

In [3]:

```
!pip install mkl
```

Collecting mkl

Using cached mkl-2023.1.0-py2.py3-none-win_amd64.whl (224.8 MB)

Collecting tbb==2021.*

Using cached tbb-2021.9.0-py3-none-win_amd64.whl (283 kB)

Collecting intel-openmp==2023.*

Using cached intel_openmp-2023.1.0-py2.py3-none-win_amd64.whl (4.2 MB)

Installing collected packages: tbb, intel-openmp, mkl

Attempting uninstall: tbb

Found existing installation: TBB 0.2

ERROR: Cannot uninstall 'TBB'. It is a distutils installed project and thus we cannot accurately determine which files belong to it which would lead to only a partial uninstall.

In [2]:

```
!pip install tensorflow
```

Requirement already satisfied: tensorflow in c:\users\samua\anaconda3.0\lib\site-packages (2.12.0)

Requirement already satisfied: tensorflow-intel==2.12.0 in c:\users\samua\anaconda3.0\lib\site-packages (from tensorflow) (2.12.0)

Requirement already satisfied: setuptools in c:\users\samua\anaconda3.0\lib\site-packages (from tensorflow-intel==2.12.0->tensorflow) (63.4.1)

Requirement already satisfied: jax>=0.3.15 in c:\users\samua\anaconda3.0\lib\site-packages (from tensorflow-intel==2.12.0->tensorflow) (0.4.12)

Requirement already satisfied: gast<=0.4.0,>=0.2.1 in c:\users\samua\anaconda3.0\lib\site-packages (from tensorflow-intel==2.12.0->tensorflow) (0.4.0)

Requirement already satisfied: typing-extensions>=3.6.6 in c:\users\samua\anaconda3.0\lib\site-packages (from tensorflow-intel==2.12.0->tensorflow) (4.3.0)

Requirement already satisfied: tensorflow-io-gcs-filesystem>=0.23.1 in c:\users\samua\anaconda3.0\lib\site-packages (from tensorflow-intel==2.12.0->tensorflow) (0.31.0)

Requirement already satisfied: google-pasta>=0.1.1 in c:\users\samua\anaconda3.0\lib\site-packages (from tensorflow-intel==2.12.0->tensorflow) (0.2.0)

Requirement already satisfied: six>=1.12.0 in c:\users\samua\anaconda3.0\lib\site-packages (from tensorflow-intel==2.12.0->tensorflow) (1.16.0)

Requirement already satisfied: h5py>=2.9.0 in c:\users\samua\anaconda3.0\lib\site-packages (from tensorflow-intel==2.12.0->tensorflow) (3.7.0)

Requirement already satisfied: packaging in c:\users\samua\anaconda3.0\lib\site-packages (from tensorflow-intel==2.12.0->tensorflow) (21.3)

Requirement already satisfied: opt-einsum>=2.3.2 in c:\users\samua\anaconda3.0\lib\site-packages (from tensorflow-intel==2.12.0->tensorflow) (3.3.0)

Requirement already satisfied: tensorflow-estimator<2.13,>=2.12.0 in c:\users\samua\anaconda3.0\lib\site-packages (from tensorflow-intel==2.12.0->tensorflow) (2.12.0)

Requirement already satisfied: numpy<1.24,>=1.22 in c:\users\samua\anaconda3.0\lib\site-packages (from tensorflow-intel==2.12.0->tensorflow) (1.23.5)

Requirement already satisfied: keras<2.13,>=2.12.0 in c:\users\samua\anaconda3.0\lib\site-packages (from tensorflow-intel==2.12.0->tensorflow) (2.12.0)

Requirement already satisfied: tensorboard<2.13,>=2.12 in c:\users\samua\anaconda3.0\lib\site-packages (from tensorflow-intel==2.12.0->tensorflow) (2.12.3)

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\samua\anaconda3.0\lib\site-packages (from tensorflow-intel==2.12.0->tensorflow) (4.23.3)

Requirement already satisfied: wrapt<1.15,>=1.11.0 in c:\users\samua\anaconda3.0\lib\site-packages (from tensorflow-intel==2.12.0->tensorflow) (1.14.1)

Requirement already satisfied: libclang>=13.0.0 in c:\users\samua\anaconda3.0\lib\site-packages (from tensorflow-intel==2.12.0->tensorflow) (16.0.0)

Requirement already satisfied: termcolor>=1.1.0 in c:\users\samua\anaconda3.0\lib\site-packages (from tensorflow-intel==2.12.0->tensorflow) (2.3.0)

Requirement already satisfied: flatbuffers>=2.0 in c:\users\samua\anaconda3.0\lib\site-packages (from tensorflow-intel==2.12.0->tensorflow) (23.5.26)

Requirement already satisfied: grpcio<2.0,>=1.24.3 in c:\users\samua\anaconda3.0\lib\site-packages (from tensorflow-intel==2.12.0->tensorflow) (1.54.2)

Requirement already satisfied: absl-py>=1.0.0 in c:\users\samua\anaconda3.0\lib\site-packages (from tensorflow-intel==2.12.0->tensorflow) (1.4.0)

Requirement already satisfied: astunparse>=1.6.0 in c:\users\samua\anaconda3.0\lib\site-packages (from tensorflow-intel==2.12.0->tensorflow) (1.6.3)

Requirement already satisfied: wheel<1.0,>=0.23.0 in c:\users\samua\anaconda3.0\lib\site-packages (from tensorflow-intel==2.12.0->tensorflow) (0.38.4)

```

da3.0\lib\site-packages (from astunparse>=1.6.0->tensorflow-intel==2.12.0->tensorflow) (0.37.1)
Requirement already satisfied: importlib-metadata>=4.6 in c:\users\samua\anaconda3.0\lib\site-packages (from jax>=0.3.15->tensorflow-intel==2.12.0->tensorflow) (4.11.3)
Requirement already satisfied: ml-dtypes>=0.1.0 in c:\users\samua\anaconda3.0\lib\site-packages (from jax>=0.3.15->tensorflow-intel==2.12.0->tensorflow) (0.2.0)
Requirement already satisfied: scipy>=1.7 in c:\users\samua\anaconda3.0\lib\site-packages (from jax>=0.3.15->tensorflow-intel==2.12.0->tensorflow) (1.9.1)
Requirement already satisfied: google-auth-oauthlib<1.1,>=0.5 in c:\users\samua\anaconda3.0\lib\site-packages (from tensorboard<2.13,>=2.12->tensorflow-intel==2.12.0->tensorflow) (1.0.0)
Requirement already satisfied: markdown>=2.6.8 in c:\users\samua\anaconda3.0\lib\site-packages (from tensorboard<2.13,>=2.12->tensorflow-intel==2.12.0->tensorflow) (3.3.4)
Requirement already satisfied: tensorboard-data-server<0.8.0,>=0.7.0 in c:\users\samua\anaconda3.0\lib\site-packages (from tensorboard<2.13,>=2.12->tensorflow-intel==2.12.0->tensorflow) (0.7.1)
Requirement already satisfied: requests<3,>=2.21.0 in c:\users\samua\anaconda3.0\lib\site-packages (from tensorboard<2.13,>=2.12->tensorflow-intel==2.12.0->tensorflow) (2.28.1)
Requirement already satisfied: werkzeug>=1.0.1 in c:\users\samua\anaconda3.0\lib\site-packages (from tensorboard<2.13,>=2.12->tensorflow-intel==2.12.0->tensorflow) (2.0.3)
Requirement already satisfied: google-auth<3,>=1.6.3 in c:\users\samua\anaconda3.0\lib\site-packages (from tensorboard<2.13,>=2.12->tensorflow-intel==2.12.0->tensorflow) (2.20.0)
Requirement already satisfied: pyparsing!=3.0.5,>=2.0.2 in c:\users\samua\anaconda3.0\lib\site-packages (from packaging->tensorflow-intel==2.12.0->tensorflow) (3.0.9)
Requirement already satisfied: rsa<5,>=3.1.4 in c:\users\samua\anaconda3.0\lib\site-packages (from google-auth<3,>=1.6.3->tensorboard<2.13,>=2.12->tensorflow-intel==2.12.0->tensorflow) (4.9)
Requirement already satisfied: urllib3<2.0 in c:\users\samua\anaconda3.0\lib\site-packages (from google-auth<3,>=1.6.3->tensorboard<2.13,>=2.12->tensorflow-intel==2.12.0->tensorflow) (1.26.11)
Requirement already satisfied: cachetools<6.0,>=2.0.0 in c:\users\samua\anaconda3.0\lib\site-packages (from google-auth<3,>=1.6.3->tensorboard<2.13,>=2.12->tensorflow-intel==2.12.0->tensorflow) (5.3.1)
Requirement already satisfied: pyasn1-modules>=0.2.1 in c:\users\samua\anaconda3.0\lib\site-packages (from google-auth<3,>=1.6.3->tensorboard<2.13,>=2.12->tensorflow-intel==2.12.0->tensorflow) (0.2.8)
Requirement already satisfied: requests-oauthlib>=0.7.0 in c:\users\samua\anaconda3.0\lib\site-packages (from google-auth-oauthlib<1.1,>=0.5->tensorboard<2.13,>=2.12->tensorflow-intel==2.12.0->tensorflow) (1.3.1)
Requirement already satisfied: zipp>=0.5 in c:\users\samua\anaconda3.0\lib\site-packages (from importlib-metadata>=4.6->jax>=0.3.15->tensorflow-intel==2.12.0->tensorflow) (3.8.0)
Requirement already satisfied: idna<4,>=2.5 in c:\users\samua\anaconda3.0\lib\site-packages (from requests<3,>=2.21.0->tensorboard<2.13,>=2.12->tensorflow-intel==2.12.0->tensorflow) (3.3)
Requirement already satisfied: certifi>=2017.4.17 in c:\users\samua\anaconda3.0\lib\site-packages (from requests<3,>=2.21.0->tensorboard<2.13,>=2.12->tensorflow-intel==2.12.0->tensorflow) (2022.9.14)
Requirement already satisfied: charset-normalizer<3,>=2 in c:\users\samua\anaconda3.0\lib\site-packages (from requests<3,>=2.21.0->tensorboard<2.13,>=2.12->tensorflow-intel==2.12.0->tensorflow) (2.0.4)
Requirement already satisfied: pyasn1<0.5.0,>=0.4.6 in c:\users\samua\anaconda3.0\lib\site-packages (from pyasn1-modules>=0.2.1->google-auth<3,>=1.

```

```
6.3->tensorboard<2.13,>=2.12->tensorflow-intel==2.12.0->tensorflow) (0.4.8)
Requirement already satisfied: oauthlib>=3.0.0 in c:\users\samua\anaconda3.0\lib\site-packages (from requests-oauthlib>=0.7.0->google-auth-oauthlib<1.1,>=0.5->tensorboard<2.13,>=2.12->tensorflow-intel==2.12.0->tensorflow) (3.2.2)
```

In []:

```
import os
os.environ['MKL_THREADING_LAYER'] = 'GNU'
import tensorflow as tf
print(tf.config.threading.get_intra_op_parallelism_threads())
```

In [4]:

```
#importing the required libraries
from tensorflow.keras.datasets import fashion_mnist
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Conv2D
from tensorflow.keras.layers import MaxPool2D
from tensorflow.keras.layers import Flatten
from tensorflow.keras.layers import Dropout
from tensorflow.keras.layers import Dense

#loading data
(X_train,y_train) , (X_test,y_test)=fashion_mnist.load_data()

#reshaping data
X_train = X_train.reshape((X_train.shape[0], X_train.shape[1], X_train.shape[2], 1))
X_test = X_test.reshape((X_test.shape[0],X_test.shape[1],X_test.shape[2],1))

#checking the shape after reshaping
print(X_train.shape)
print(X_test.shape)

#normalizing the pixel values
X_train=X_train/255
X_test=X_test/255

#defining model
model=Sequential()

#adding convolution layer
model.add(Conv2D(32,(3,3),activation='relu',input_shape=(28,28,1)))

#adding pooling layer
model.add(MaxPool2D(2,2))
```

```
(60000, 28, 28, 1)
(10000, 28, 28, 1)
```

In [5]:

```
#adding fully connected layer
model.add(Flatten())
model.add(Dense(100,activation='relu'))
#adding output layer
model.add(Dense(10,activation='softmax'))
#compiling the model
model.compile(loss='sparse_categorical_crossentropy',optimizer='adam',metrics=['accuracy'])
#fitting the model
model.fit(X_train,y_train,epochs=10)
```

```
Epoch 1/10
1875/1875 [=====] - 31s 16ms/step - loss: 0.4072
- accuracy: 0.8565
Epoch 2/10
1875/1875 [=====] - 34s 18ms/step - loss: 0.2745
- accuracy: 0.9021
Epoch 3/10
1875/1875 [=====] - 32s 17ms/step - loss: 0.2285
- accuracy: 0.9171
Epoch 4/10
1875/1875 [=====] - 31s 17ms/step - loss: 0.1984
- accuracy: 0.9258
Epoch 5/10
1875/1875 [=====] - 31s 17ms/step - loss: 0.1701
- accuracy: 0.9367
Epoch 6/10
1875/1875 [=====] - 31s 17ms/step - loss: 0.1463
- accuracy: 0.9467
Epoch 7/10
1875/1875 [=====] - 31s 17ms/step - loss: 0.1257
- accuracy: 0.9541
Epoch 8/10
1875/1875 [=====] - 31s 17ms/step - loss: 0.1073
- accuracy: 0.9605
Epoch 9/10
1875/1875 [=====] - 31s 17ms/step - loss: 0.0920
- accuracy: 0.9666
Epoch 10/10
1875/1875 [=====] - 31s 17ms/step - loss: 0.0773
- accuracy: 0.9721
```

Out[5]:

```
<keras.callbacks.History at 0x1c4782cae50>
```

In [6]:

```
model.evaluate(X_test,y_test)
```

```
313/313 [=====] - 1s 4ms/step - loss: 0.3185 - ac
curacy: 0.9154
```

Out[6]:

```
[0.31846314668655396, 0.9154000282287598]
```

In []: