Copyright Notice

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  tf.keras.layers.Flatten(input_shape=(28, 28)),
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```

```
if(x>0):
    return x
else:
    return 0
```

```
Epoch 1/5
1875/1875 [==============================] - 4s 2ms/step - loss: 0.2591 -
accuracy: 0.9262
Epoch 2/5
1875/1875 [==============================] - 4s 2ms/step - loss: 0.1157 -
accuracy: 0.9662
Epoch 3/5
1875/1875 [==============================] - 4s 2ms/step - loss: 0.0801 -
accuracy: 0.9760
Epoch 4/5
1875/1875 [==============================] - 4s 2ms/step - loss: 0.0601 -
accuracy: 0.9820
Epoch 5/5
1875/1875 [==============================] - 4s 2ms/step - loss: 0.0456 -
accuracy: 0.9862
313/313 [==============================] - 0s 1ms/step - loss: 0.0757 -

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Epoch 1/5
1875/1875 [==============================] - 3s 2ms/step - loss: 0.3568 -
accuracy: 0.8984
Epoch 2/5
1875/1875 [==============================] - 4s 2ms/step - loss: 0.2988 -
accuracy: 0.9170
Epoch 3/5
1875/1875 [==============================] - 4s 2ms/step - loss: 0.2880 -
accuracy: 0.9192
Epoch 4/5
1875/1875 [==============================] - 4s 2ms/step - loss: 0.2821 -
accuracy: 0.9205
Epoch 5/5
1875/1875 [==============================] - 3s 2ms/step - loss: 0.2763 -
accuracy: 0.9227
313/313 [==============================] - 0s 1ms/step - loss: 0.3031 -
accuracy: 0.9154
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1875/1875 [==============================] - 3s 2ms/step - loss: 0.3568 -
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```
Epoch 1/5
1875/1875 [==============================] - 4s 2ms/step - loss: 0.2229 -
accuracy: 0.9377
Epoch 2/5
1875/1875 [==============================] - 3s 2ms/step - loss: 0.0908 -
accuracy: 0.9734
Epoch 3/5
1875/1875 [==============================] - 3s 2ms/step - loss: 0.0636 -
accuracy: 0.9807
Epoch 4/5
1875/1875 [==============================] - 4s 2ms/step - loss: 0.0471 -
accuracy: 0.9853
Epoch 5/5
1875/1875 [==============================] - 4s 2ms/step - loss: 0.0396 -
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313/313 [==============================] - 0s 1ms/step - loss: 0.0840 -
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  return K.maximum(0.0, x)

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```

Some commonly used layers

Convolutional

Conv1D/Conv2D/Conv3D

SeparableConv2D

DepthwiseConv2D

Recurrent

LSTM

GRU

Pooling

MaxPooling2D

AveragePooling2D

GlobalAveragePooling2D

Merge

Add

Subtract

Multiply

Activations (Advanced)

LeakyReLU

PReLU

ELU

Core

Activation

Lambda

Input

Dense

Dropout

BatchNormalization

Some commonly used layers

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Activations (Advanced)

LeakyReLU

PReLU

ELU

Core

Activation

Lambda

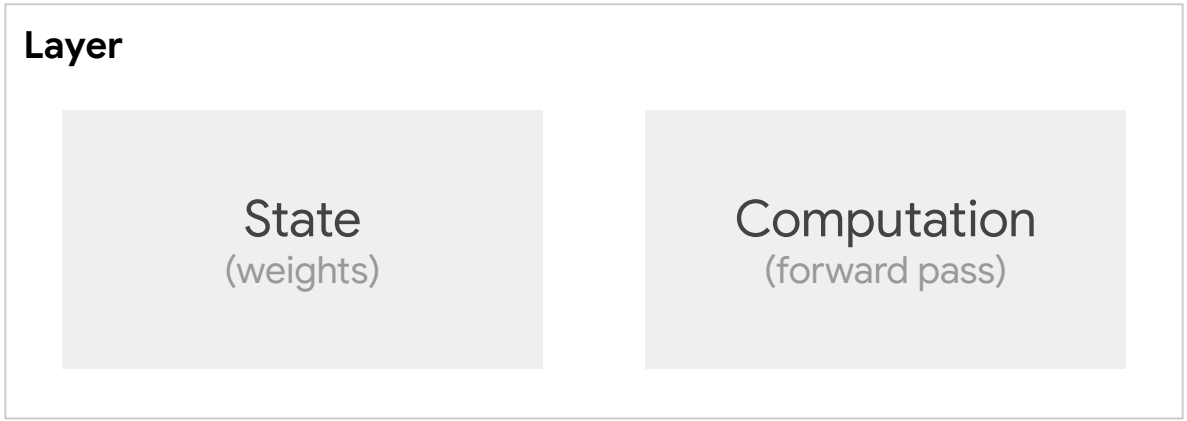
Input

Dense

Dropout

BatchNormalization

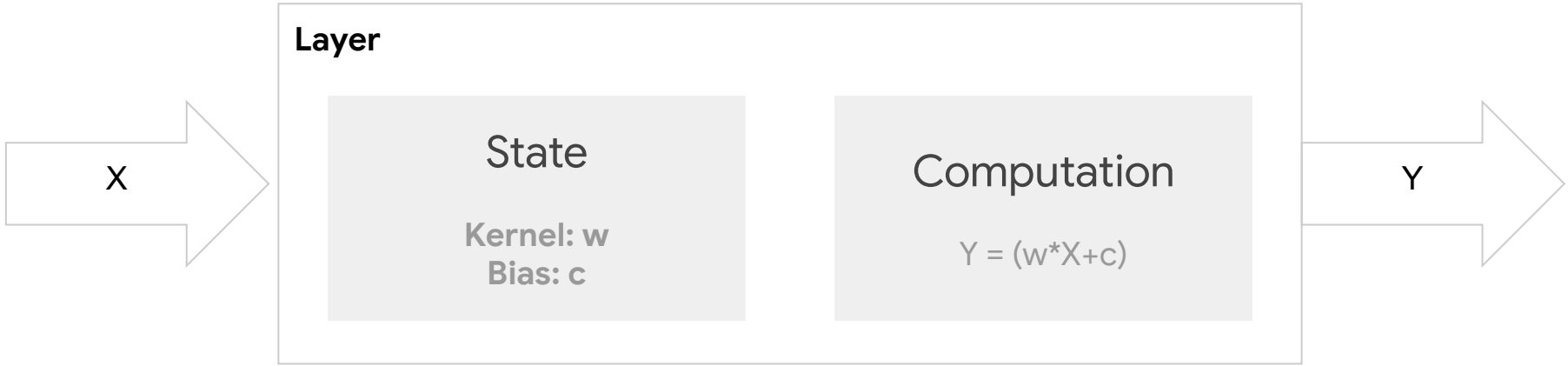
What is a Layer?

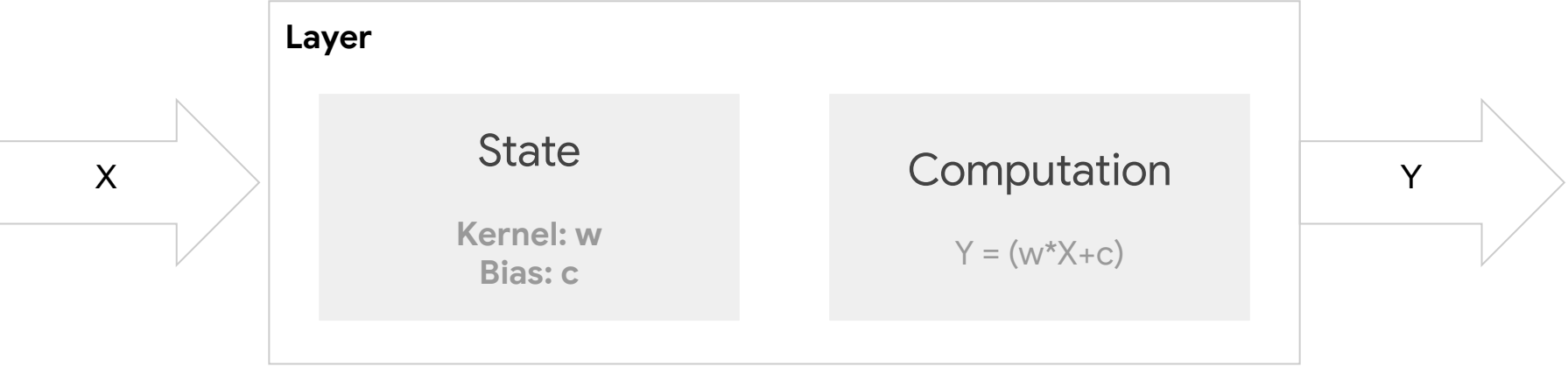


What is a Layer?

What is a Layer?

Simple Dense Layer




Layer
X
State
Kernel: w
Bias: c
Computation
Y = (w*X+c)
Y

```python
class SimpleDense(Layer):

  def __init__(self, units=32):
      super(SimpleDense, self).__init__()
      self.units = units

  def build(self, input_shape):  # Create the state of the layer (weights)
    w_init = tf.random_normal_initializer()
    self.w = tf.Variable(name="kernel",
        initial_value=w_init(shape=(input_shape[-1], self.units), dtype='float32'),
        trainable=True)

    b_init = tf.zeros_initializer()
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my_dense = SimpleDense(units=1)
x = tf.ones((1, 1))
y = my_dense(x)
print(my_dense.variables)
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```
[<tf.Variable 'simple_dense_7/kernel:0' shape=(1, 1)
dtype=float32, numpy=array([[0.03688493]], dtype=float32)>,

<tf.Variable 'simple_dense_7/bias:0' shape=(1,)
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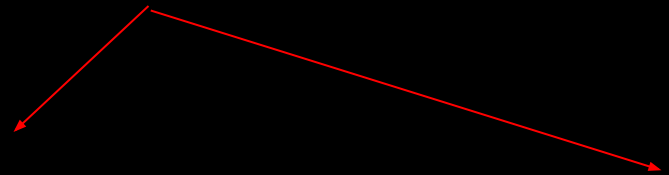
```

```
import numpy as np

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 = tf.keras.Sequential([SimpleDense(units=1)])
model.compile(optimizer='sgd', loss='mean_squared_error')
model.fit(xs, ys, epochs=500,verbose=0)
print(model.predict([10.0]))
```



Expected Answer: 19 (y=2x-1)

Actual Answer: 0.36

(W = 0.036, B=0 => Y=.036 * 10 + 0 = 0.36)

```
Epoch 1/500
1/1 [==============================] - 0s 1ms/step - loss: 14.8152
Epoch 2/500
1/1 [==============================] - 0s 3ms/step - loss: 11.8951
Epoch 3/500
1/1 [==============================] - 0s 1ms/step - loss: 9.5928
```

```
Epoch 498/500
1/1 [==============================] - 0s 2ms/step - loss: 4.1124e-05
Epoch 499/500
1/1 [==============================] - 0s 2ms/step - loss: 4.0279e-05
Epoch 500/500
1/1 [==============================] - 0s 1ms/step - loss: 3.9452e-05
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```

```
[[18.981468]]
```

```
[<tf.Variable
'sequential_15/simple_dense_19/kernel:0' shape=(1, 1)
dtype=float32, numpy=array([[1.9972587]],
dtype=float32)>, <tf.Variable
'sequential_15/simple_dense_19/bias:0' shape=(1,)
dtype=float32, numpy=array([-0.991501],
dtype=float32)>]
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class SimpleDense(Layer):

  def __init__(self, units=32):
      super(SimpleDense, self).__init__()
      self.units = units

  def build(self, input_shape):  # Create the state of the layer (weights)
    w_init = tf.random_normal_initializer()
    self.w = tf.Variable(name="kernel",
        initial_value=w_init(shape=(input_shape[-1], self.units), dtype='float32'),
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    b_init = tf.zeros_initializer()
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