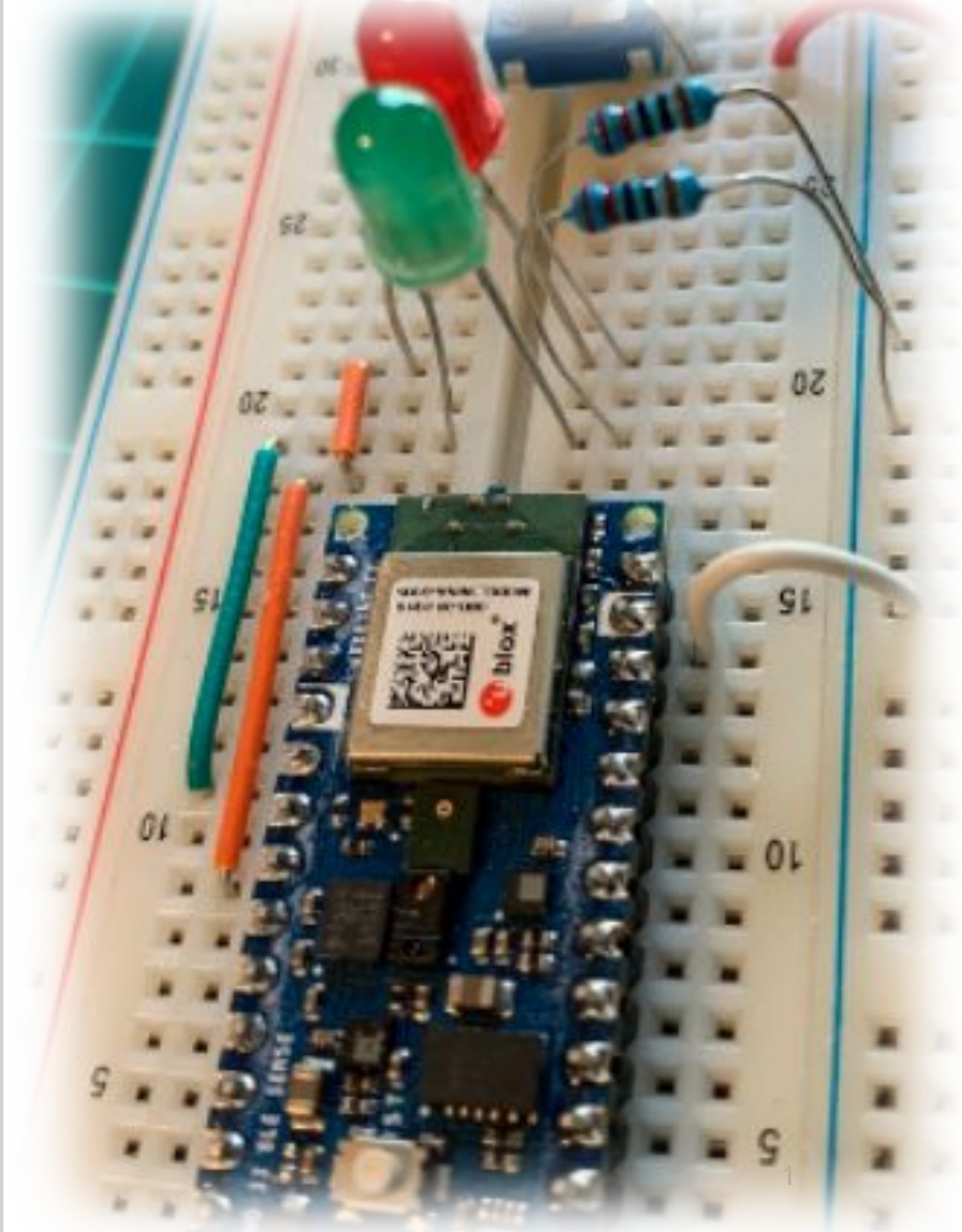
IESTI01 – TinyML

Embedded Machine Learning

6. Machine Learning
   Regression with DNN



Prof. Marcelo Rovai
UNIFEI

First Neural Network

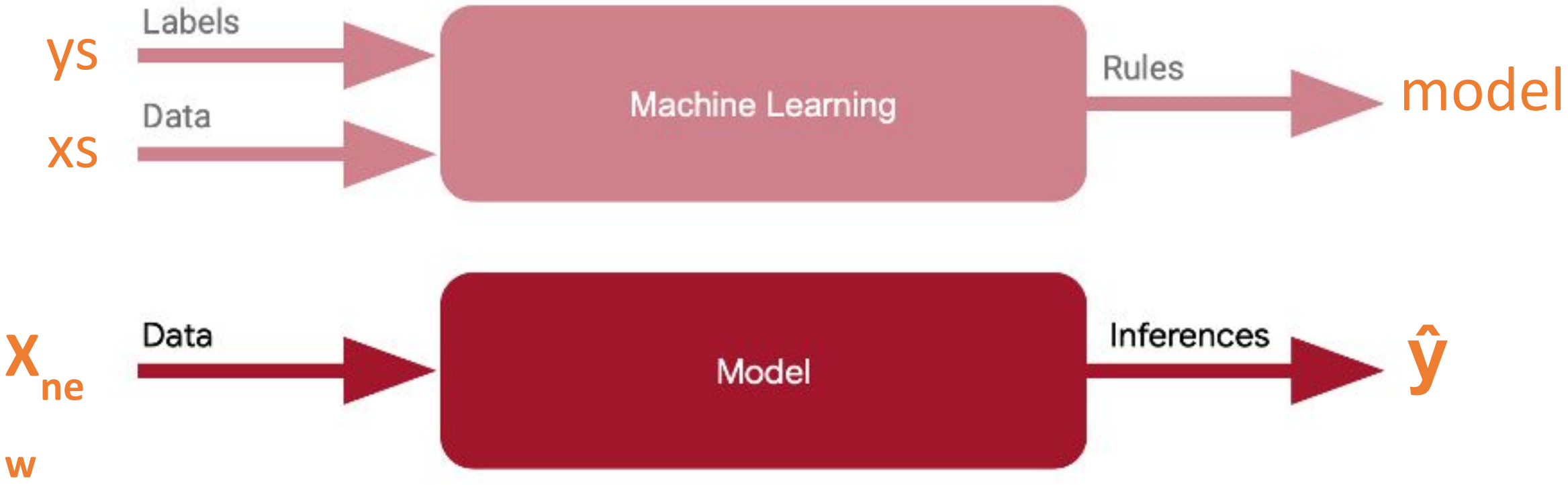
Putting it all together

X ➡ -1, 0, 1, 2, 3, 4

Y ➡ -3, -1, 1, 3, 5, 7


Answers
ys
Data
xs
Machine Learning
Rules
model

Inference -> predict output ($\hat{y}$) for new input (X_{new})

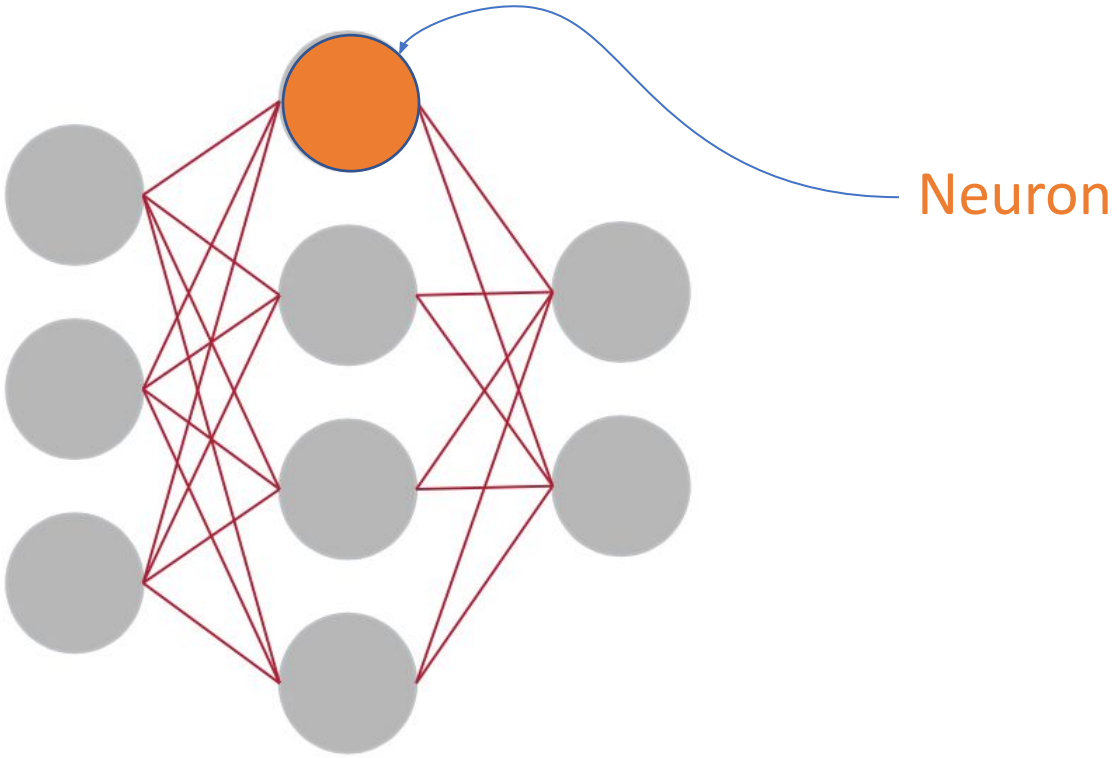


```
model = keras.Sequential([keras.layers.Dense(units=1, input_shape=[1])])
model.compile(optimizer='sgd', loss='mean_squared_error')

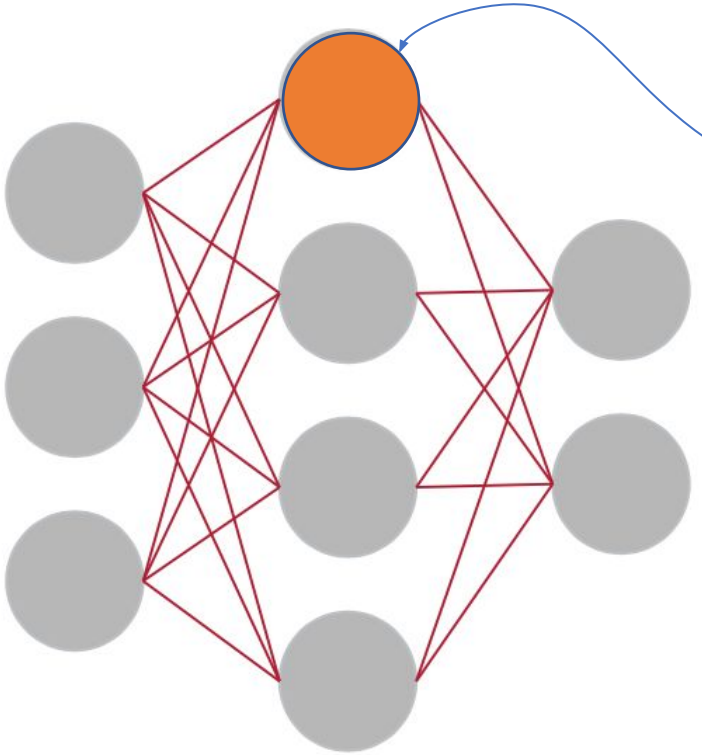
xs = np.array([-1.0, 0.0, 1.0, 2.0, 3.0, 4.0], dtype=float)
ys = np.array([-3.0, -1.0, 1.0, 3.0, 5.0, 7.0], dtype=float)

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

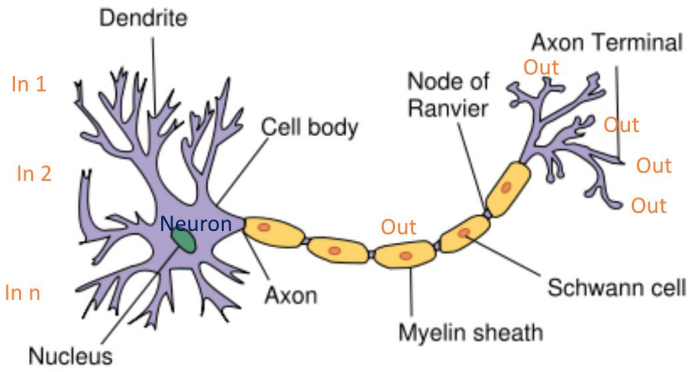
print(model.predict([10.0]))
```

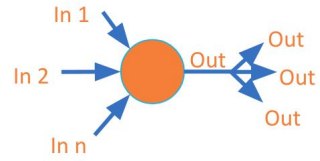


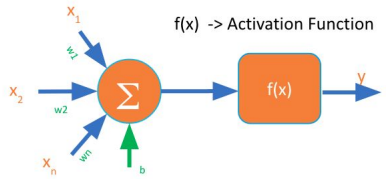
Dense Neural Network (DNN)



Neuron (Perceptron)



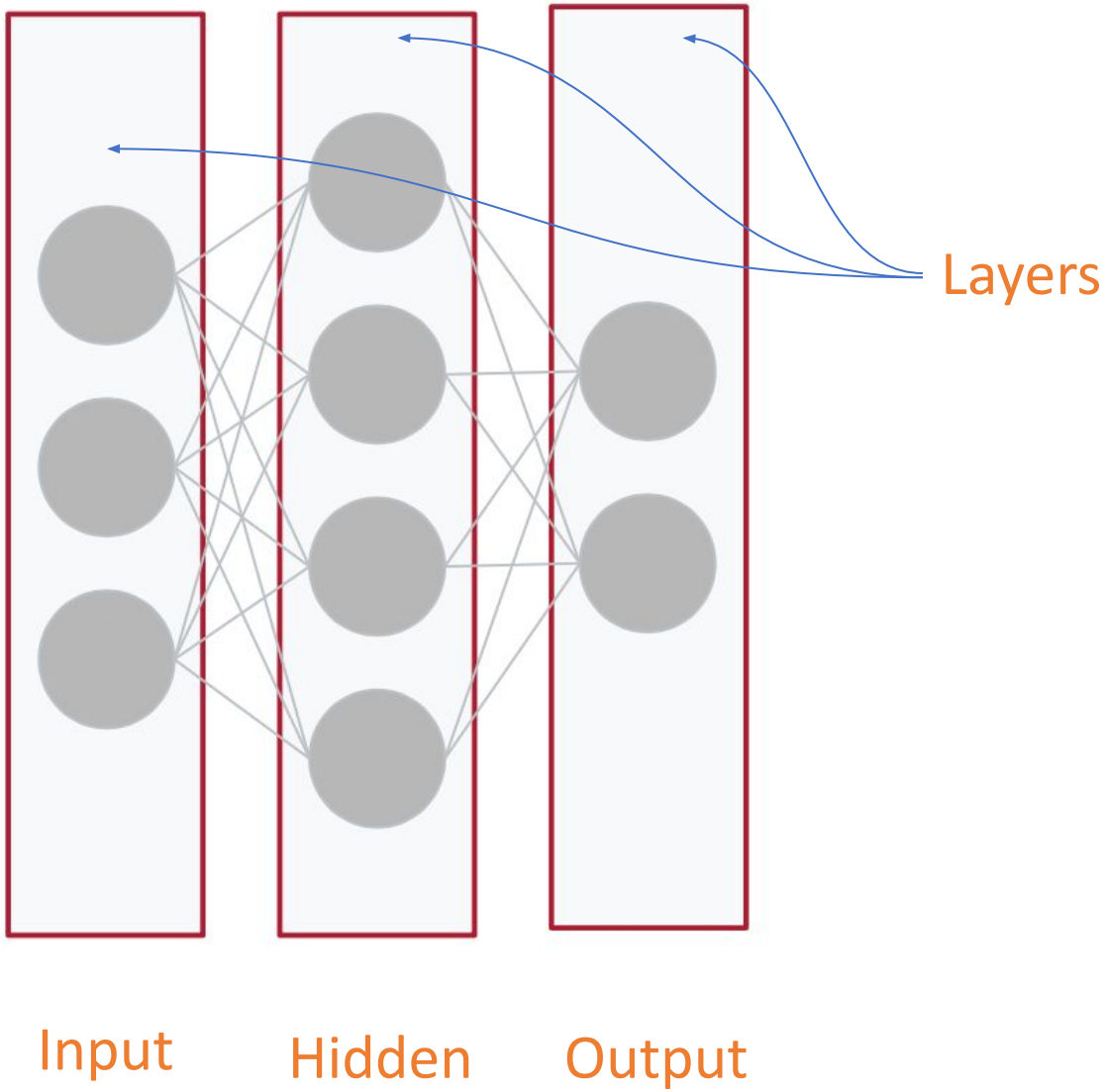


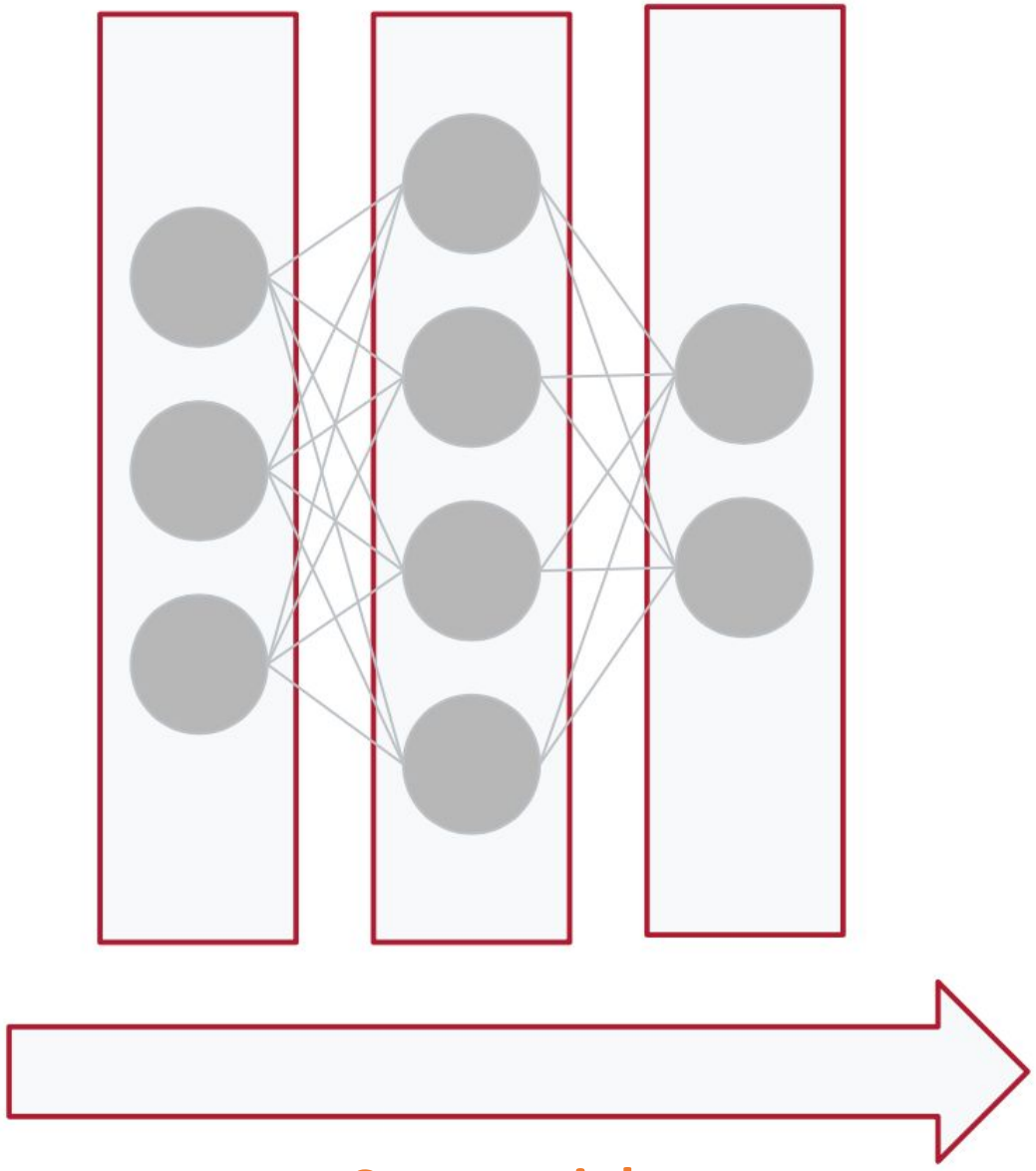


Parameters

$$y = f(\sum_{i=1}^{n} x_i w_i + b)$$

Dense Neural Network (DNN)


Layers
Input
Hidden
Output


Sequencial

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

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

1 Neuron

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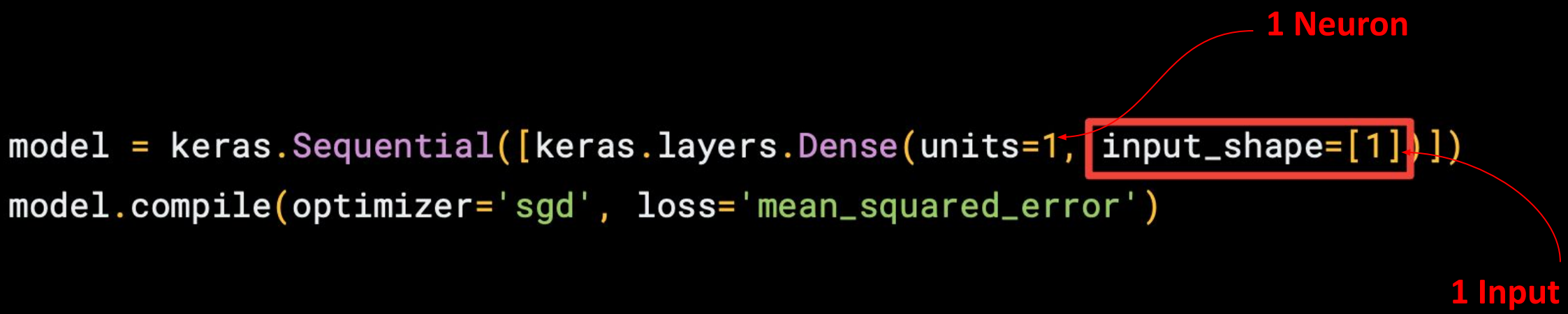
1 Layer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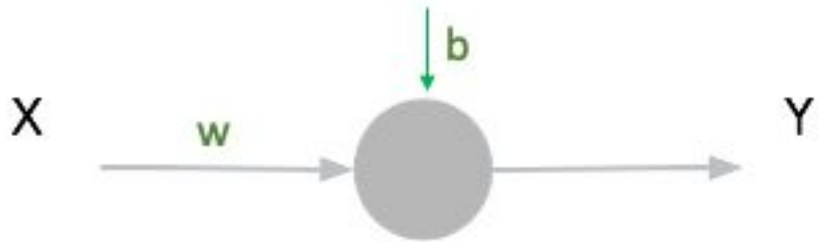

units=1, Input_shape=[1]

```
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Answers
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Machine Learning
Rules
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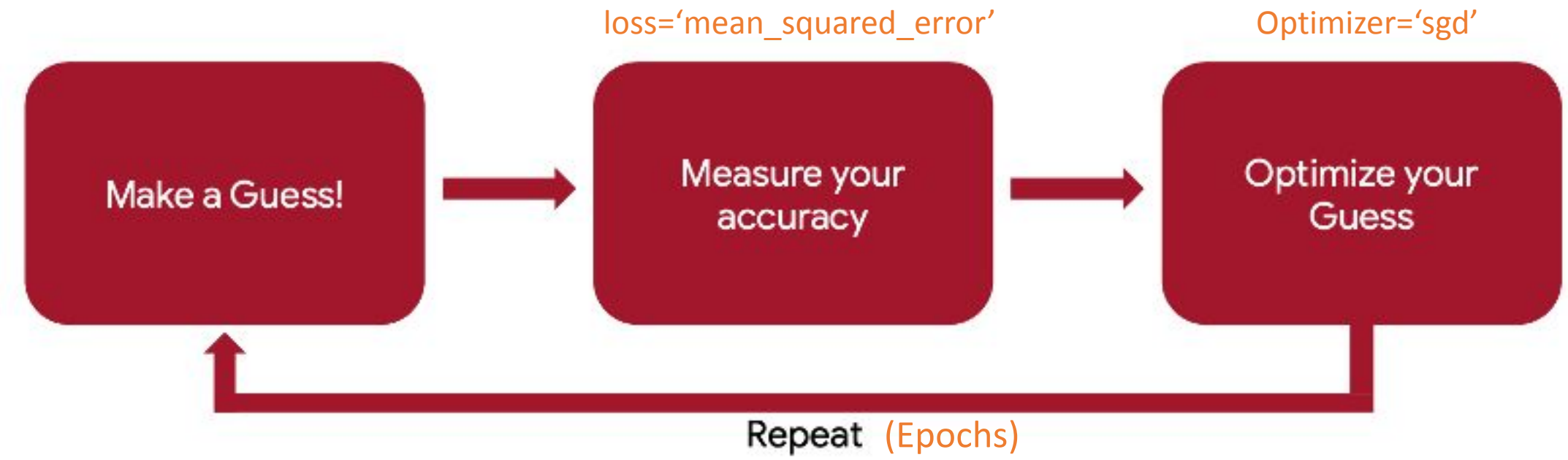
```

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



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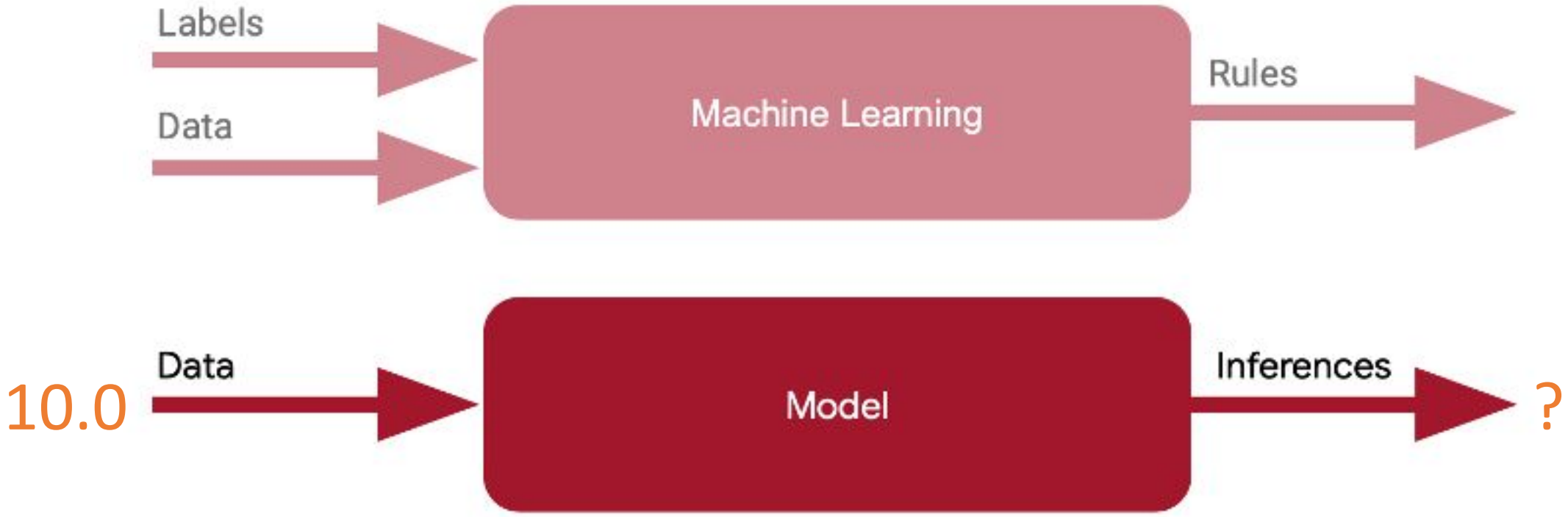
print(model.predict([10.0]))
```

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)
- Text Book: "TinyML" by Pete Warden, Daniel Situnayake

I want to thank Shawn Hymel and Edge Impulse, Pete Warden and Laurence Moroney from Google, and especially Harvard professor Vijay Janapa Reddi, Ph.D. student Brian Plancher and their staff 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

And stay safe!

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