Build your own model in Tensorflow 2.0

This notebook will teach you how to build your own custom model, where you define your own variables and how to compute predictions.

In [ ]:
```
# Install TensorFlow
# !pip install -q tensorflow-gpu==2.0.0-beta1

try:
  %tensorflow_version 2.x  # Colab only.
except Exception:
  pass

import tensorflow as tf
print(tf.__version__)
```

```
`%tensorflow_version` only switches the major version: `1.x` or `2.x`.
You set: `2.x  # Colab only.`. This will be interpreted as: `2.x`.


TensorFlow 2.x selected.
2.0.0-beta1
```

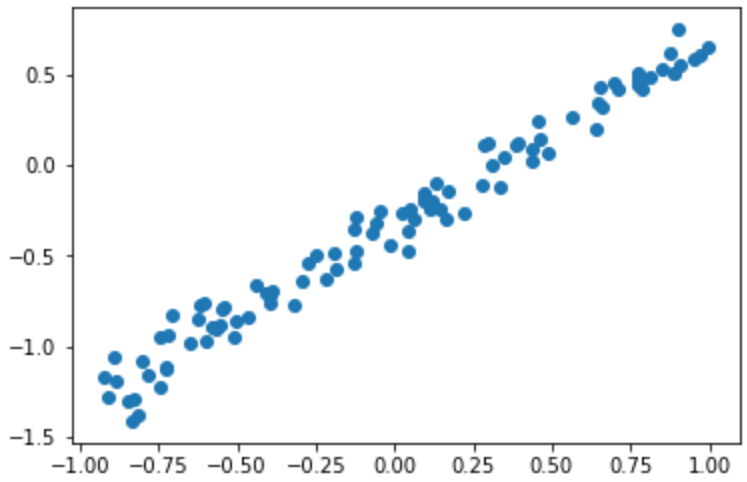
In [ ]:
```
# Other imports
import numpy as np
import matplotlib.pyplot as plt
```

In [ ]:
```
# Define linear regression model

class LinearRegression(tf.keras.Model):
  def __init__(self, num_inputs, num_outputs):
    super(LinearRegression, self).__init__()
    self.W = tf.Variable(
        tf.random_normal_initializer()((num_inputs, num_outputs)))
    self.b = tf.Variable(tf.zeros(num_outputs))
    self.params = [self.W, self.b]

  def call(self, inputs):
    return tf.matmul(inputs, self.W) + self.b
```

In [ ]:
```
# Create a dataset
N = 100
D = 1
K = 1
X = np.random.random((N, D)) * 2 - 1
w = np.random.randn(D, K)
b = np.random.randn()
Y = X.dot(w) + b + np.random.randn(N, 1) * 0.1
```

In [ ]:
```
plt.scatter(X, Y)
```

Out[ ]: <matplotlib.collections.PathCollection at 0x7fc430437e48>



In [ ]:
```
# Cast type, otherwise Tensorflow will complain

X = X.astype(np.float32)
Y = Y.astype(np.float32)
```

In [ ]:
```
# Define the loss

def get_loss(model, inputs, targets):
  predictions = model(inputs)
  error = targets - predictions
  return tf.reduce_mean(tf.square(error))
```

In [ ]:
```
# Gradient function
def get_grad(model, inputs, targets):
  with tf.GradientTape() as tape:
    # calculate the loss
    loss_value = get_loss(model, inputs, targets)

  # return gradient
  return tape.gradient(loss_value, model.params)
```

In [ ]:
```
# Create and train the model
model = LinearRegression(D, K)

# Print the params before training
print("Initial params:")
print(model.W)
print(model.b)
```

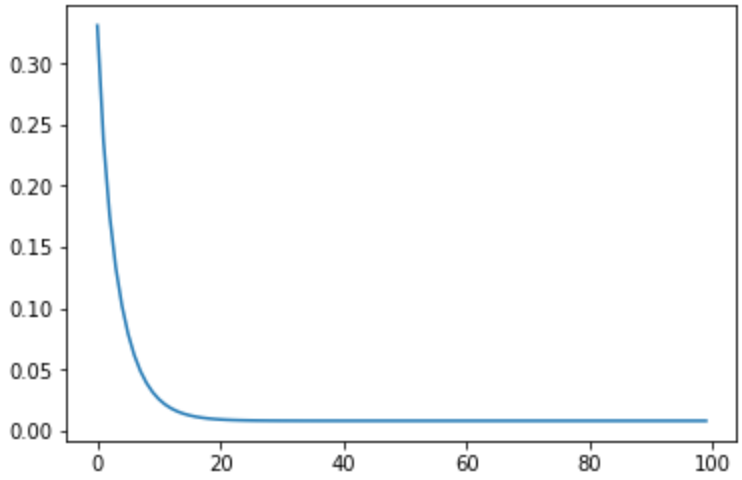
```
Initial params:
<tf.Variable 'Variable:0' shape=(1, 1) dtype=float32, numpy=array([[-0.07139343]], dtype
=float32)>
<tf.Variable 'Variable:0' shape=(1,) dtype=float32, numpy=array([0.], dtype=float32)>
```

In [ ]:
```
# Store the losses here
losses = []
```

```
# Create an optimizer
optimizer = tf.keras.optimizers.SGD(learning_rate=0.2)

# Run the training loop
for i in range(100):
  # Get gradients
  grads = get_grad(model, X, Y)

  # Do one step of gradient descent: param <- param - learning_rate * grad
  optimizer.apply_gradients(zip(grads, model.params))

  # Store the loss
  loss = get_loss(model, X, Y)
  losses.append(loss)
```

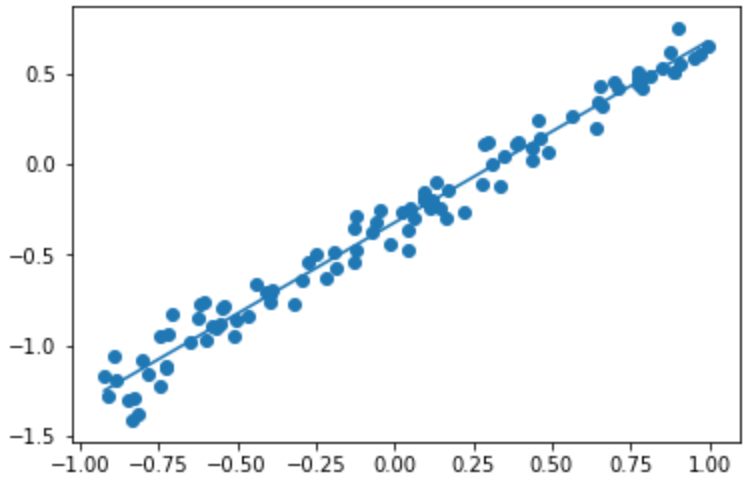
In [ ]:
```
plt.plot(losses)
```

Out[ ]: [<matplotlib.lines.Line2D at 0x7fc428b362b0>]



In [ ]:
```
x_axis = np.linspace(X.min(), X.max(), 100)
y_axis = model.predict(x_axis.reshape(-1, 1)).flatten()

plt.scatter(X, Y)
plt.plot(x_axis, y_axis)
```

Out[ ]: [<matplotlib.lines.Line2D at 0x7fc428b1f2e8>]



In [ ]:
```
print("Predicted params:")
print(model.W)
print(model.b)
```

```
Predicted params:
<tf.Variable 'Variable:0' shape=(1, 1) dtype=float32, numpy=array([[1.0059998]], dtype=f
loat32)>
<tf.Variable 'Variable:0' shape=(1,) dtype=float32, numpy=array([-0.3224416], dtype=floa
t32)>
```

In [ ]:
```
print("True params:")
w, b
```

```
True params:
```

Out[ ]:
```
(array([[1.01350001]]), -0.3286531216778375)
```