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One Device Strategy

In this ungraded lab, you'll learn how to set up a One Device Strategy. This is typically used to deliberately test your code on a single device. This can be used before switching to a different strategy that distributes across multiple devices. Please click on the **Open in Colab** badge above so you can download the datasets and use a GPU-enabled lab environment.

Imports

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

    import tensorflow as tf
    import tensorflow_hub as hub
    import tensorflow_datasets as tfds

    tfds.disable_progress_bar()
```

Define the Distribution Strategy

You can list available devices in your machine and specify a device type. This allows you to verify the device name to pass in `tf.distribute.OneDeviceStrategy()`.

```
[2] # choose a device type such as CPU or GPU
    devices = tf.config.list_physical_devices('GPU')
    print(devices[0])

    # You'll see that the name will look something like "/physical_device:GPU:0"
    # Just take the GPU:0 part and use that as the name
    gpu_name = "GPU:0"

    # define the strategy and pass in the device name
    one_strategy = tf.distribute.OneDeviceStrategy(device=gpu_name)
```

```
PhysicalDevice(name='/physical_device:GPU:0', device_type='GPU')
```

Parameters

We'll define a few global variables for setting up the model and dataset.

```
[3] pixels = 224
    MODULE_HANDLE = 'https://tfhub.dev/tensorflow/resnet_50/feature_vector/1'
    IMAGE_SIZE = (pixels, pixels)
    BATCH_SIZE = 32

    print("Using {} with input size {}".format(MODULE_HANDLE, IMAGE_SIZE))
```

```
Using https://tfhub.dev/tensorflow/resnet_50/feature_vector/1 with input size (224, 224)
```

Download and Prepare the Dataset

We will use the Cats vs Dogs dataset and we will fetch it via TFDS.

```
[4] splits = ['train[:80%]', 'train[80%:90%]', 'train[90%:]']

    (train_examples, validation_examples, test_examples), info = tfds.load('cats_vs_dogs', with_info=True, as_supervised=True, split=splits)

    num_examples = info.splits['train'].num_examples
    num_classes = info.features['label'].num_classes
```

```
Downloading and preparing dataset cats_vs_dogs/4.0.0 (download: 786.68 MiB, generated: Unknown size, total: 786.68 MiB) to /root/tensorflow_datasets/cats_vs_dogs/4.0.0...
WARNING:absl:1738 images were corrupted and were skipped
Shuffling and writing examples to /root/tensorflow_datasets/cats_vs_dogs/4.0.0.incompleteI2CZ7L/cats_vs_dogs-train.tfrecord
Dataset cats_vs_dogs downloaded and prepared to /root/tensorflow_datasets/cats_vs_dogs/4.0.0. Subsequent calls will reuse this data.
```

```
[5] # resize the image and normalize pixel values
    def format_image(image, label):
        image = tf.image.resize(image, IMAGE_SIZE) / 255.0
        return  image, label
```

```
[6] # prepare batches
    train_batches = train_examples.shuffle(num_examples // 4).map(format_image).batch(BATCH_SIZE).prefetch(1)
    validation_batches = validation_examples.map(format_image).batch(BATCH_SIZE).prefetch(1)
    test_batches = test_examples.map(format_image).batch(1)
```

```
[7] # check if the batches have the correct size and the images have the correct shape
    for image_batch, label_batch in train_batches.take(1):
        pass

    print(image_batch.shape)
```

```
(32, 224, 224, 3)
```

Define and Configure the Model

As with other strategies, setting up the model requires minimal code changes. Let's first define a utility function to build and compile the model.

```
[8] # tells if we want to freeze the layer weights of our feature extractor during training
    do_fine_tuning = False
```

```
[9] def build_and_compile_model():
        print("Building model with", MODULE_HANDLE)

        # configures the feature extractor fetched from TF Hub
        feature_extractor = hub.KerasLayer(MODULE_HANDLE,
                                           input_shape=IMAGE_SIZE + (3,),
                                           trainable=do_fine_tuning)

        # define the model
        model = tf.keras.Sequential([
          feature_extractor,
          # append a dense with softmax for the number of classes
          tf.keras.layers.Dense(num_classes, activation='softmax')
        ])

        # display summary
        model.summary()

        # configure the optimizer, loss and metrics
        optimizer = tf.keras.optimizers.SGD(lr=0.002, momentum=0.9) if do_fine_tuning else 'adam'
        model.compile(optimizer=optimizer,
                      loss='sparse_categorical_crossentropy',
                      metrics=['accuracy'])

        return model
```

You can now call the function under the strategy scope. This places variables and computations on the device you specified earlier.

```
[10] # build and compile under the strategy scope
     with one_strategy.scope():
         model = build_and_compile_model()
```

```
Building model with https://tfhub.dev/tensorflow/resnet_50/feature_vector/1
Model: "sequential"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
keras_layer (KerasLayer)     (None, 2048)              23561152
_________________________________________________________________
dense (Dense)                (None, 2)                 4098
=================================================================
Total params: 23,565,250
Trainable params: 4,098
Non-trainable params: 23,561,152
_________________________________________________________________
```

`model.fit()` can be run as usual.

```
EPOCHS = 5
hist = model.fit(train_batches,
                 epochs=EPOCHS,
                 validation_data=validation_batches)
```

```
Epoch 1/5
582/582 [==============================] - 110s 122ms/step - loss: 0.0366 - accuracy: 0.9879 - val_loss: 0.0308 - val_accuracy: 0.9888
Epoch 2/5
582/582 [==============================] - 72s 116ms/step - loss: 0.0193 - accuracy: 0.9933 - val_loss: 0.0291 - val_accuracy: 0.9901
Epoch 3/5
582/582 [==============================] - 71s 116ms/step - loss: 0.0147 - accuracy: 0.9954 - val_loss: 0.0321 - val_accuracy: 0.9910
Epoch 4/5
582/582 [==============================] - 71s 115ms/step - loss: 0.0122 - accuracy: 0.9959 - val_loss: 0.0308 - val_accuracy: 0.9918
Epoch 5/5
582/582 [==============================] - 71s 115ms/step - loss: 0.0087 - accuracy: 0.9975 - val_loss: 0.0306 - val_accuracy: 0.9931
```

Once everything is working correctly, you can switch to a different device or a different strategy that distributes to multiple devices.