```
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Open in Colab

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

```
import tensorflow as tf
import numpy as np
import matplotlib.pyplot as plt
print(tf.__version__)
```

```
2.3.0
```

```
#generate some random time series
def plot_series(time, series, format="-", start=0, end=None):
    plt.plot(time[start:end], series[start:end], format)
    plt.xlabel("Time")
    plt.ylabel("Value")
    plt.grid(True)

def trend(time, slope=0):
    return slope * time

def seasonal_pattern(season_time):
    """Just an arbitrary pattern, you can change it if you wish"""
    return np.where(season_time < 0.4,
                    np.cos(season_time * 2 * np.pi),
                    1 / np.exp(3 * season_time))

def seasonality(time, period, amplitude=1, phase=0):
    """Repeats the same pattern at each period"""
    season_time = ((time + phase) % period) / period
    return amplitude * seasonal_pattern(season_time)
```

```
def noise(time, noise_level=1, seed=None):
    rnd = np.random.RandomState(seed)
    return rnd.randn(len(time)) * noise_level

time = np.arange(4 * 365 + 1, dtype="float32")
baseline = 10
series = trend(time, 0.1)
baseline = 10
amplitude = 40
slope = 0.05
noise_level = 5

# Create the series
series = baseline + trend(time, slope) + seasonality(time, period=365, amplitude=amplitude)
# Update with noise
series += noise(time, noise_level, seed=42)

#splitting data into training and validation datasets
split_time = 1000
time_train = time[:split_time]
x_train = series[:split_time]
time_valid = time[split_time:]
x_valid = series[split_time:]

#variables that we'll use for windowing
window_size = 20
batch_size = 32
shuffle_buffer_size = 1000


def windowed_dataset(series, window_size, batch_size, shuffle_buffer):
  #putting everything together to create the formatted dataset
  dataset = tf.data.Dataset.from_tensor_slices(series)
  dataset = dataset.window(window_size + 1, shift=1, drop_remainder=True)
  dataset = dataset.flat_map(lambda window: window.batch(window_size + 1))
  dataset = dataset.shuffle(shuffle_buffer).map(lambda window: (window[:-1], window[-1]))
  dataset = dataset.batch(batch_size).prefetch(1)
  return dataset


dataset = windowed_dataset(x_train, window_size, batch_size, shuffle_buffer_size)
print(dataset)
l0 = tf.keras.layers.Dense(1, input_shape=[window_size])
model = tf.keras.models.Sequential([l0])

#using only linear regression
#mse -> mean squared error
model.compile(loss="mse", optimizer=tf.keras.optimizers.SGD(lr=1e-6, momentum=0.9))
model.fit(dataset,epochs=100,verbose=0)

print("Layer weights {}".format(l0.get_weights()))
```

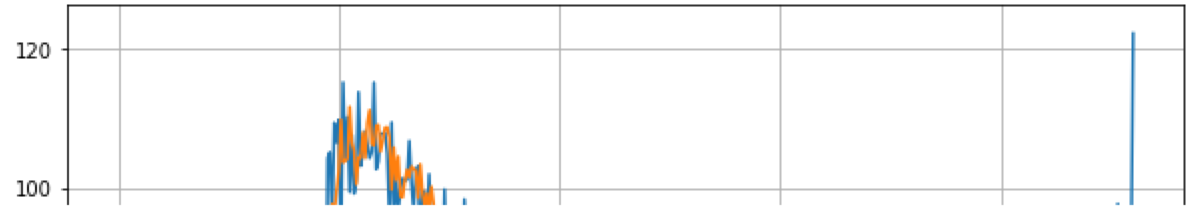
```
<PrefetchDataset shapes: ((None, None), (None,)), types: (tf.float32, tf.float32)>
Layer weights [array([[-0.11103843],
       [ 0.05191648],
       [ 0.06685166],
       [-0.02439825],
       [ 0.09887417],
       [-0.03999918],
       [-0.01302115],
       [-0.04818792],
       [-0.07966663],
       [ 0.09810047],
       [ 0.03367889],
       [-0.00523788],
       [-0.07973041],
       [ 0.06818611],
       [ 0.07053313],
       [ 0.04500167],
       [-0.0507101 ],
       [ 0.16973057],
       [ 0.3292246 ],
       [ 0.42588478]], dtype=float32), array([0.01711132], dtype=float32)]
```

```
forecast = []
#plot points on time series relative to window_size before it
for time in range(len(series) - window_size):
  #np new axis reshapes it to the input dimension that's used by the model
  forecast.append(model.predict(series[time:time + window_size][np.newaxis]))

forecast = forecast[split_time-window_size:]
results = np.array(forecast)[:, 0, 0]


plt.figure(figsize=(10, 6))

plot_series(time_valid, x_valid)
plot_series(time_valid, results)
```




```
tf.keras.metrics.mean_absolute_error(x_valid, results).numpy()
```

```
5.0923204
```