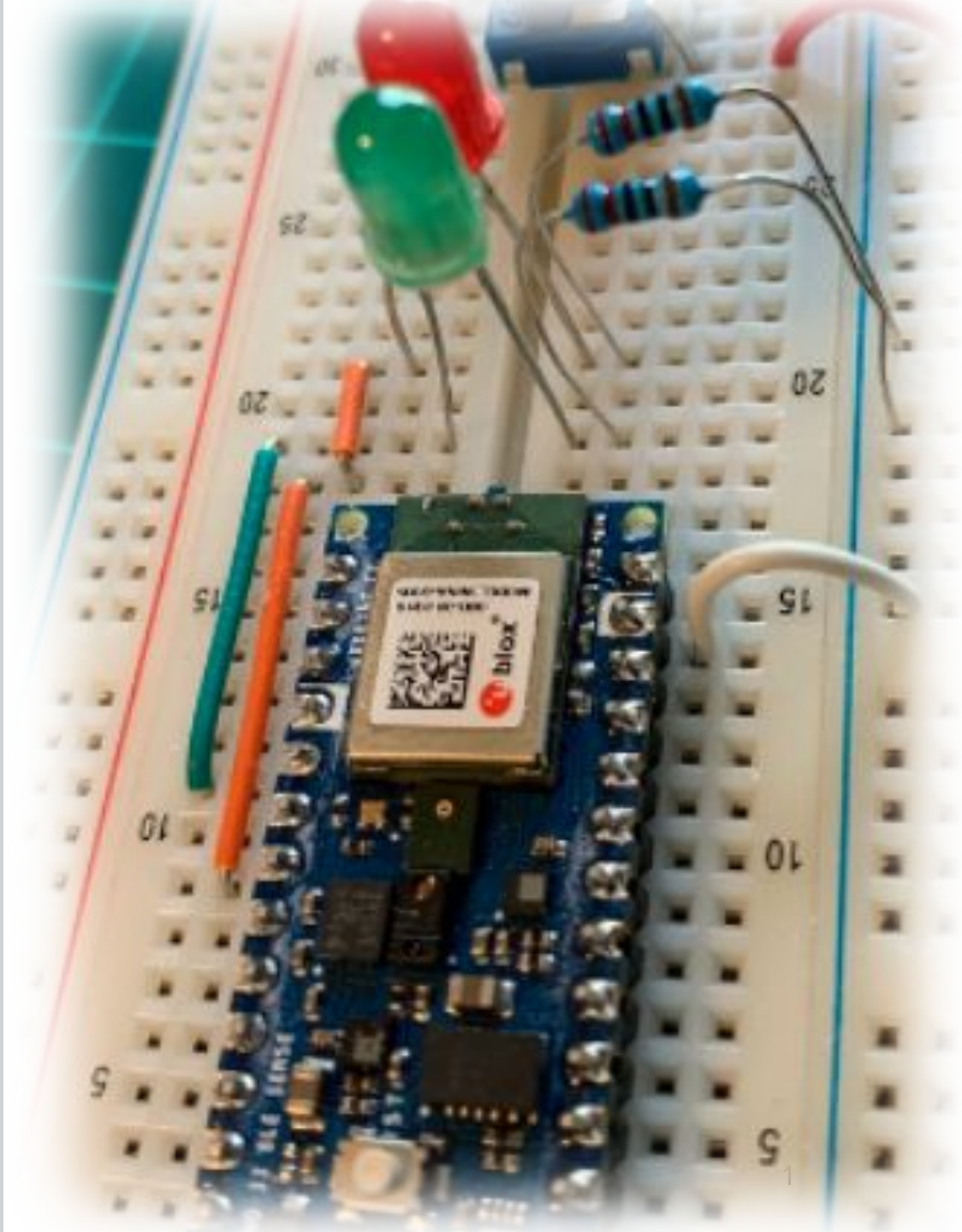
IESTI01 – TinyML

Embedded Machine Learning

6. Machine Learning
   Regression with DNN



Prof. Marcelo Rovai
UNIFEI

First Neural Network

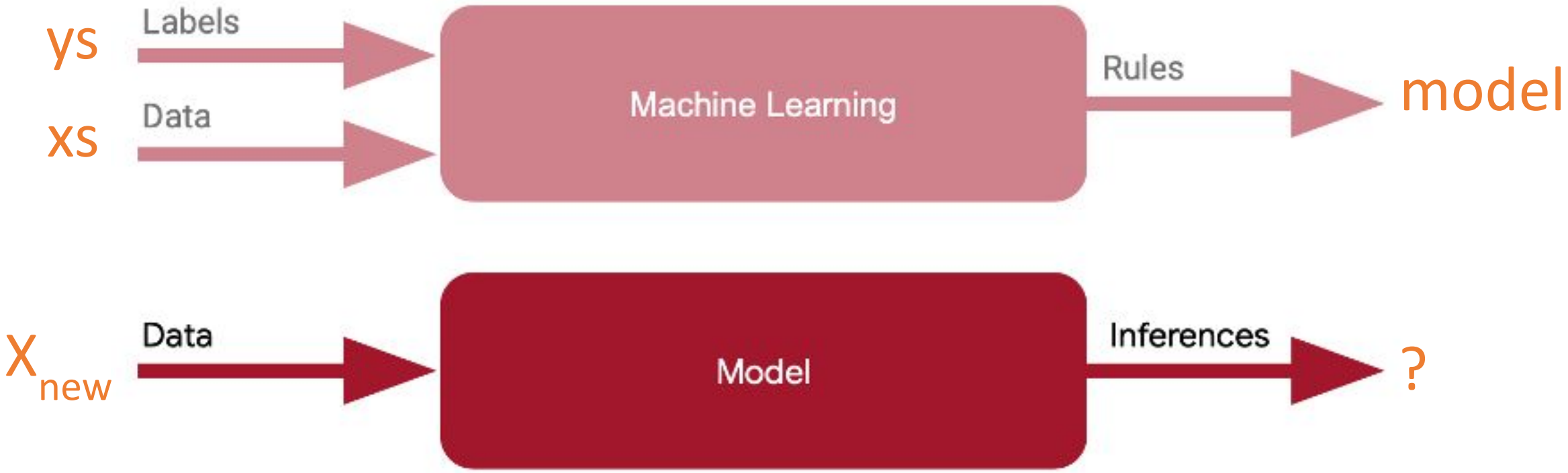
Putting it all together

X ➡ -1, 0, 1, 2, 3, 4

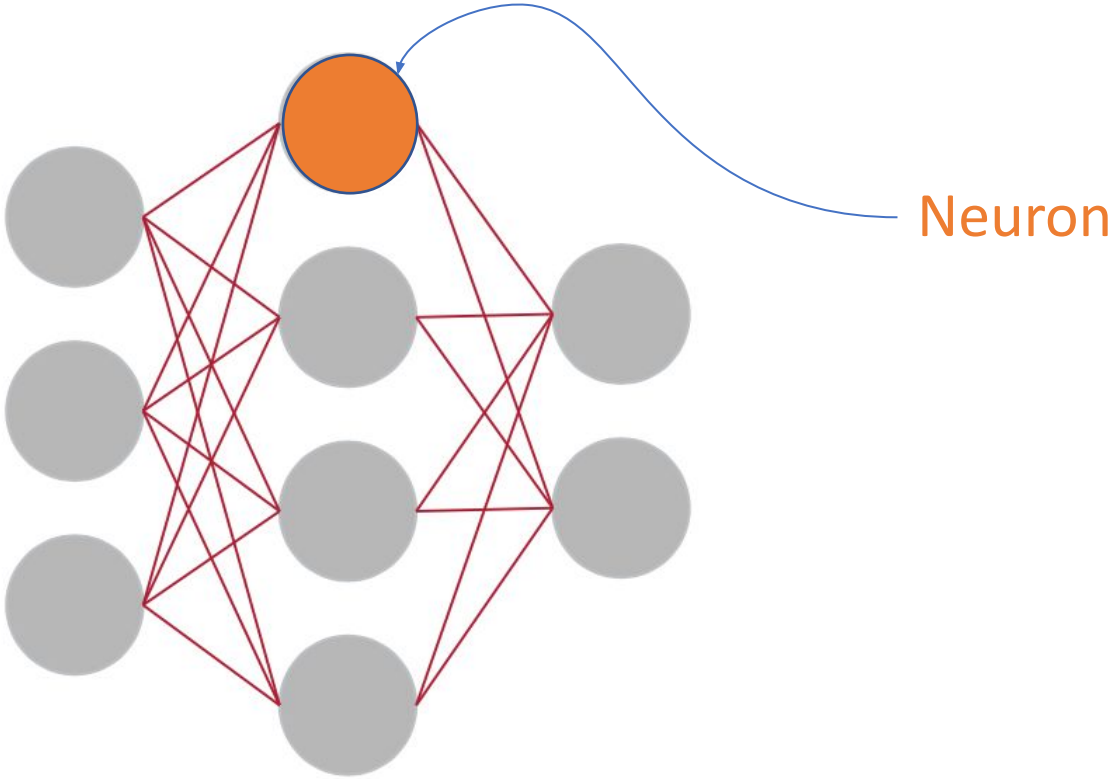
Y ➡ -3, -1, 1, 3, 5, 7


ys
Answers
Data
xs
Machine Learning
Rules
model

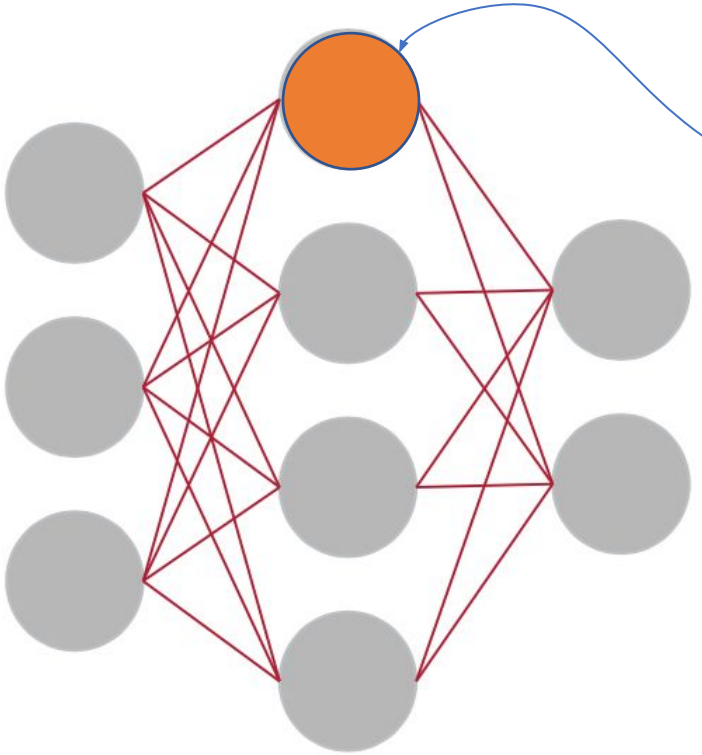
Inference -> model.predict (X_{new})



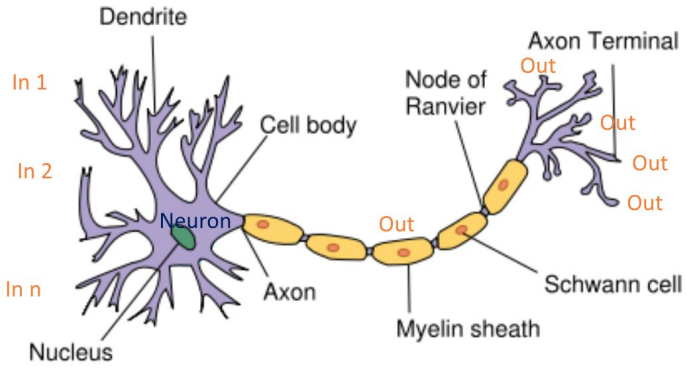
```
model = keras.Sequential([keras.layers.Dense(units=1, input_shape=[1])])
model.compile(optimizer='sgd', loss='mean_squared_error')

xs = np.array([-1.0, 0.0, 1.0, 2.0, 3.0, 4.0], dtype=float)
ys = np.array([-3.0, -1.0, 1.0, 3.0, 5.0, 7.0], dtype=float)

model.fit(xs, ys, epochs=500)

print(model.predict([10.0]))
```

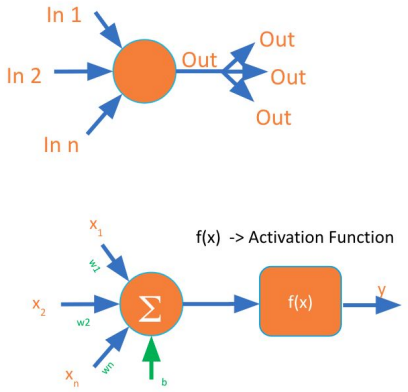


Dense Neural Network (DNN)

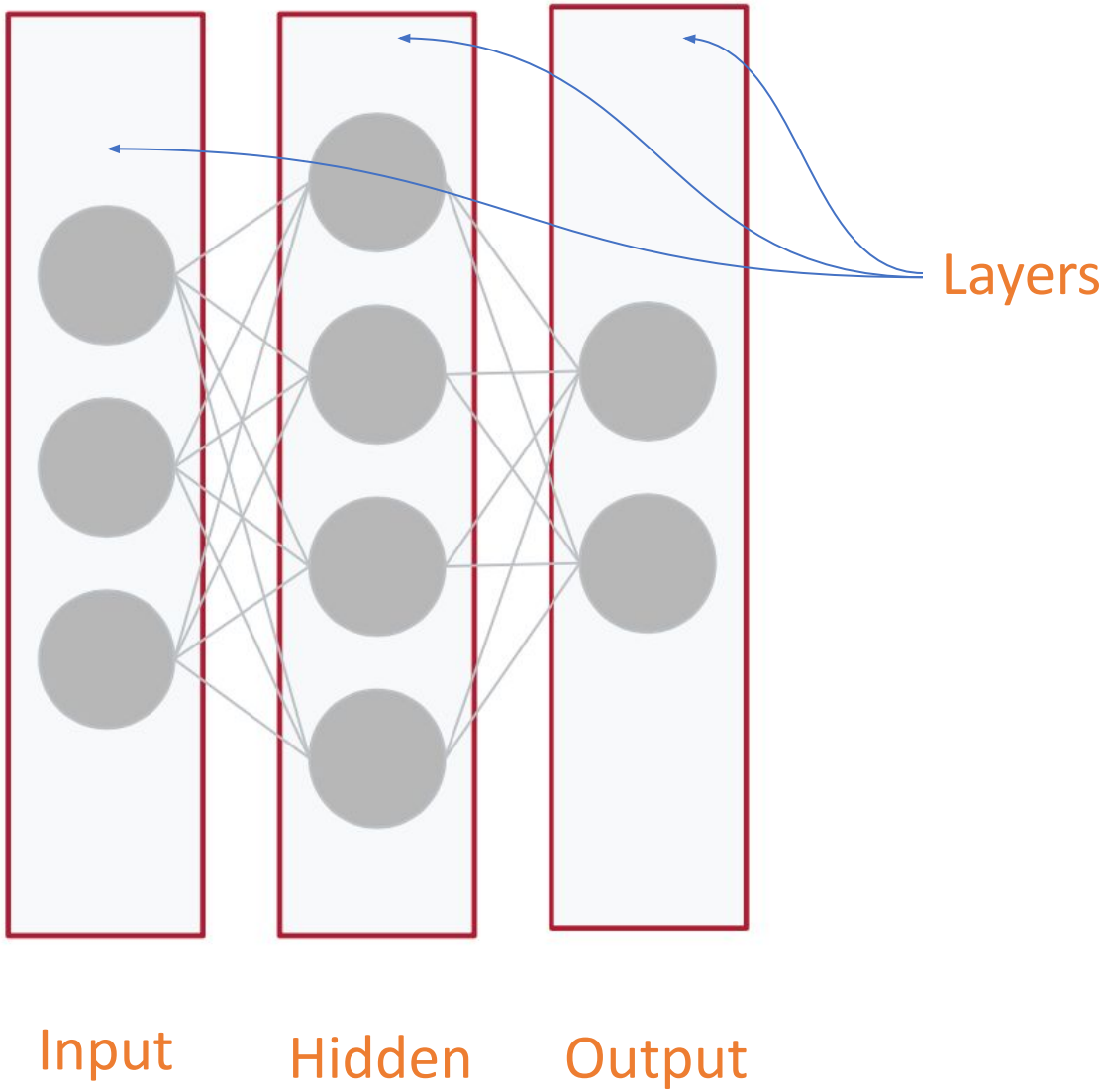


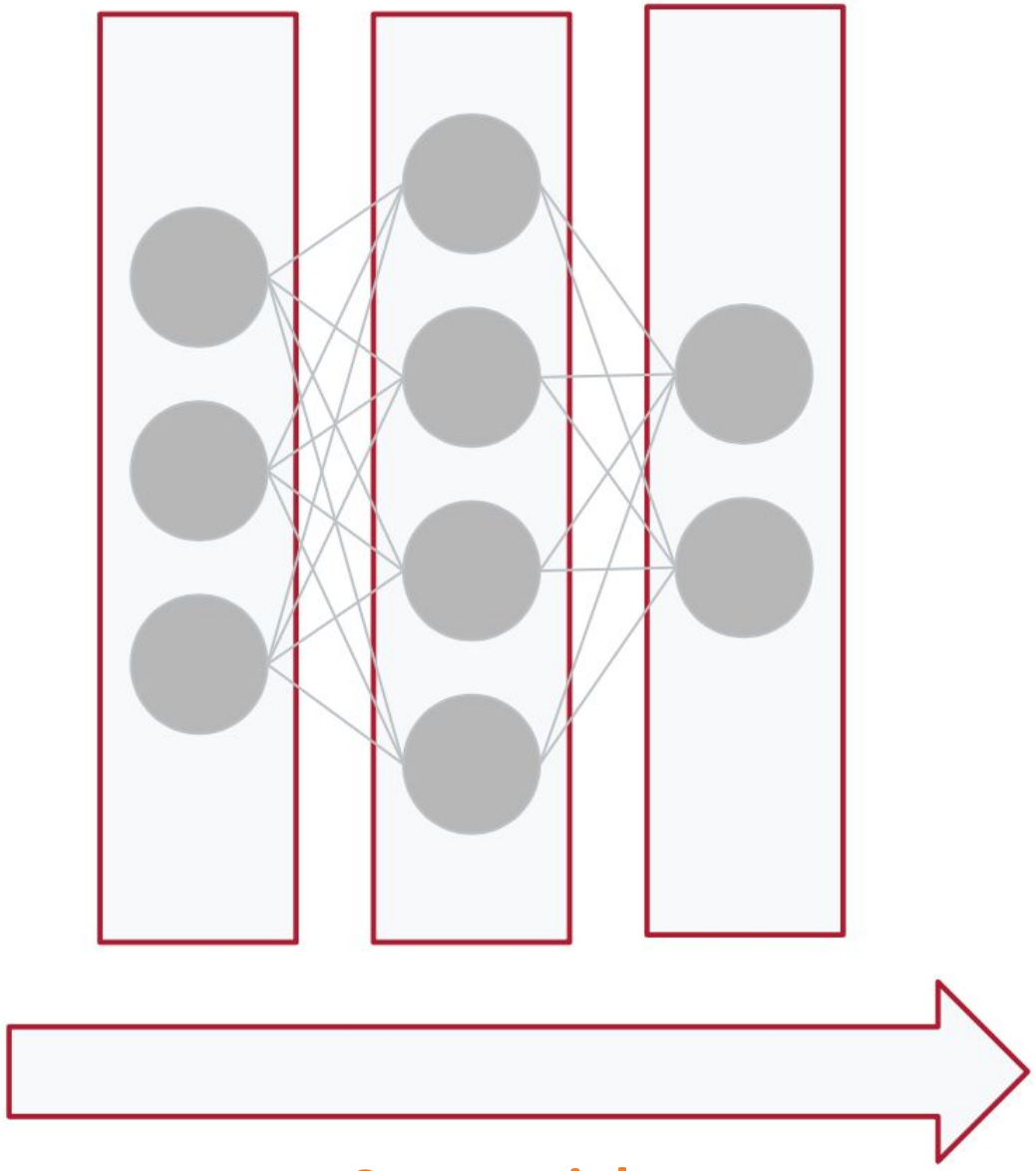
Neuron (Perceptron)





Dense Neural Network (DNN)


Layers
Input
Hidden
Output


Sequential

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ys = np.array([-3.0, -1.0, 1.0, 3.0, 5.0, 7.0], dtype=float)

model.fit(xs, ys, epochs=500)

print(model.predict([10.0]))
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1 Layer

1 Neuron

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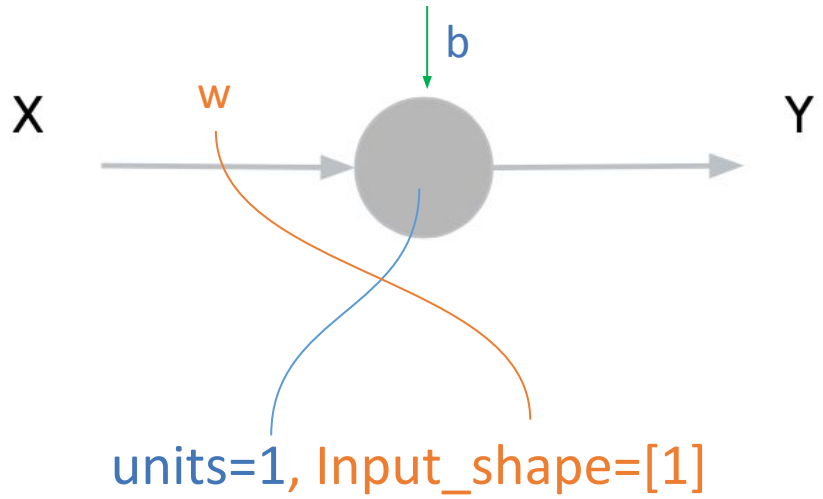
1 Neuron

1 Input


b
X
w
Y
units=1, Input_shape=[1]

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Answers
ys
Data
xs
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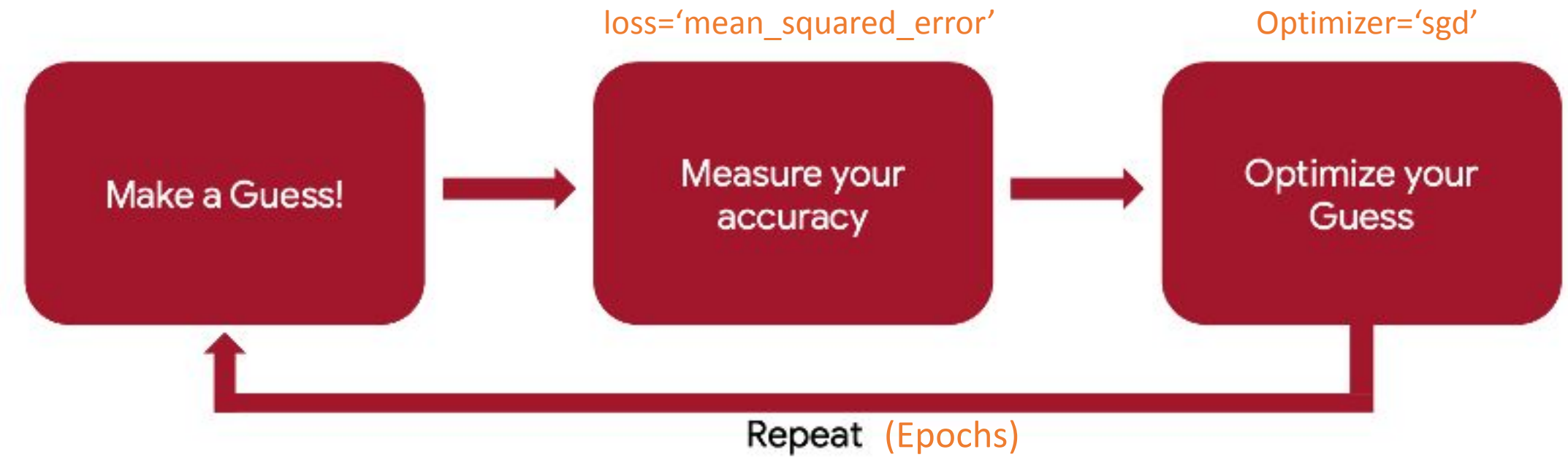
```

Training -> model.fit(xs, ys, epochs=500)



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print(model.predict([10.0]))
```
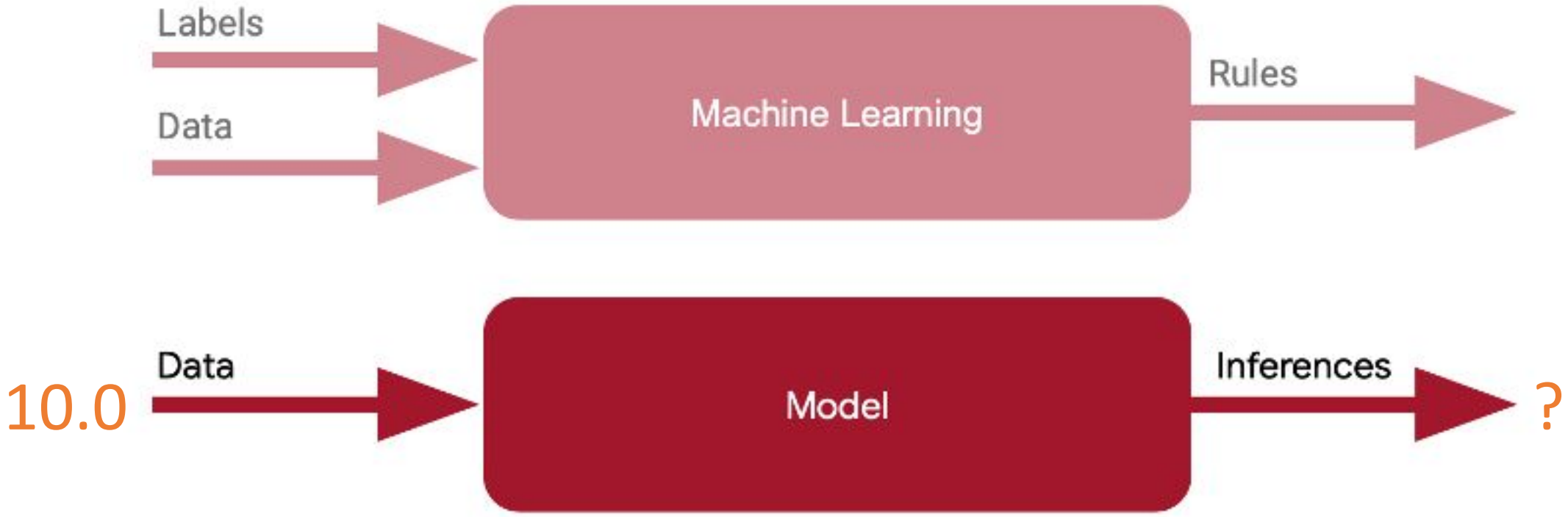

Inference -> model.predict([10.0])



First Neural Network with TF2

Code Time!

Reading Material

Main references

- Harvard School of Engineering and Applied Sciences - CS249r: Tiny Machine Learning
- Professional Certificate in Tiny Machine Learning (TinyML) – edX/Harvard
- Introduction to Embedded Machine Learning - Coursera/Edge Impulse
- Computer Vision with Embedded Machine Learning - Coursera/Edge Impulse
- Fundamentals textbook: “Deep Learning with Python” by François Chollet
- Applications & Deploy textbook: “TinyML” by Pete Warden, Daniel Situnayake
- Deploy textbook “TinyML Cookbook” by Gian Marco Iodice

I want to thank Shawn Hymel and Edge Impulse, Pete Warden and Laurence Moroney from Google, Professor Vijay Janapa Reddi and Brian Plancher from Harvard, and the rest of the TinyMLedu team for preparing the excellent material on TinyML that is the basis of this course at UNIFEI.

The IESTI01 course is part of the **TinyML4D**, an initiative to make TinyML education available to everyone globally.

Thanks

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