Track 7

Inteligencia Artificial Aplicada

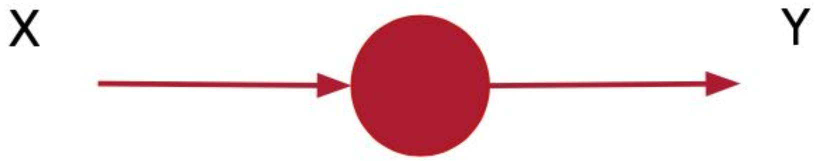
5. DNN – Classification (Hands-On with CoLab)

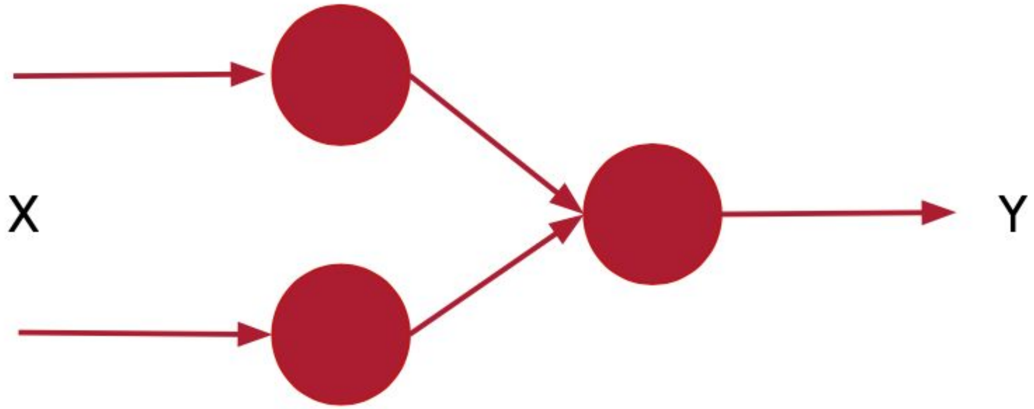
Prof. Marcelo José Rovai
rovai@unifei.edu.br

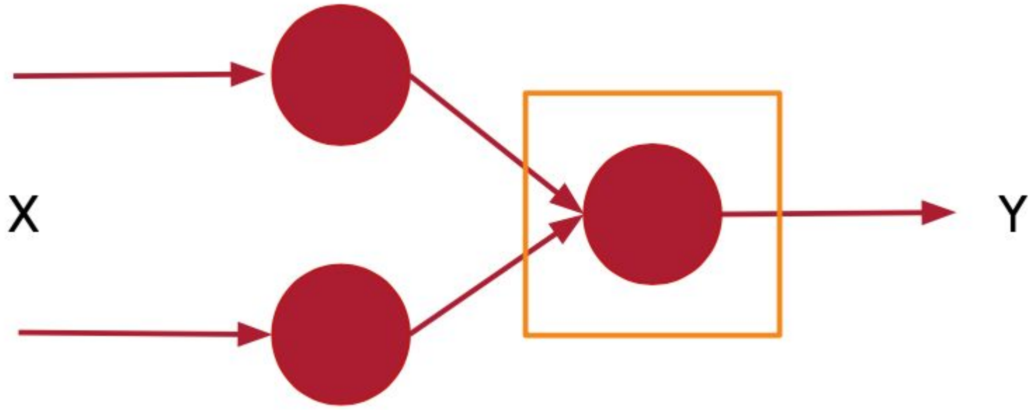
UNIFEI - Universidade Federal de Itajubá, Brazil

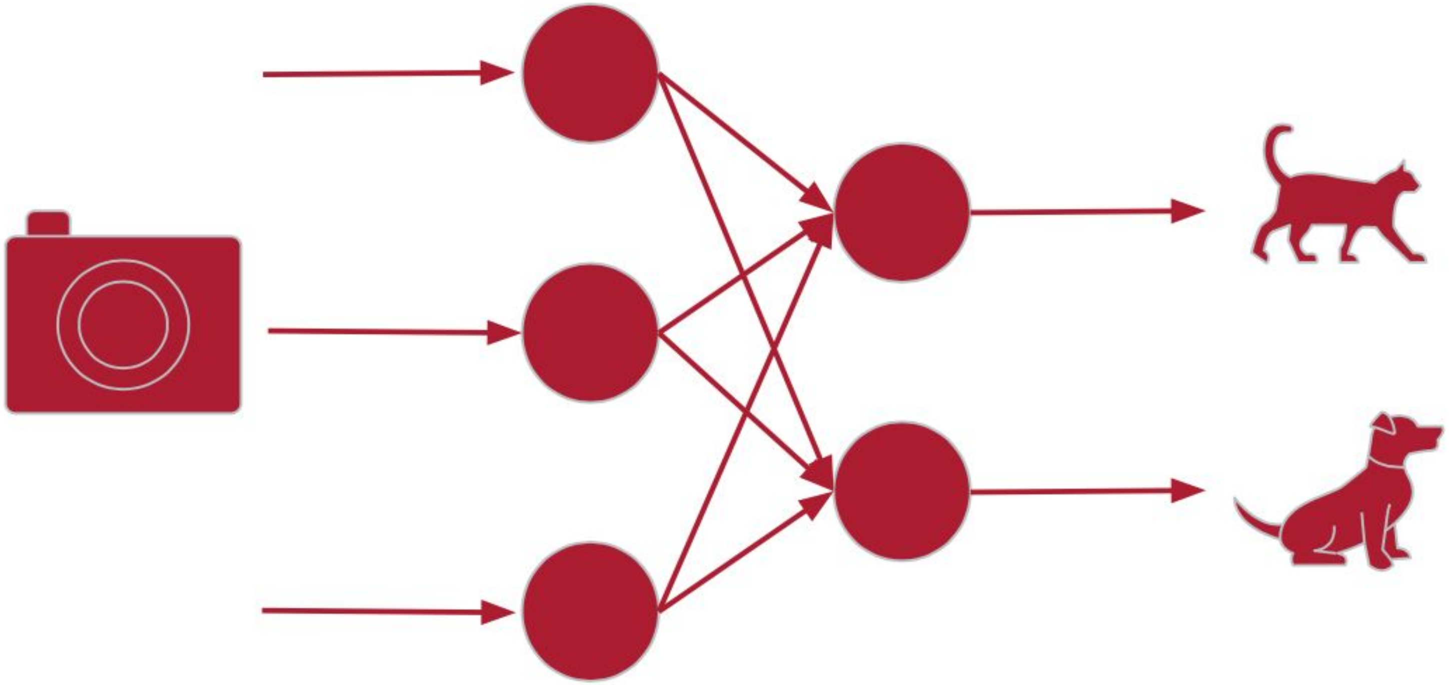
Going Further

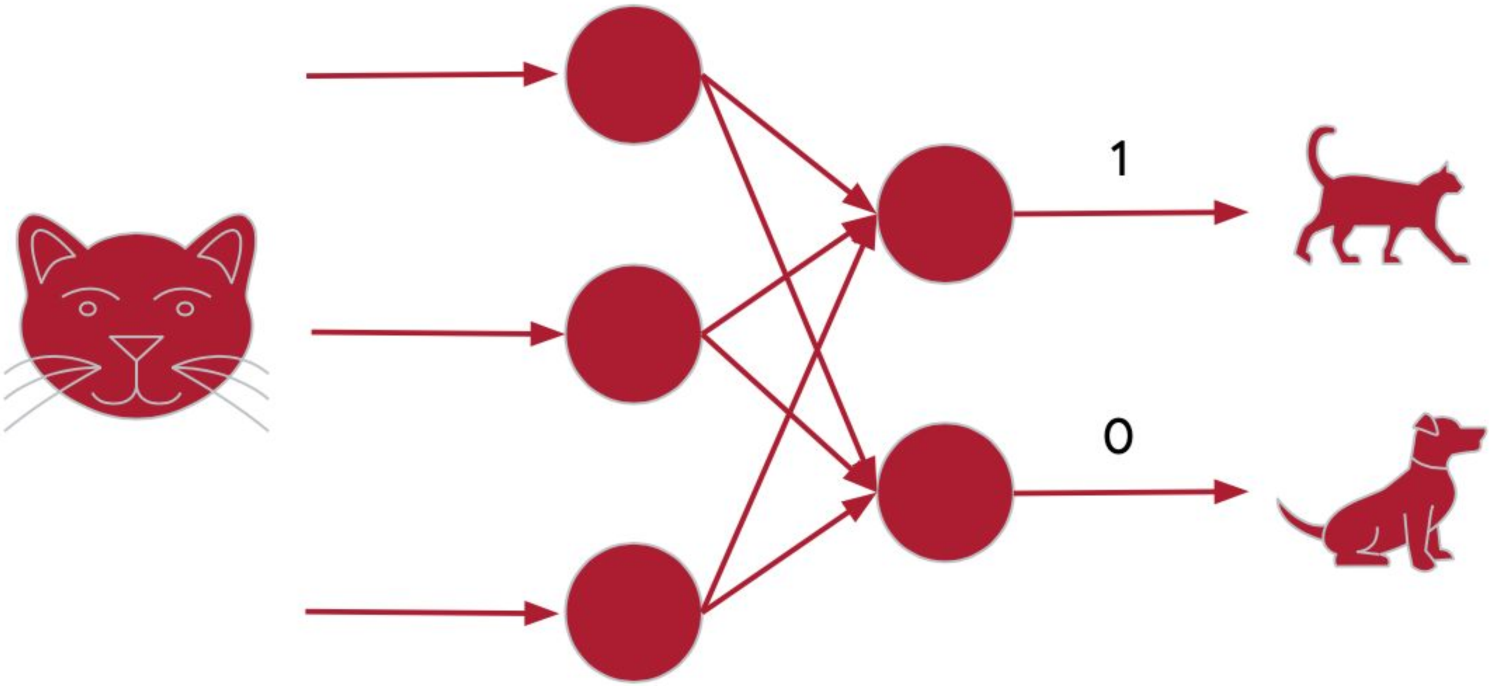
From regression to classification

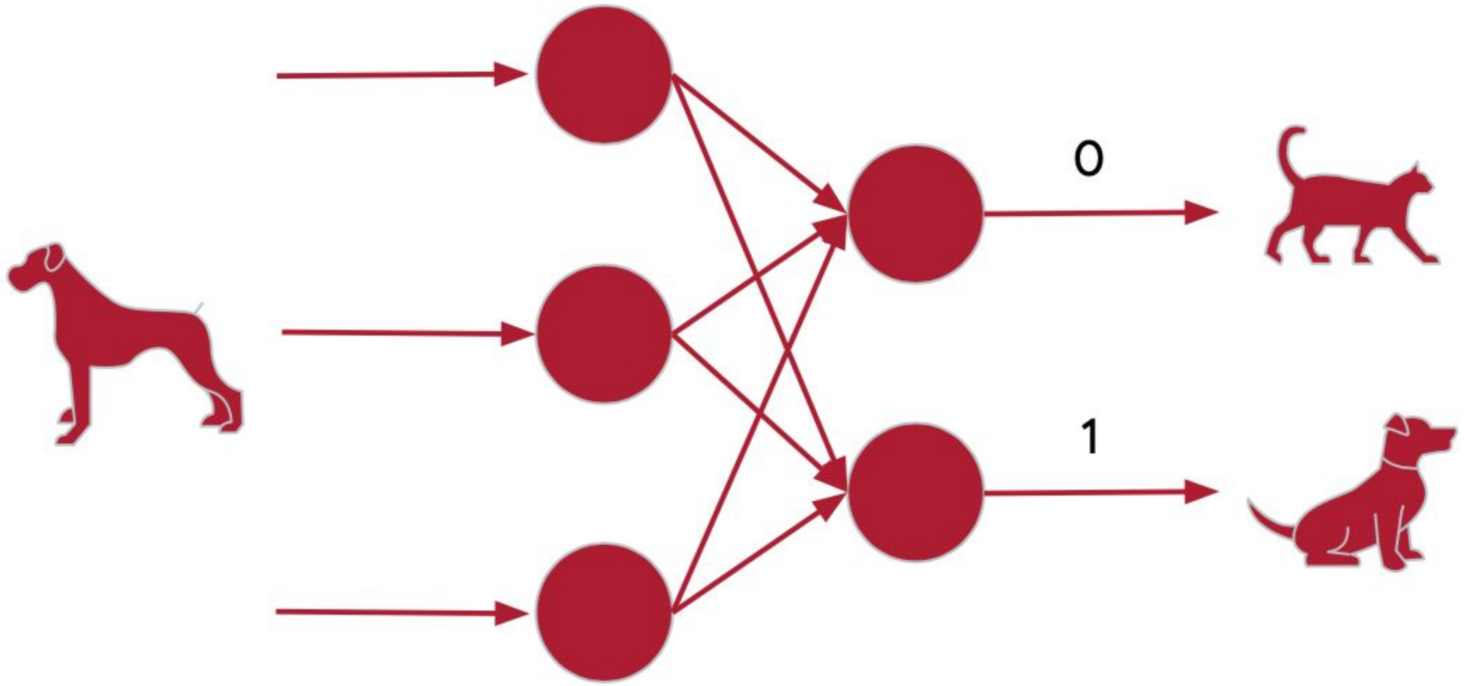

X
Y

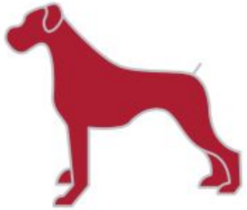

X
Y


X
Y




1
0


0
1

Data	Label
	[1, 0]
	[0, 1]

0	[1, 0, 0, 0, 0, 0, 0, 0, 0, 0]
1	[0, 1, 0, 0, 0, 0, 0, 0, 0, 0]
2	[0, 0, 1, 0, 0, 0, 0, 0, 0, 0]
3	[0, 0, 0, 1, 0, 0, 0, 0, 0, 0]
4	[0, 0, 0, 0, 1, 0, 0, 0, 0, 0]
5	[0, 0, 0, 0, 0, 1, 0, 0, 0, 0]
6	[0, 0, 0, 0, 0, 0, 1, 0, 0, 0]
7	[0, 0, 0, 0, 0, 0, 0, 1, 0, 0]
8	[0, 0, 0, 0, 0, 0, 0, 0, 1, 0]
9	[0, 0, 0, 0, 0, 0, 0, 0, 0, 1]

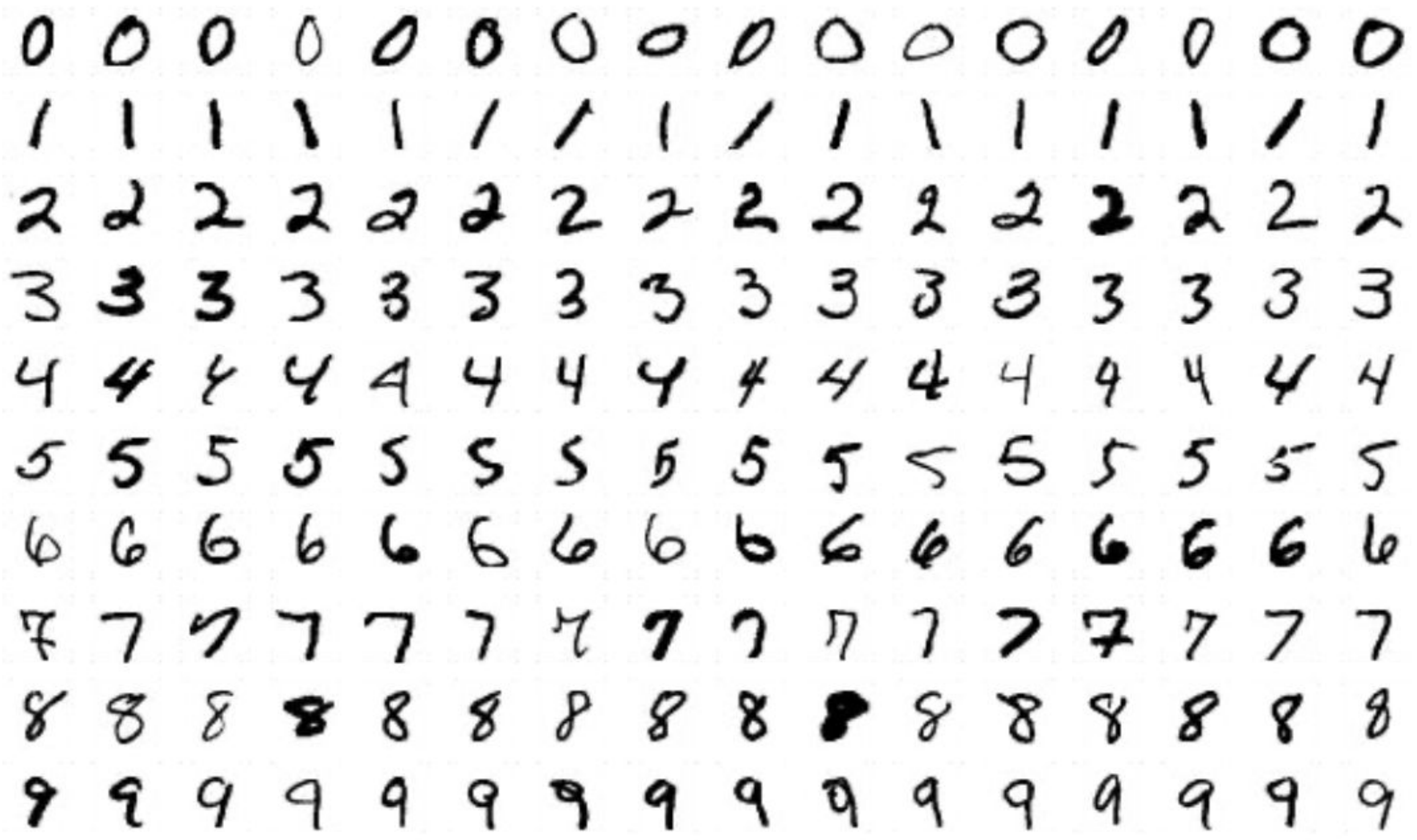
```
import tensorflow as tf

data = tf.keras.datasets.mnist
(training_images, training_labels), (val_images, val_labels) = data.load_data()

training_images  = training_images / 255.0
val_images = val_images / 255.0

model = tf.keras.models.Sequential(
    [tf.keras.layers.Flatten(input_shape=(28,28)),
     tf.keras.layers.Dense(20, activation=tf.nn.relu),
     tf.keras.layers.Dense(10, activation=tf.nn.softmax)])
```

Collect Data



60,000 Labelled Training Examples
10.000 Labelled Validation Examples

```python
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data = tf.keras.datasets.mnist
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Preprocess
Data

```
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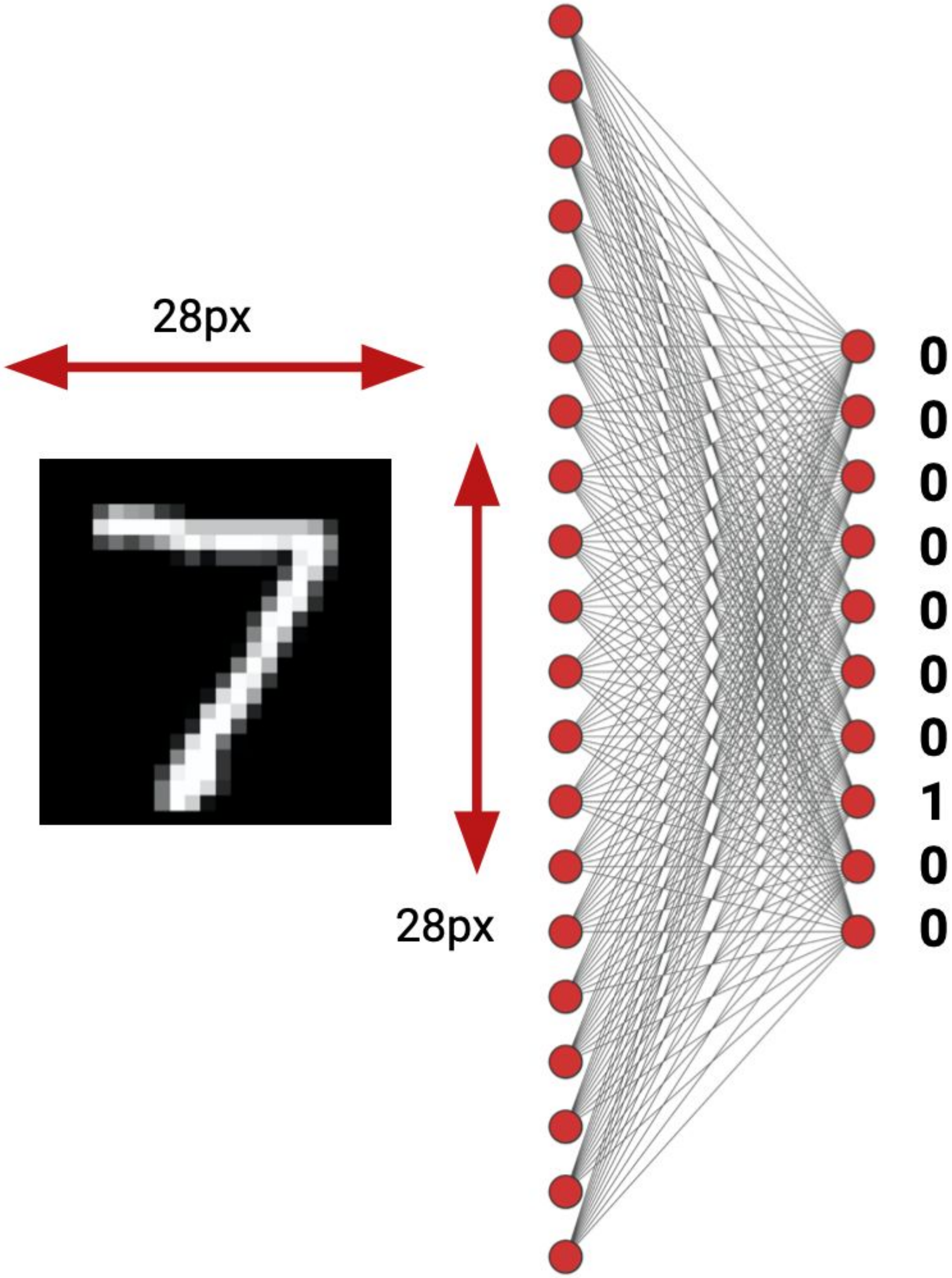
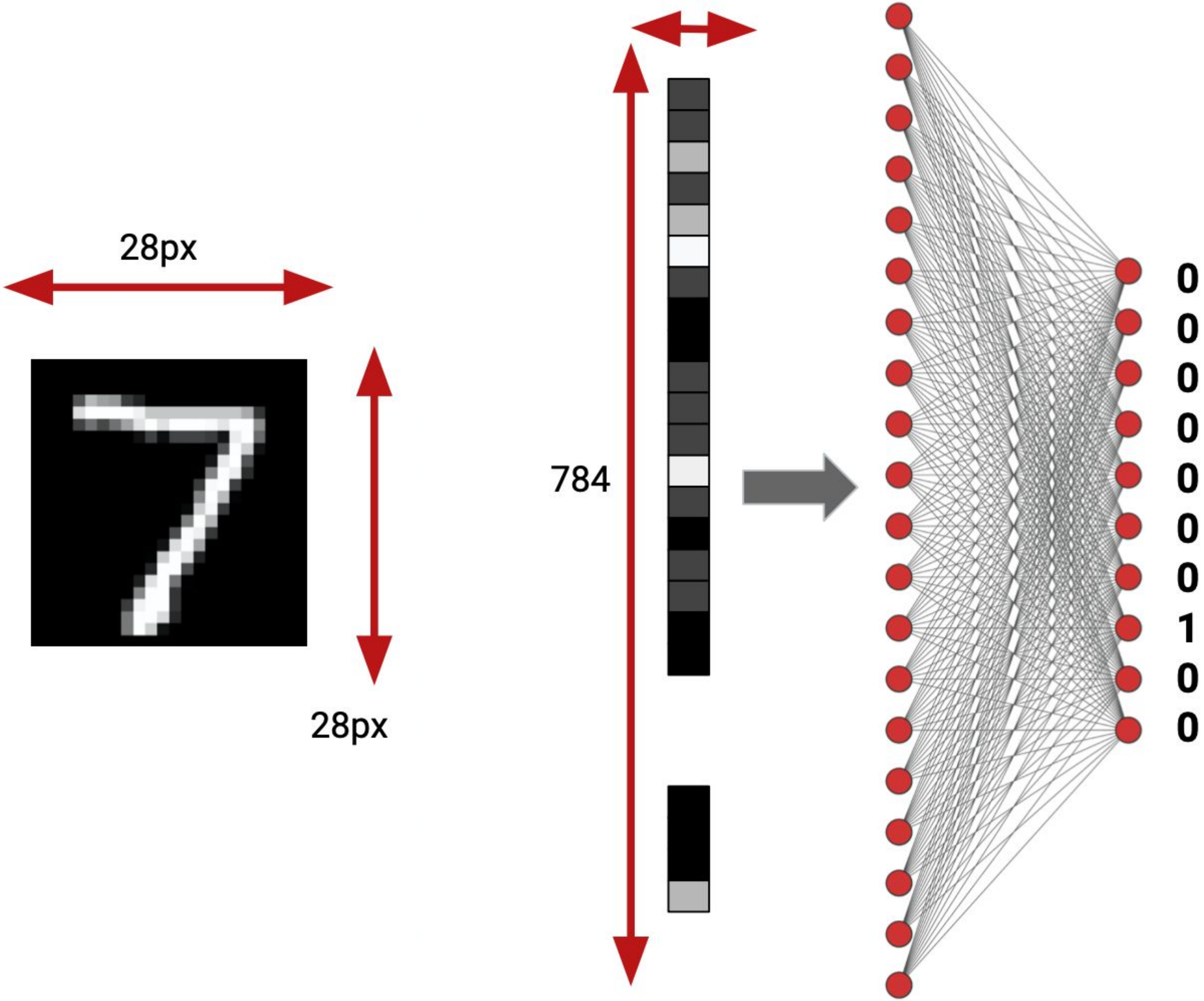
```

Design a Model



28px
28px
0
0
0
0
0
0
0
1
0
0


28px
28px
784
0
0
0
0
0
0
0
1
0
0

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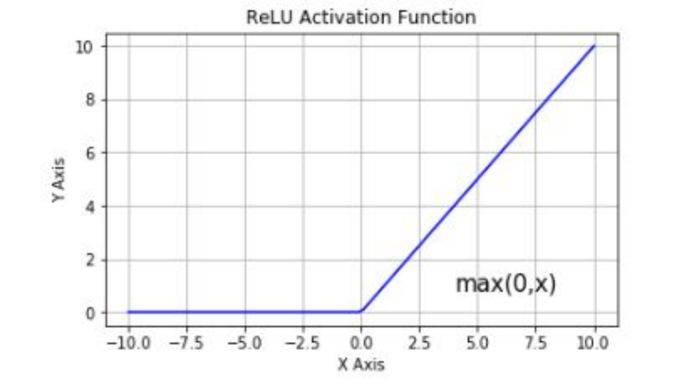

ReLU applies much-needed non-linearity into the model. Non-linearity is necessary to produce non-linear decision boundaries, so that the output cannot be written as a linear combination of the inputs.

https://en.wikipedia.org/wiki/Activation_function

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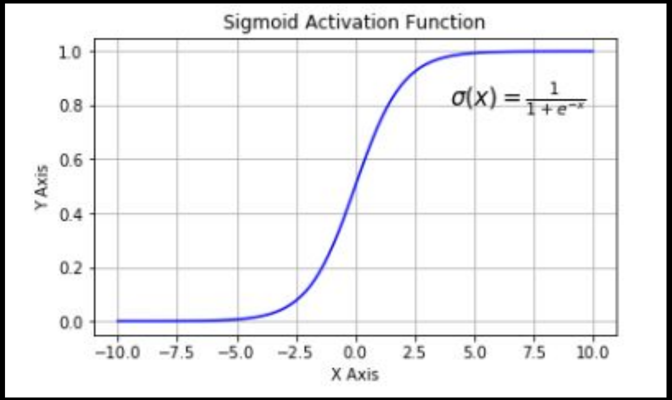

SOFTMAX: Generalization of the logistic function (or Sigmoid) to multiple dimensions. A softmax operation serves a key purpose: making sure the Neural Network (in this case, a DNN) outputs sum to 1. Because of this, softmax operations are useful to scale model outputs into probabilities.

```
model.compile(optimizer='adam',
              loss='sparse_categorical_crossentropy',
              metrics=['accuracy'])
```

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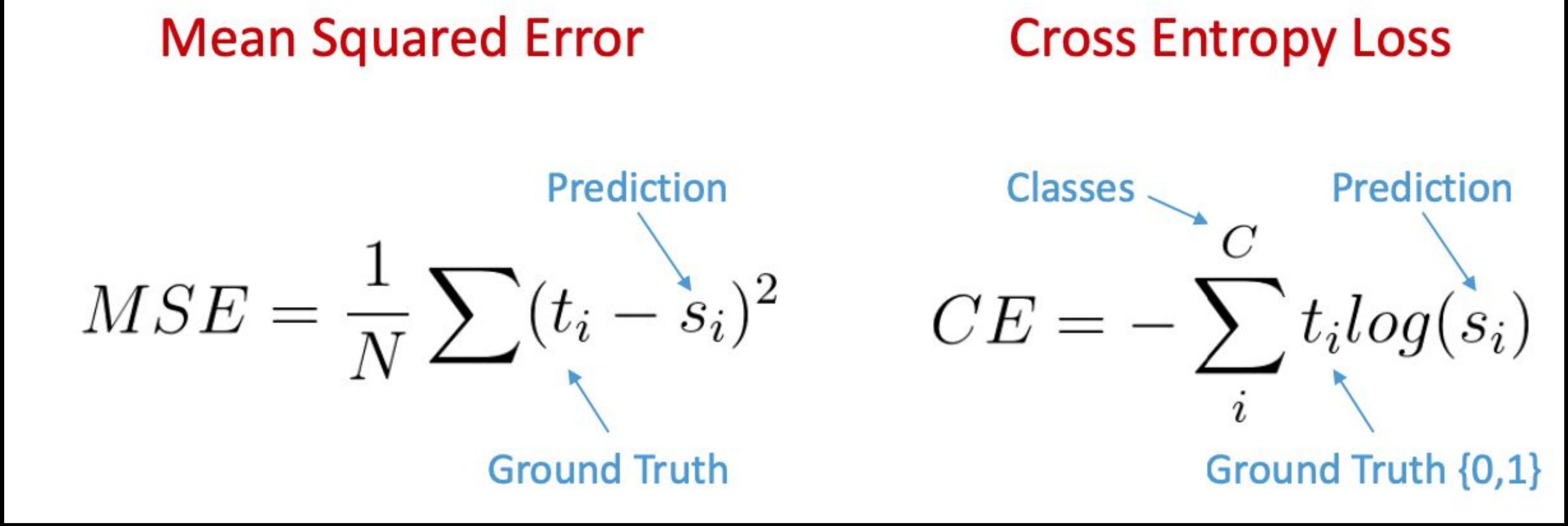


Mean Squared Error

$$MSE = \frac{1}{N}\sum(t_i - s_i)^2$$

Cross Entropy Loss

$$CE = -\sum_{i}^{C} t_i log(s_i)$$

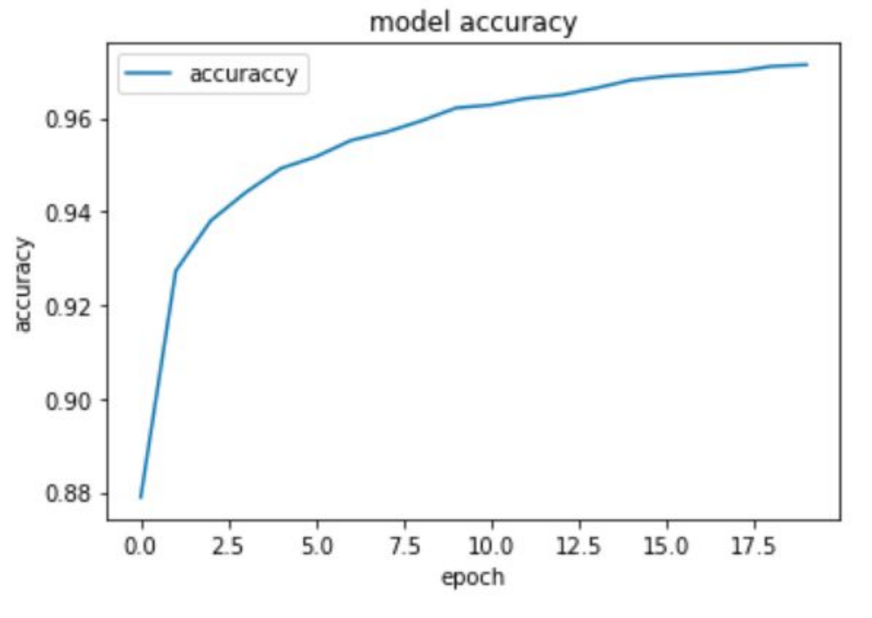
```
model.compile(optimizer='adam',
              loss='sparse_categorical_crossentropy',
              metrics=['accuracy'])

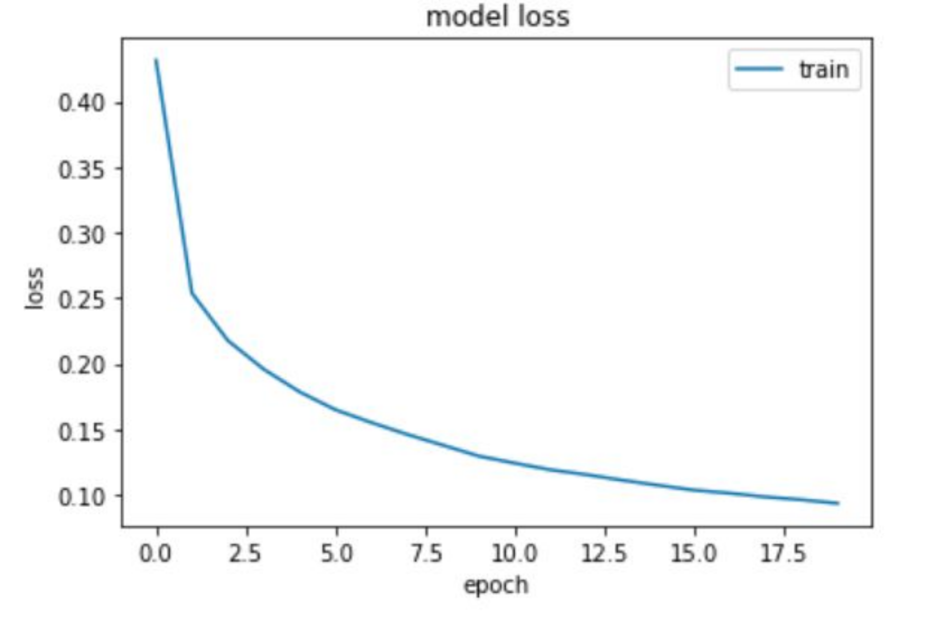
model.fit(training_images, training_labels, epochs=20)
```

Train a Model

```
model.compile(optimizer='adam',
              loss='sparse_categorical_crossentropy',
              metrics=['accuracy'])

model.fit(training_images, training_labels, epochs=20)
```





Evaluate
Optimize

```
classifications = model.predict(val_images)

print(classifications[0])

print(test_labels[0])
```

```
[2.4921512e-09 1.3765138e-10 8.8281205e-08
 1.0477231e-03 2.8455029e-12 4.0820678e-06
 2.0070659e-16 9.9894780e-01 1.0296049e-07
 2.9972372e-07]


7
```

Make Inferences

Digits Classification using DNN with TF2

Code Time!

TF_MNIST_Classification.ipynb

Going deeper with Deep Learning

Initializing neural networks

https://www.deeplearning.ai/ai-notes/initialization/

Neural networks – PlayList - 3Blue1Brown

https://www.youtube.com/playlist?list=PLZHQObOWTQDNU6R1_67000Dx_ZCJB-3pi

An introductory lecture for MIT course 6.S094 by Prof. Lex Fridman

https://youtu.be/O5xeyoRL95U

A Complete Machine Learning Package by Jean de Dieu Nyandwi

https://github.com/Nyandwi/machine_learning_complete

Thanks

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