# THE AI DEVCON 2018



# Seeing AI: Currency Classifier

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### Seeing Al

### Turning the visual world into an audible experience.

# Well! You may know this...

### Artificial Intelligence







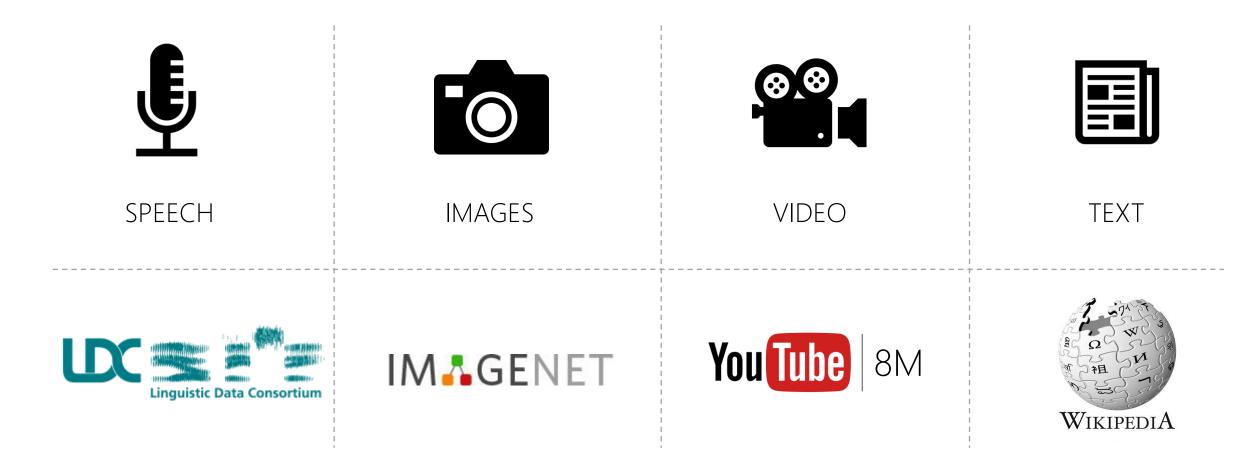
### Deep Learning Artificial Neural Network Biological Neural Network Input Layer Hidden Layer **Output Layer** 4 2 3



 $\leq$  ---- Convolution Neural Network (CNN) Recurrent Neural Network (RNN) U ----→ Long Short Term Memory (LSTM)  $\geq$ Generative Adversarial Network (GAN) ✓ ---- Autoencoder



### Data -> CORPUS





### Supervised Learning

### Well! You may know this...a refresher



Unsupervised Learning

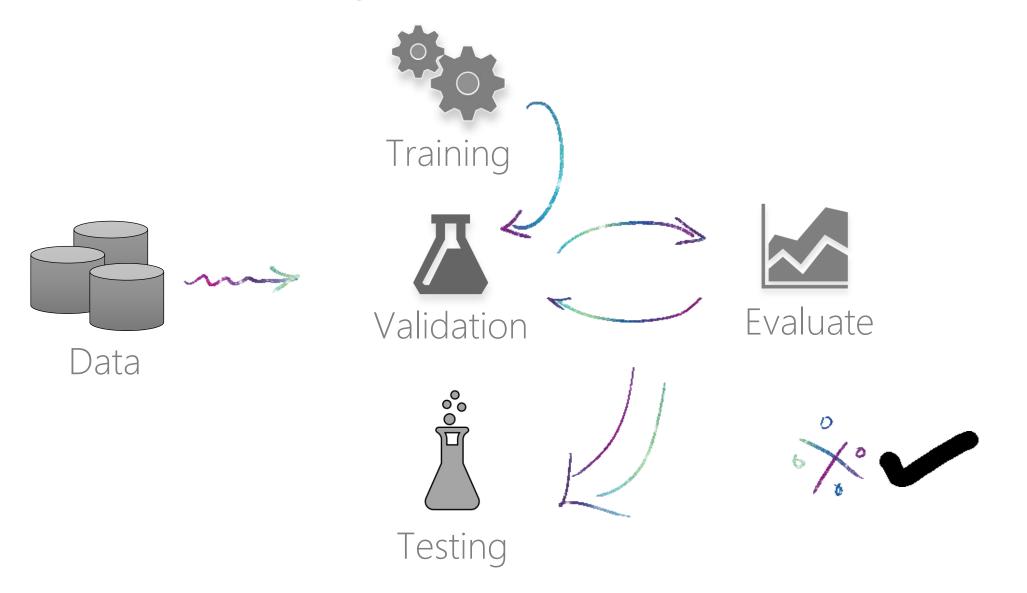


Reinforcement Learning

• • •



### Machine Learning Model





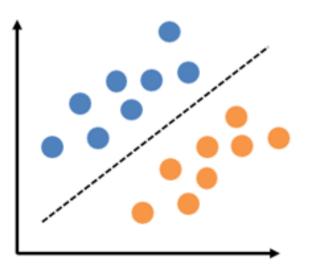
### Popular Deep Learning Frameworks





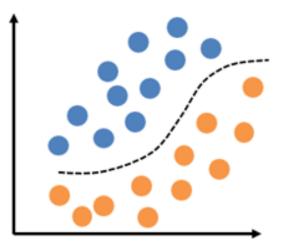
### Foundation: A Neural Network Algorithm

Linear



Nonlinear

Microsoft



### Single Perceptron



### Multilayer Perceptron



### Neural Network



## **Back Propagation**





### The Beginning...

# Lots of Training Data



Significant Computational Resources



# Coffee Mode

Model Development and Training



### Data Collection...A Task







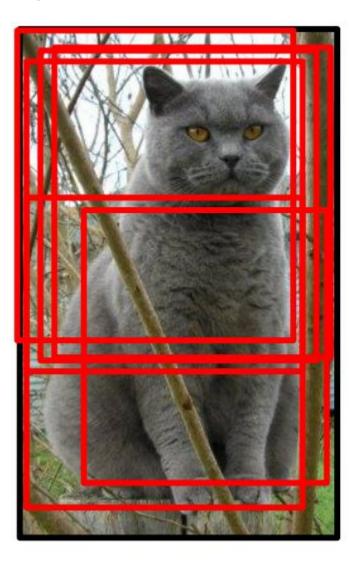
• Image Re-sizing and Standardization

• Resolution & Features

• Variety (Angles, Background)



### Data Augmentation



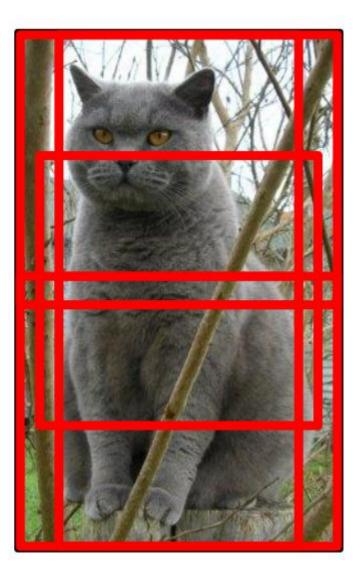
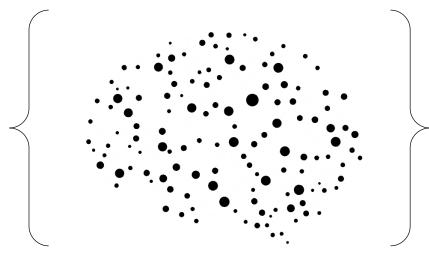


Image Source: https://deeplearningsandbox.com/



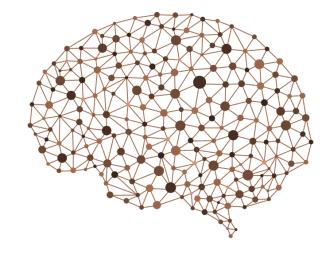
### Transfer Learning



Pre-Trained Models



Reload the weights & Freeze Pre-trained Layers



Aggregate Model

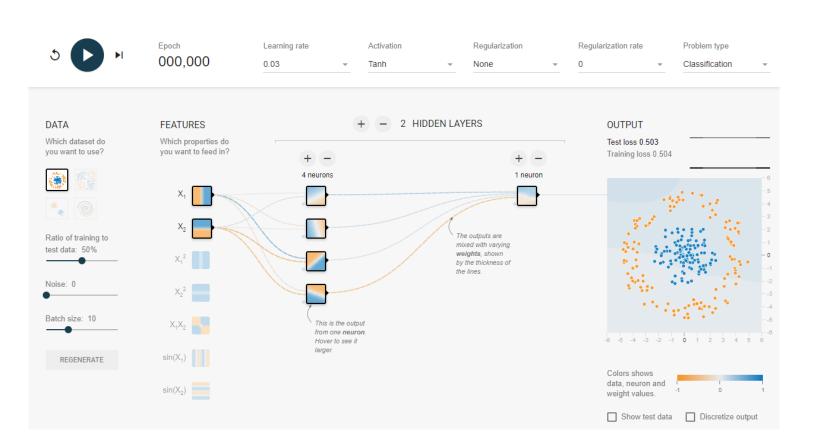


### Designing a DNN

Art

• Science

• Trial & Error



<u>Resource</u>: http://playground.tensorflow.org

### A few knobs to adjust



Data		Epoch		
	Hidden Layers			
Features (X)		Iterations	Test Loss	
	# of Neurons			Output (Y)
Learning Rate		Batch Size	Training Loss	
	Activation			
Problem Type		Pool Size		

### Convolutional Neural Network

0	0	0	0	0	0	
0	105	102	100	97	96	
0	103	99	103	101	102	
0	101	98	104	102	100	
0	99	101	106	104	99	
0	104	104	104	100	98	

0 -1 0 -1 5 -1

-1

0

0

Kernel Matrix

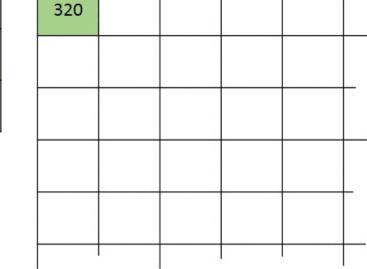


Image Matrix

0 \* 0 + 0 \* -1 + 0 \* 0+0 \* -1 + 105 \* 5 + 102 \* -1 +0 \* 0 + 103 \* -1 + 99 \* 0 = 320

**Output Matrix** 

#### Convolution with horizontal and vertical strides = 1

Image Source: http://machinelearninguru.com/computer\_vision/basics/convolution/convolution\_layer.html

### End to End – A Summary

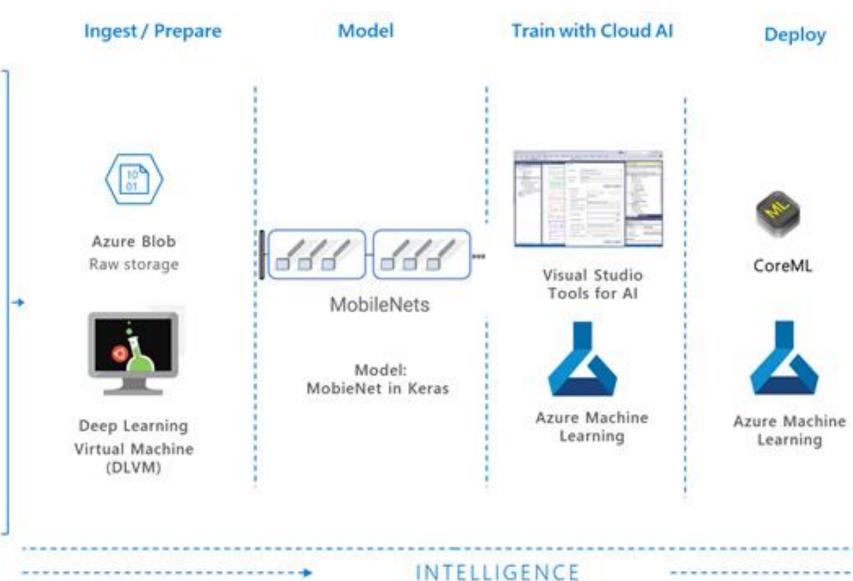




Data Sources

Currency Dataset

250 images per class 15 classes including a background class



### DATA

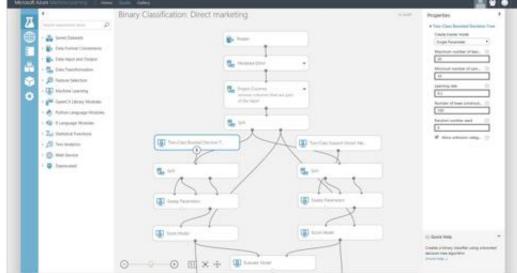


### Azure Machine Learning

#### Azure Machine Learning Studio

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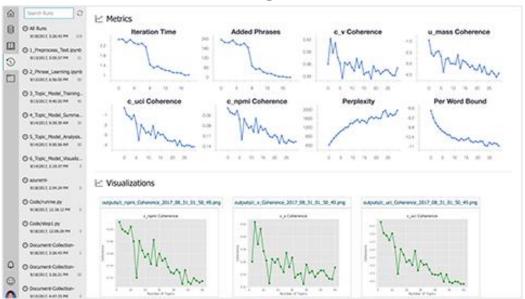




#### Deep Learning Virtual Machine

M PER CLUSTER			VM CPU UTILIZATION			VM MEMORY UTILIZATI	um.
Virtual Machines	Machines per Cluster over time		VM CPU utilization over time			VM memory utilization over time	
40 29 600 PM	питаліо-зірла питаліо-ізета питаліо 1200 Ам 600 Ам 1200		200 80 40 20 0 0 0 0 0 0 0 0 0 0 0 0 12			100 80 40 20 600 PM 12	00 AM 600 AM
POWER STATE	NTX:VMS_QUISTERNAME_S	COUNT	VMINAME	NTK/MS_CLUSTERNAME_S	CPU %	VM NAME	NTKAMSJOLUST
on	nutanix-alpha	45	nutanix-scom-8	nutaniio alpha	75.3	ntx-sqlsrvr4	nutanix-beta
off	nutanix-gamma	29	scom-mark-2012	nutanix-alpha	68	nutanix-scom-8	nutanix-alpha
unknown	nutania-beta	22	nutanix-scom-7	nutanis-alpha	67.6	nutanix-scom-7	nutanix-alpha
off	nutanix-alpha	11	nutanix-scom-4	nutanis-alpha	52.3	nutanix-scom-6	nutanix-alpha
			nutania-scom-5	nutanix-alpha	41.4	nutanix-scom-5	nutanix-alpha
			beta-xaxd-3	nutanisealpha	41	nutanix-scom-4	nutanix-alpha
			beta-sf-sn-2	nutanix-alpha	30	nutanix-scom-11	nutanix-alpha
			beta-sf-srv-1	nutanix-alpha	29.1	nutLinuxMachine	nutanix-alpha
			nutanix-scom-9	nutaniscalpha	22.7	sp2013stgm2	nutanix-alpha
			nutanis-supp	nutanix-alpha	22	ntx-sqlarvr3	nutanix-beta

#### Azure Machine Learning services





### THANK YOU

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