```
! pip install tensorflow
```

```
Collecting tensorflow
  Obtaining dependency information for tensorflow from https://files.pythonhosted.org/packages/93/21/9b035a4f823d6aee2917c75415be9a958
  Using cached tensorflow-2.15.0-cp311-cp311-win_amd64.whl.metadata (3.6 kB)
Requirement already satisfied: tensorflow-intel==2.15.0 in c:\users\ayesh\anaconda3\lib\site-packages (from tensorflow) (2.15.0)
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Requirement already satisfied: protobuf!=4.21.0,!=4.21.1,!=4.21.2,!=4.21.3,!=4.21.4,!=4.21.5,<5.0.0dev,>=3.20.3 in c:\users\ayesh\anac
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Requirement already satisfied: six>=1.12.0 in c:\users\ayesh\anaconda3\lib\site-packages (from tensorflow-intel==2.15.0->tensorflow) (
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Requirement already satisfied: rsa<5,>=3.1.4 in c:\users\ayesh\anaconda3\lib\site-packages (from google-auth<3,>=1.6.3->tensorboard<2
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Requirement already satisfied: oauthlib>=3.0.0 in c:\users\ayesh\anaconda3\lib\site-packages (from requests-oauthlib>=0.7.0->google-au
Using cached tensorflow-2.15.0-cp311-cp311-win_amd64.whl (2.1 kB)
Installing collected packages: tensorflow
Successfully installed tensorflow-2.15.0
Collecting tensorflow
  Obtaining dependency information for tensorflow from https://files.pythonhosted.org/packages/93/21/9b035a4f823d6aee2917c75415be9a958
  Downloading tensorflow-2.15.0-cp311-cp311-win_amd64.whl.metadata (3.6 kB)
Collecting tensorflow-intel==2.15.0 (from tensorflow)
  Obtaining dependency information for tensorflow-intel==2.15.0 from https://files.pythonhosted.org/packages/4c/48/1a5a15517f18eaa4ff8
  Downloading tensorflow_intel-2.15.0-cp311-cp311-win_amd64.whl.metadata (5.1 kB)
Collecting absl-py>=1.0.0 (from tensorflow-intel==2.15.0->tensorflow)
  Obtaining dependency information for absl-py>=1.0.0 from https://files.pythonhosted.org/packages/a2/ad/e0d3c824784ff121c03cc031f944b
  Downloading absl_py-2.1.0-py3-none-any.whl.metadata (2.3 kB)
Collecting astunparse>=1.6.0 (from tensorflow-intel==2.15.0->tensorflow)
```

```python
import tensorflow as tf
from tensorflow.keras.datasets import fashion_mnist
from sklearn.model_selection import train_test_split

(x_train, y_train), (x_test, y_test) = fashion_mnist.load_data()

x_train, x_test = x_train / 255.0, x_test / 255.0

x_train, x_val, y_train, y_val = train_test_split(x_train, y_train, test_size=0.2, random_state=42)

x_train = x_train.reshape(x_train.shape[0], 28*28)
x_val = x_val.reshape(x_val.shape[0], 28*28)
x_test = x_test.reshape(x_test.shape[0], 28*28)
```

```
WARNING:tensorflow:From c:\Users\ayesh\anaconda3\Lib\site-packages\keras\src\losses.py:2976: The name tf.losses.sparse_softmax_cross_ent

Downloading data from https://storage.googleapis.com/tensorflow/tf-keras-datasets/train-labels-idx1-ubyte.gz
29515/29515 [==============================] - 0s 6us/step
Downloading data from https://storage.googleapis.com/tensorflow/tf-keras-datasets/train-images-idx3-ubyte.gz
```

```
26421880/26421880 [==============================] - 24s 1us/step
Downloading data from https://storage.googleapis.com/tensorflow/tf-keras-datasets/t10k-labels-idx1-ubyte.gz
5148/5148 [==============================] - 0s 0s/step
Downloading data from https://storage.googleapis.com/tensorflow/tf-keras-datasets/t10k-images-idx3-ubyte.gz
4422102/4422102 [==============================] - 4s 1us/step
```

```
! pip install keras-tuner
```

```
Collecting keras-tuner
  Obtaining dependency information for keras-tuner from https://files.pythonhosted.org/packages/2b/39/21f819fcda657c37519cf817ca1cd03a
  Downloading keras_tuner-1.4.6-py3-none-any.whl.metadata (5.4 kB)
Requirement already satisfied: keras in c:\users\ayesh\anaconda3\lib\site-packages (from keras-tuner) (2.15.0)
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Collecting kt-legacy (from keras-tuner)
  Obtaining dependency information for kt-legacy from https://files.pythonhosted.org/packages/16/53/aca9f36da2516db008017db85a1f3cafa
  Downloading kt_legacy-1.0.5-py3-none-any.whl.metadata (221 bytes)
Requirement already satisfied: charset-normalizer<4,>=2 in c:\users\ayesh\anaconda3\lib\site-packages (from requests->keras-tuner) (2
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Requirement already satisfied: certifi>=2017.4.17 in c:\users\ayesh\anaconda3\lib\site-packages (from requests->keras-tuner) (2023.7.2
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```

```python
from tensorflow import keras
from tensorflow.keras.layers import Dense
from kerastuner.tuners import RandomSearch

def build_model(hp):
    model = keras.Sequential()

    model.add(keras.layers.Flatten(input_shape=(784,)))

    hp_units = hp.Int('units', min_value=32, max_value=512, step=32)
    model.add(Dense(units=hp_units, activation='relu'))
    model.add(Dense(10, activation='softmax'))  # Output layer for 10 classes

    hp_learning_rate = hp.Choice('learning_rate', values=[1e-2, 1e-3, 1e-4])

    model.compile(optimizer=keras.optimizers.Adam(learning_rate=hp_learning_rate),
                  loss='sparse_categorical_crossentropy',
                  metrics=['accuracy'])
    return model

tuner = RandomSearch(
    build_model,
    objective='val_accuracy',
    max_trials=10,
    executions_per_trial=1,
    directory='my_dir',
    project_name='fashion_mnist')

tuner.search_space_summary()

tuner.search(x_train, y_train, epochs=10, validation_data=(x_val, y_val))

best_hps=tuner.get_best_hyperparameters(num_trials=1)[0]

print(f"""
The hyperparameter search is complete. The optimal number of units in the first densely-connected
layer is {best_hps.get('units')} and the optimal learning rate for the optimizer
is {best_hps.get('learning_rate')}.
""")


model = tuner.hypermodel.build(best_hps)
history = model.fit(x_train, y_train, epochs=10, validation_data=(x_val, y_val))
```

```
    Trial 10 Complete [00h 03m 22s]
    val_accuracy: 0.8818333148956299

    Best val_accuracy So Far: 0.8934166431427002
    Total elapsed time: 00h 30m 11s

    The hyperparameter search is complete. The optimal number of units in the first densely-connected
    layer is 384 and the optimal learning rate for the optimizer
    is 0.001.

    Epoch 1/10
    1500/1500 [==============================] - 22s 14ms/step - loss: 0.4952 - accuracy: 0.8238 - val_loss: 0.4479 - val_accuracy: 0.8372
    Epoch 2/10
    1500/1500 [==============================] - 14s 10ms/step - loss: 0.3731 - accuracy: 0.8637 - val_loss: 0.3569 - val_accuracy: 0.8712
    Epoch 3/10
    1500/1500 [==============================] - 13s 9ms/step - loss: 0.3322 - accuracy: 0.8771 - val_loss: 0.3322 - val_accuracy: 0.8812
    Epoch 4/10
    1500/1500 [==============================] - 14s 9ms/step - loss: 0.3093 - accuracy: 0.8857 - val_loss: 0.3567 - val_accuracy: 0.8720
    Epoch 5/10
    1500/1500 [==============================] - 14s 9ms/step - loss: 0.2859 - accuracy: 0.8933 - val_loss: 0.3283 - val_accuracy: 0.8802
    Epoch 6/10
    1500/1500 [==============================] - 22s 15ms/step - loss: 0.2727 - accuracy: 0.8985 - val_loss: 0.3309 - val_accuracy: 0.8793
    Epoch 7/10
    1500/1500 [==============================] - 17s 12ms/step - loss: 0.2596 - accuracy: 0.9033 - val_loss: 0.3578 - val_accuracy: 0.8743
    Epoch 8/10
    1500/1500 [==============================] - 17s 11ms/step - loss: 0.2464 - accuracy: 0.9076 - val_loss: 0.3256 - val_accuracy: 0.8848
    Epoch 9/10
    1500/1500 [==============================] - 16s 11ms/step - loss: 0.2376 - accuracy: 0.9119 - val_loss: 0.3152 - val_accuracy: 0.8865
    Epoch 10/10
    1500/1500 [==============================] - 22s 15ms/step - loss: 0.2246 - accuracy: 0.9157 - val_loss: 0.3179 - val_accuracy: 0.8877
```

```
test_loss, test_acc = model.evaluate(x_test, y_test, verbose=2)
print('\nTest accuracy:', test_acc)
```

```
313/313 - 2s - loss: 0.3510 - accuracy: 0.8815 - 2s/epoch - 6ms/step

Test accuracy: 0.8815000057220459
```