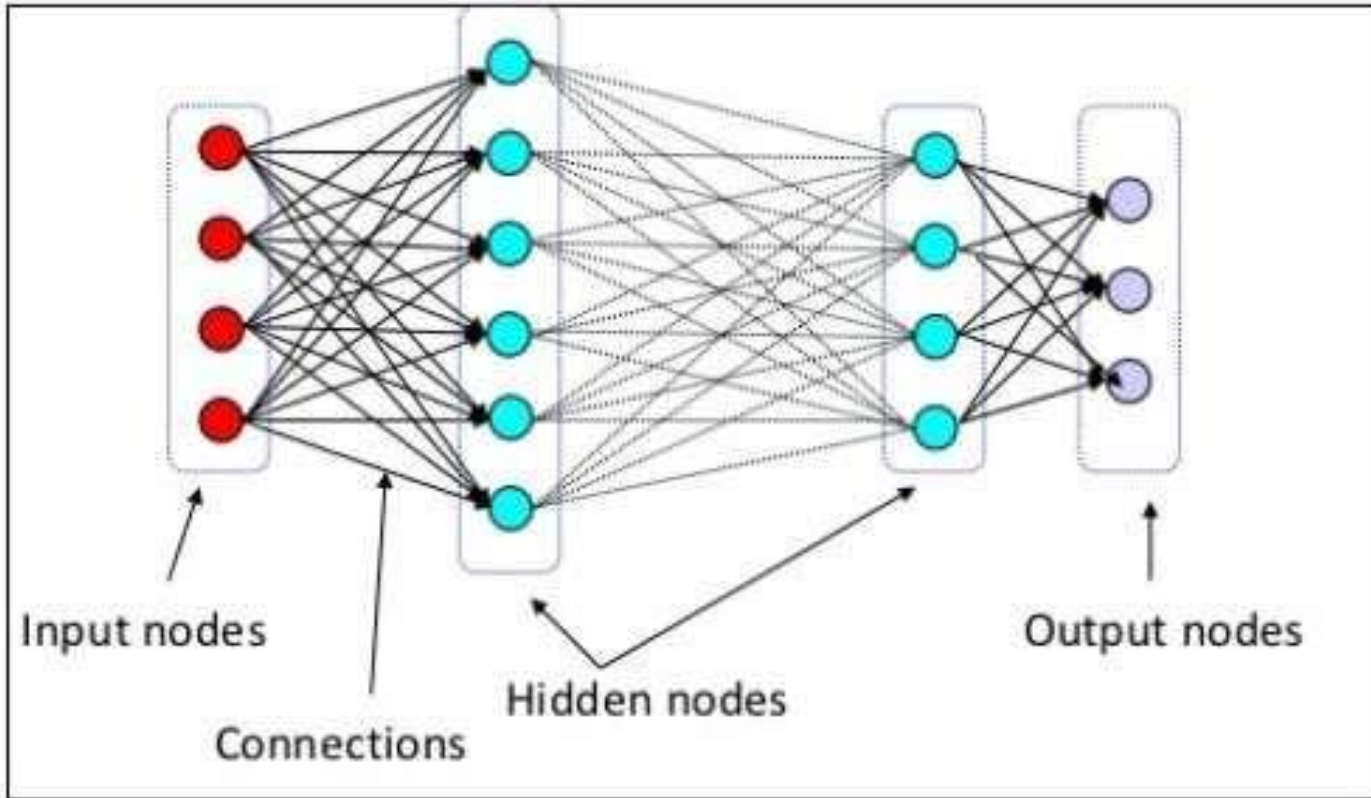


# Neural Networks

- Interconnected units (neurons)
- Activation signal(s)
- Information processing
- Learning involves adjustments to the synaptic connections



# Artificial Neural Networks building blocks



Introduction to Tensorflow

# TENSORFLOW

# Introduction to TensorFlow

- Computational Graph
- Loss Function Optimisation
- Neural Network Architectures
- Deep Learning components
- Machine Learning APIs
- ...



# What is it?

---

An Open Source Machine Learning  
Library released by Google in 2015

Built on top of Google's Inception  
v3

Google's most advanced image  
recognition system

Convolution Neural Network (CNN)

Available as a Python (or C++)  
Library

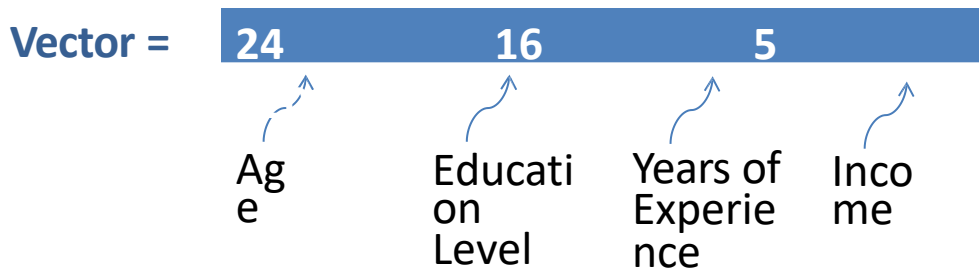


# Basics – What is a Vector?

- A vector is an array of numbers.

Vector = [ number, number, ... ]

- In machine learning, a vector holds the feature values (variables) for a sample.



# Basics – What is a Matrix?

- A matrix is a 2-dimensional array of numbers.

Matrix = [ n ][ m ]

- In machine learning, a matrix holds the feature values [columns] for samples [rows] in a dataset.

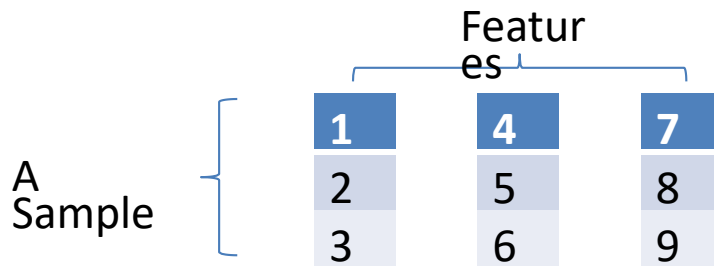
Matrix =	24	16	5	
	27000	12	8	
	28000	18	2	
	35000			
Age		Education Level	Years of Experience	Income

# What is a Tensor?

- A tensor is a high dimensional array.

$$\text{Tensor} = [n1][n2] \dots [nx]$$

- A tensor consists of features, where each feature is a vector or multi-dimensional array (e.g., such as in embedding).

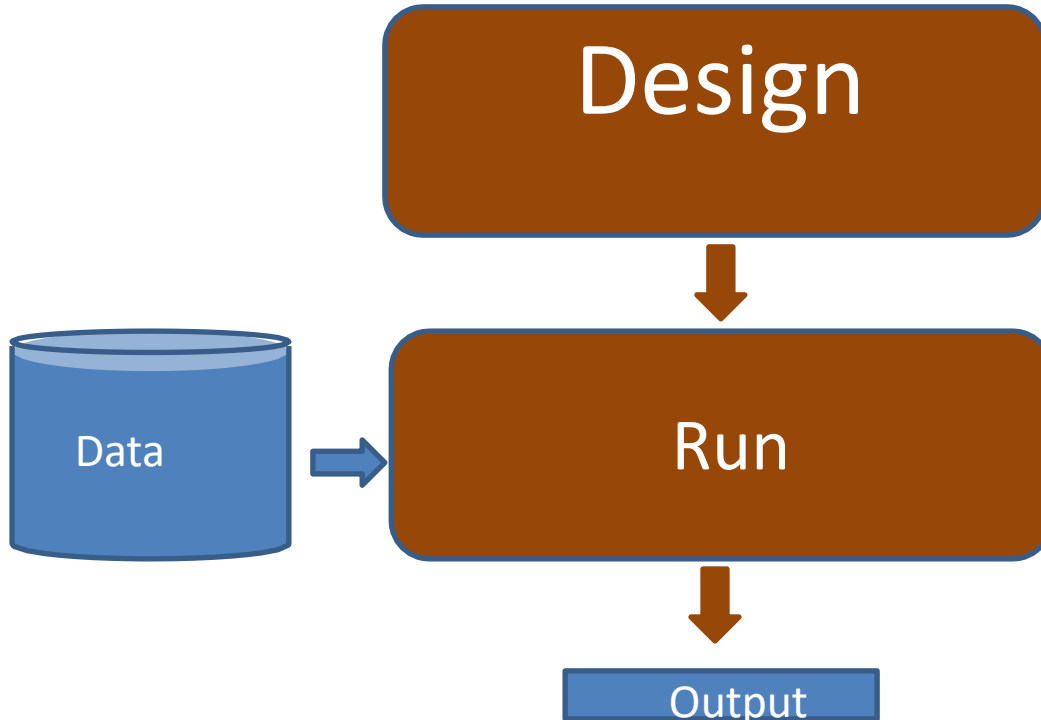




# Design & Run

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- TensorFlow uses a **Design & Run** methodology.



# Tensorflow Hub

- What is Tensorflow?
- train a model with a smaller dataset
- improve generalization,
- significantly speed up training

# Sample Code

```
import tensorflow as tf
import tensorflow_hub as hub

with tf.Graph().as_default():
    embed = hub.Module("https://tfhub.dev/google/nnlm-en-dim128-with-normalization/1")
    embeddings = embed(["A long sentence.", "single-word", "http://example.com"])

with tf.Session() as sess:
    sess.run(tf.global_variables_initializer())
    sess.run(tf.tables_initializer())

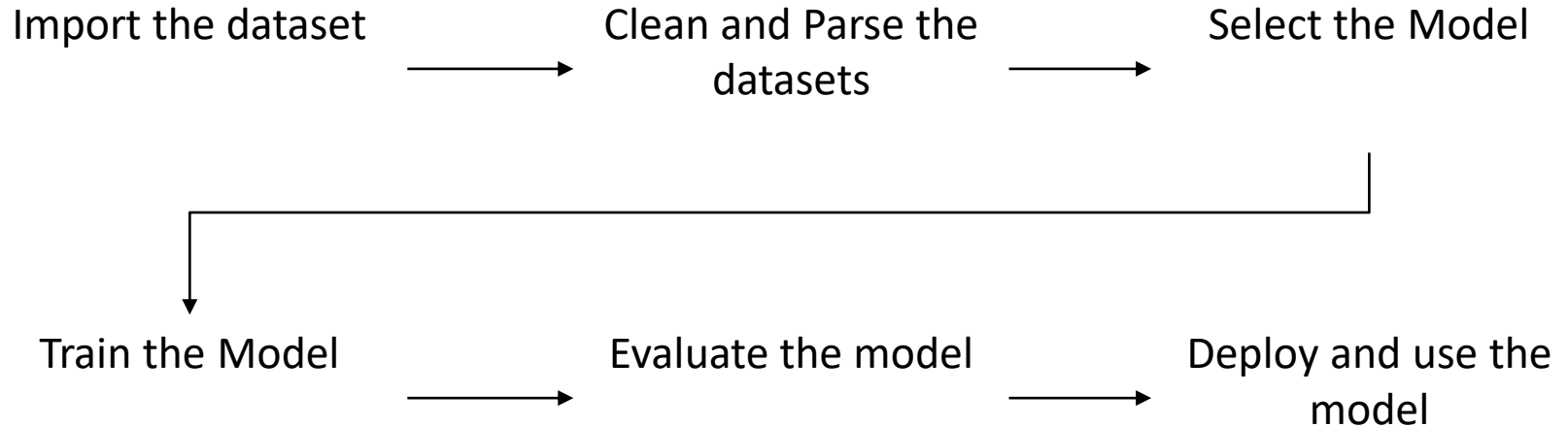
    print(sess.run(embeddings))
```

# Getting Started With Tensorflow

- Enable Eager Execution dev environment

- Import Data with the Datasets API
- Build Models and Layers with Keras API

# SEQUENCE



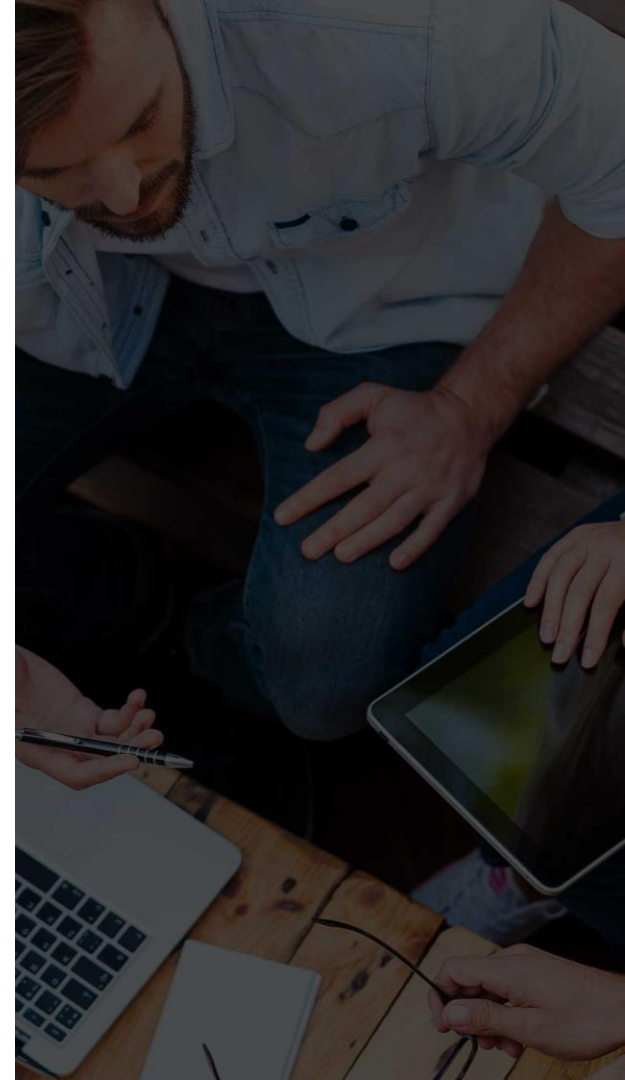
# TensorFlow



## TensorFlow Object Detection API

This is a package which trains a neural network capable of recognizing objects in a frame, for example, an image.

Pikachu





Towards Data Science

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HOME DATA SCIENCE MACHINE LEARNING PROGRAMMING VISUALIZATION PICKS CONTRIBUTE 



Juan De Dios Santos

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Machine Learning/Data Engineer guy. Also, I like Pokemon.

May 13 · 7 min read

# Detecting Pikachu in videos using Tensorflow Object Detection



@sqlpass  
#sqlpass



@PASScommunity

# Deep Learning at Microsoft



Microsoft

Cognitive Toolkit

Features ▾

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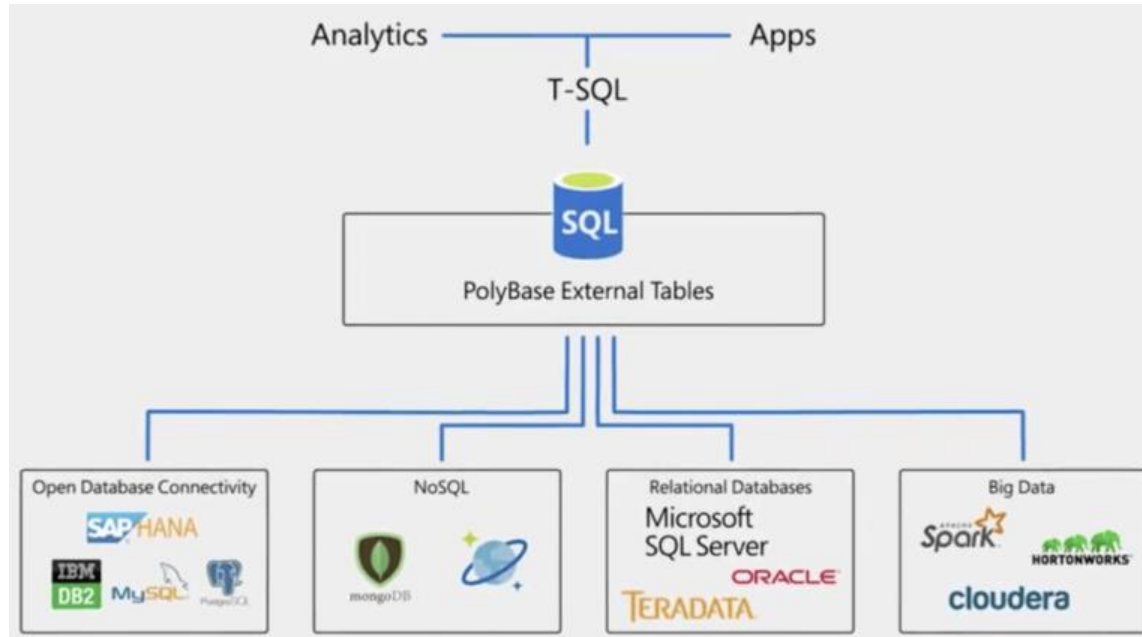
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## Model Gallery

Below you'll find a collection of code samples, recipes and tutorials on the various ways you can use the Cognitive Toolkit against scenarios for image, text and speech data.



# Deep Learning at Microsoft



# Computational Network Toolkit

- CNTK is Microsoft's open-source, cross-platform toolkit for learning and evaluating deep neural networks.
- CNTK expresses (nearly) arbitrary neural networks by composing simple building blocks into complex computational networks, supporting relevant network types and applications.
- CNTK is production-ready: State-of-the-art accuracy, efficient, and scales to multi-GPU/multi-server.

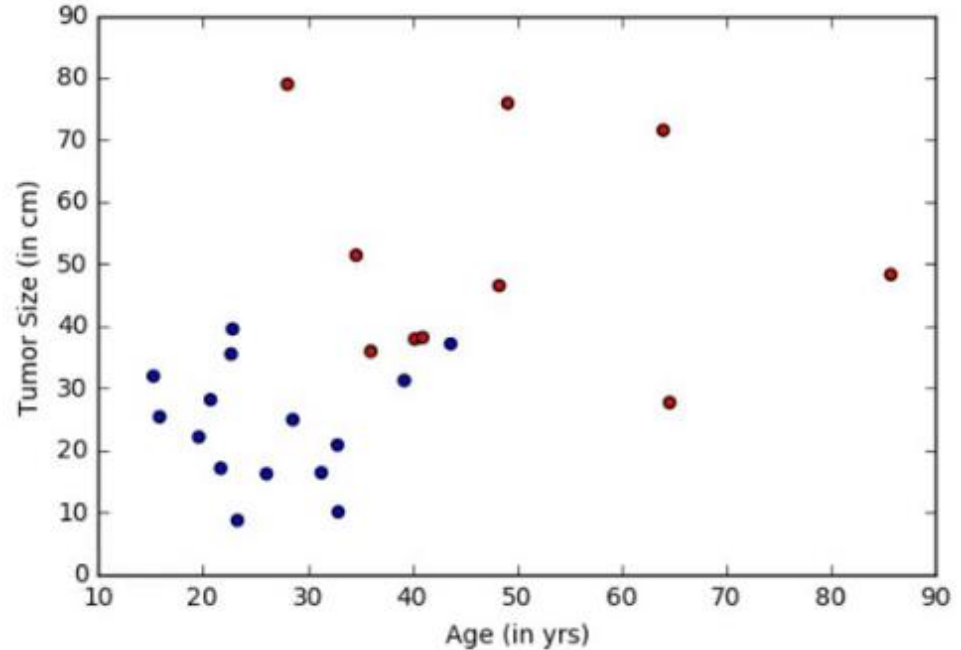
# Computational Network Toolkit

- open-source model inside and outside the company
- used by Speech, Windows (Hololens), Bing (relevance, ads), MSR
- external contributions e.g. from MIT and Stanford

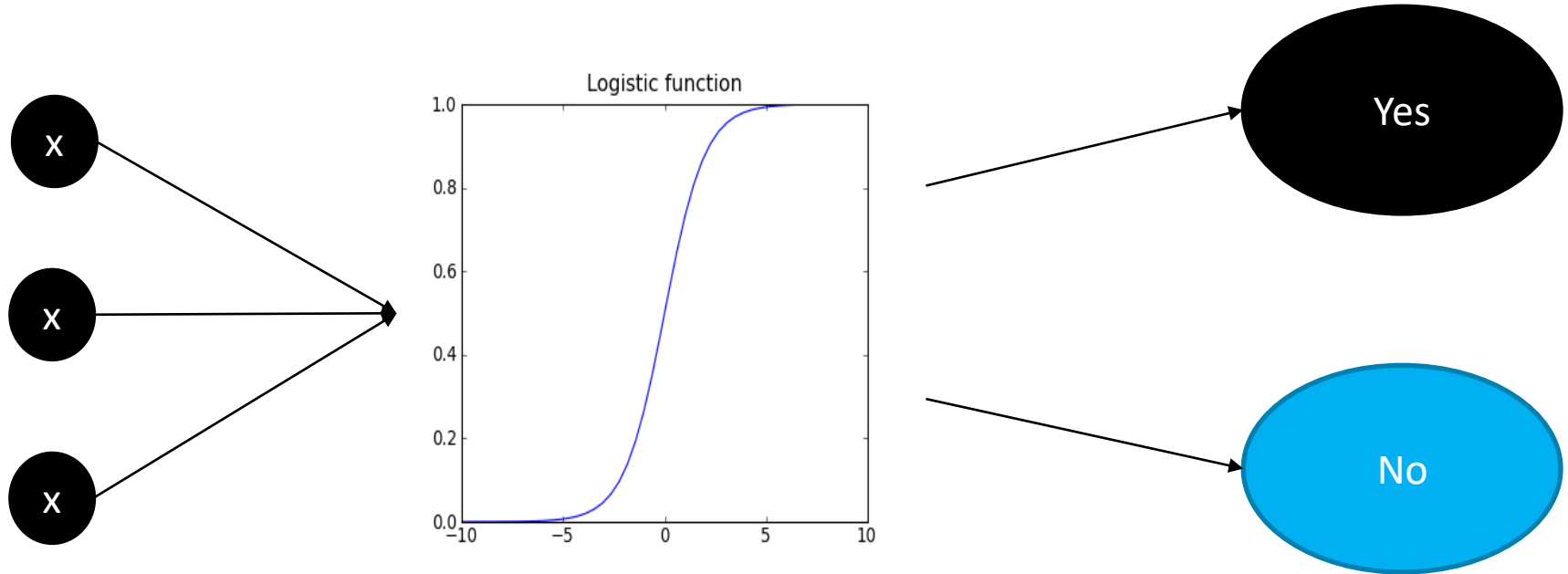
# Demo

## Classification Problem

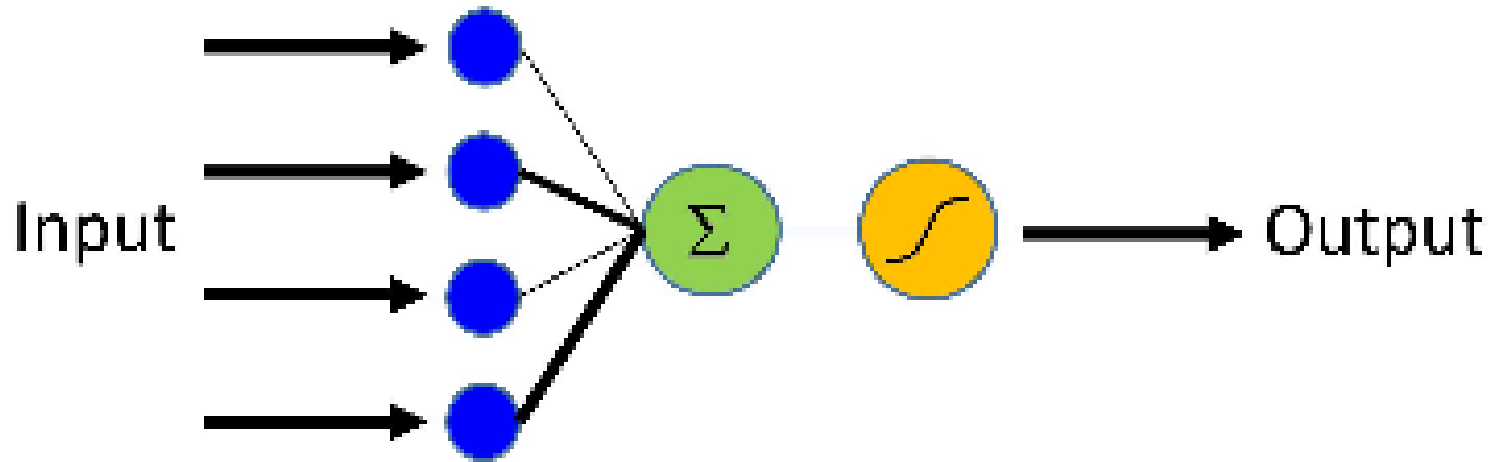
- Classification Problem
- Cancer cells
  - Demo data



# Logistic Regression



The output from the hypothesis is the estimated probability.

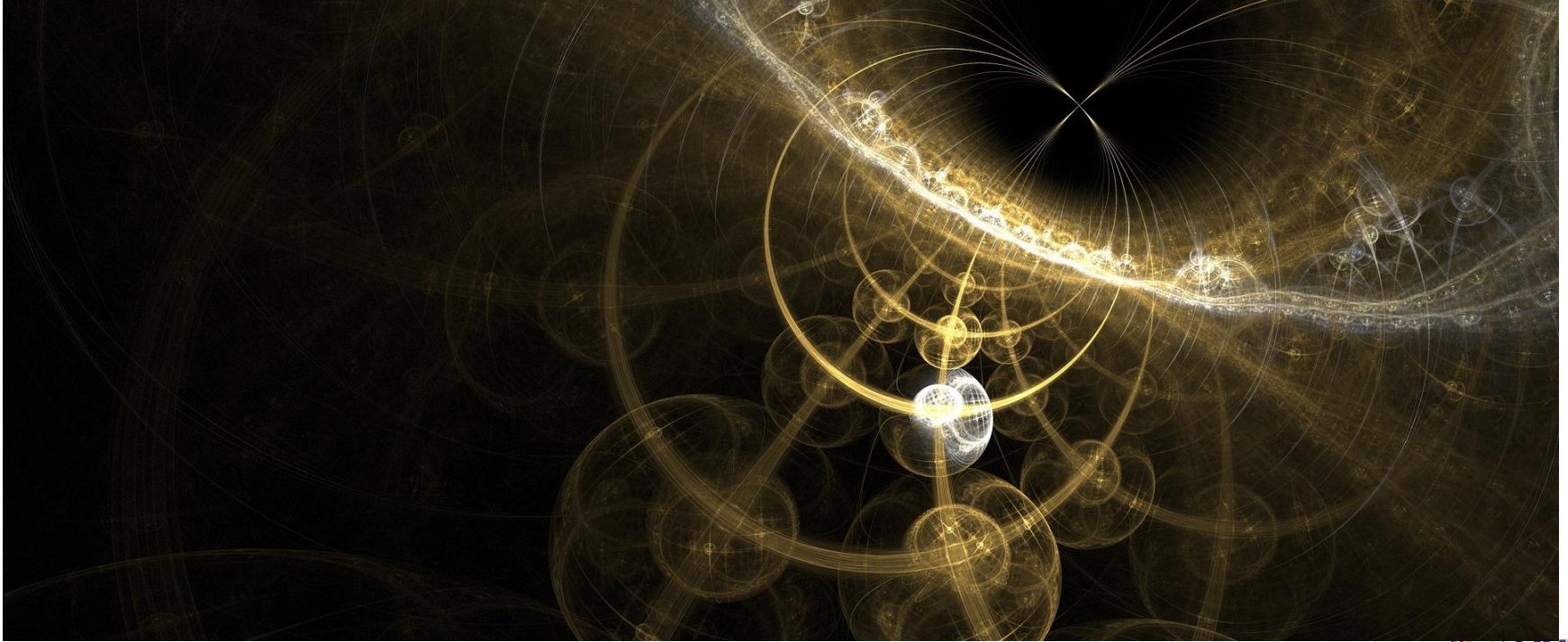


Because we have two output labels, we call this a binary classification task: blue or red.

# Numpy

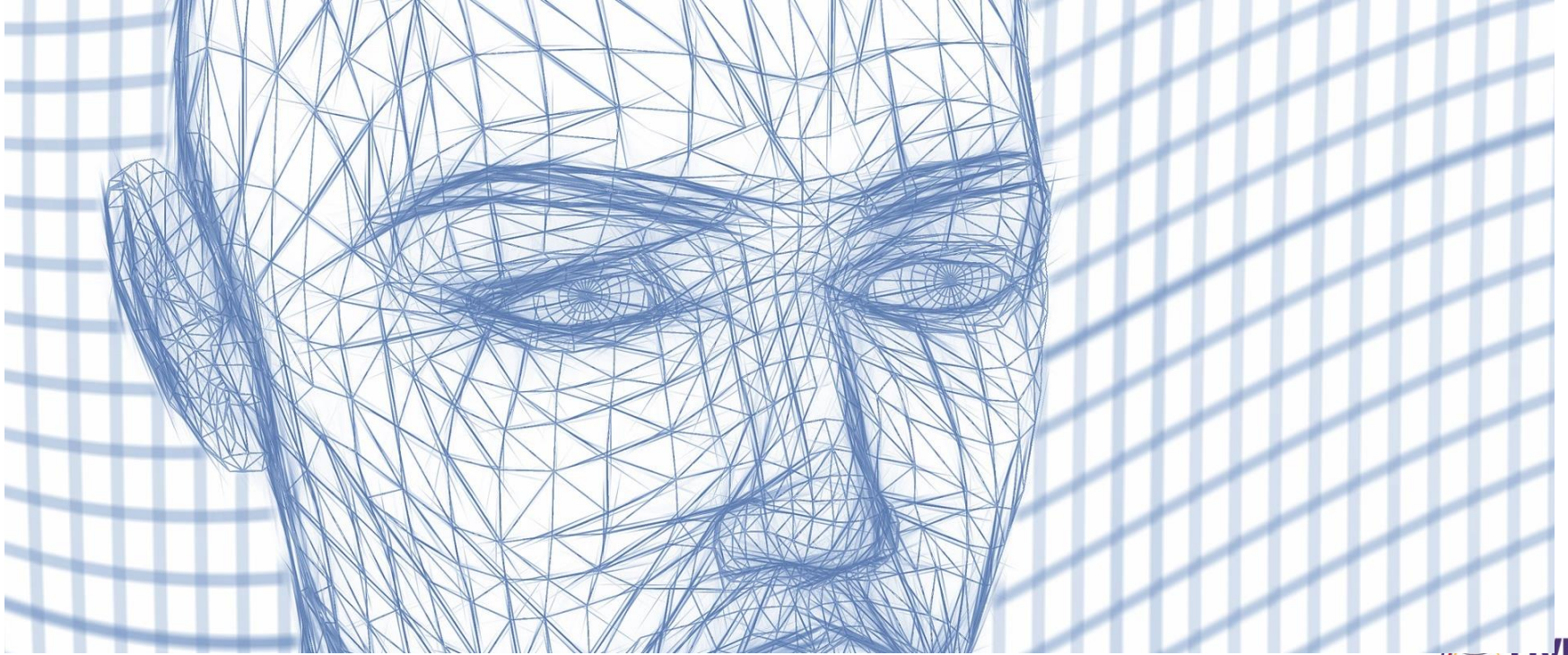
- NumPy is the fundamental package for scientific computing with Python.
- A powerful N-dimensional array object
- NumPy can also be used as an efficient multi-dimensional container of generic data.

# Deep Learning Futures





# Summary



# References

- Channel 9 –Microsoft Cognitive Toolkit CNTK for Deep Learning
- Microsoft Ignite Orlando 2017 videos
- Tensorflow.org