STC EXPERIMENT 7

[3]:
```
import keras
keras.backend.backend()
```

[4]:
```
'tensorflow'
```

[4]:
```
import pandas as pd
import numpy as np
import scipy as sp
```

[5]:
```
import matplotlib.pyplot as plt
import seaborn as sns
from keras.datasets import fashion_mnist
(x_train, y_train), (x_test, y_test) = fashion_mnist.load_data()
x_train.shape
x_test.shape
```

[6]:

[7]:

[7]: (10000, 28, 28)

[8]:
```
plt.matshow(x_train[0])
```

[8]: <matplotlib.image.AxesImage at 0x7f618ea0db90>

---

output_5_1.png

---

[9]:
```
plt.matshow(x_train[1])
```

[9]: <matplotlib.image.AxesImage at 0x7f618e9ad4d0>

---

output_6_1.png

---

[10]:
```
plt.matshow(x_train[2])
```

[10]: <matplotlib.image.AxesImage at 0x7f618e913d10>

---

output_7_1.png

---

[11]:
```
x_train=x_train/255
x_test=x_test/255
```

[12]:
```
from keras.models import Sequential
from keras.layers import Dense, Activation, Flatten
```

[13]:
```
model=Sequential()
```

[14]:
```
WARNING:tensorflow:From /home/spit/anaconda3/lib/python3.7/site-
packages/keras/backend/tensorflow_backend.py:66: The name tf.get_default_graph
is deprecated. Please use tf.compat.v1.get_default_graph instead.
```

[15]:

[16]:
```
model.add(Flatten(input_shape=[28,28]))
```

```
WARNING:tensorflow:From /home/spit/anaconda3/lib/python3.7/site-
packages/keras/backend/tensorflow_backend.py:541: The name tf.placeholder is
deprecated. Please use tf.compat.v1.placeholder instead.
```

[17]:
```
model.add(Dense(20,activation="elu"))
```

```
WARNING:tensorflow:From /home/spit/anaconda3/lib/python3.7/site-
packages/keras/backend/tensorflow_backend.py:4432: The name tf.random_uniform is
deprecated. Please use tf.random.uniform instead.
```

[18]:
```
model.add(Dense(10,activation="softmax"))
```

[19]:
```
model.compile(loss="sparse_categorical_crossentropy",optimizer="adam",
metrics=["accuracy"])
model.summary()
```

WARNING:tensorflow:From /home/spit/anaconda3/lib/python3.7/site-packages/keras/optimizers.py:793: The name tf.train.Optimizer is deprecated. Please use tf.compat.v1.train.Optimizer instead.

WARNING:tensorflow:From /home/spit/anaconda3/lib/python3.7/site-packages/keras/backend/tensorflow_backend.py:3622: The name tf.log is deprecated. Please use tf.math.log instead.

Model: "sequential_1"

Layer (type)	Output Shape	Param #
flatten_1 (Flatten)	(None, 784)	0
dense_1 (Dense)	(None, 20)	15700
dense_2 (Dense)	(None, 10)	210

Total params: 15,910
Trainable params: 15,910
Non-trainable params: 0

[20]:
```
model.fit(x_train,y_train,epochs=5)
```

WARNING:tensorflow:From /home/spit/anaconda3/lib/python3.7/site-packages/tensorflow/python/ops/math_grad.py:1250: add_dispatch_support.<locals>.wrapper (from tensorflow.python.ops.array_ops) is deprecated and will be removed in a future version.
Instructions for updating:
Use tf.where in 2.0, which has the same broadcast rule as np.where
WARNING:tensorflow:From /home/spit/anaconda3/lib/python3.7/site-packages/keras/backend/tensorflow_backend.py:1033: The name tf.assign_add is deprecated. Please use tf.compat.v1.assign_add instead.

Epoch 1/5
60000/60000 [==============================] acc: - 2s 34us/step - loss: 0.5572 - 0.8120
Epoch 2/5
60000/60000 [==============================] - 1s 22us/step - loss: 0.4206 - acc: 0.8517
Epoch 3/5
60000/60000 [==============================] - 1s 24us/step - loss: 0.3908 - acc: 0.8617: 1s - lo
Epoch 4/5
60000/60000 [==============================] - 1s 23us/step - loss: 0.3720 - acc: 0.8677

```
Epoch 5/5
60000/60000 [==============================] - 1s 22us/step - loss: 0.3556 -
acc: 0.8742
```

[20]: <keras.callbacks.History at 0x7f619182e850>

[21]:
```
x_test.shape
```

[21]: (10000, 28, 28)

[22]:
```
plt.matshow(x_test[0])
```

[22]: <matplotlib.image.AxesImage at 0x7f619155d790>

---

output_19_1.png

---

[23]:
```
y_test[0]
```

[23]: 9

[24]:
```
ypred=model.predict(x_test)
ypred[0]
```

[25]:

[25]: array([1.7423141e-05, 7.4248396e-06, 1.0429349e-04, 7.8115900e-06,
4.0205883e-05, 5.6720681e-02, 2.3382341e-05, 1.8671228e-01,
4.5550894e-03, 7.5181139e-01], dtype=float32)

[26]:
```
np.argmax(ypred[0])
```

[26]: 9

[27]:
```
model.evaluate(x_test,y_test)
```

```
10000/10000 [==============================] - 0s 14us/step
```

[27]: [0.3996692024707794, 0.8601]

[28]:
```
import time
import sys
start=time.time()
end=time.time()
elapsed=end-start
print(elapsed)
```

```
1.811981201171875e-05
```

[29]:
```
from keras.datasets import mnist
(x_train, y_train), (x_test, y_test)  = mnist.load_data()
```

[30]:
```
x_train.shape
x_test.shape
```

[30]: (10000, 28, 28)

[31]:
```
plt.matshow(x_train[0])
```

[31]: <matplotlib.image.AxesImage at 0x7f618e874dd0>

output_28_1.png

[32]:
```
plt.matshow(x_train[1])
```

[32]: <matplotlib.image.AxesImage at 0x7f618e855cd0>

output_29_1.png

[33]:
```
plt.matshow(x_train[2])
```

[33]: <matplotlib.image.AxesImage at 0x7f618e7b4ed0>

output_30_1.png

[34]:
```
x_train=x_train/255
```

[35]:
```
x_test=x_test/255
```

[36]:
```
from keras.models import Sequential
```

[37]:
```
from keras.layers import Dense, Activation, Flatten
```

[38]:
```
model=Sequential()
```

[39]:
```
model.add(Flatten(input_shape=[28,28]))
```

[40]:
```
model.add(Dense(20,activation="elu"))
```

[41]:
```
model.add(Dense(10,activation="softmax"))
```

[42]:
```
from keras import losses
```

```
model.compile(loss=losses.sparse_categorical_crossentropy, optimizer='adam')
```

```
model.compile(loss="sparse_categorical_crossentropy",optimizer="adam",
metrics=["accuracy"])
```

[43]:
```
model.summary()
```

```
Model: "sequential_2"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
flatten_2 (Flatten)          (None, 784)               0
_________________________________________________________________
dense_3 (Dense)              (None, 20)                15700
_________________________________________________________________
dense_4 (Dense)              (None, 10)                210
=================================================================
Total params: 15,910
Trainable params: 15,910
Non-trainable params: 0
_________________________________________________________________
```

[ ]:

[44]:
```
model.fit(x_train,y_train,epochs=10)
```

```
Epoch 1/10
60000/60000 [==============================] - 1s 25us/step - loss: 0.4113 -
acc: 0.8850
Epoch 2/10
60000/60000 [==============================] - 1s 22us/step - loss: 0.2495 -
acc: 0.9287: 0s - loss:
Epoch 3/10
60000/60000 [==============================] - 1s 22us/step - loss: 0.2061 -
acc: 0.9408
Epoch 4/10
60000/60000 [==============================] - 1s 22us/step - loss: 0.1764 -
acc: 0.9489
Epoch 5/10
```

```
60000/60000 [==============================] - 1s 22us/step - loss: 0.1579 -
acc:  0.9539
Epoch 6/10
60000/60000 [==============================] - 1s 22us/step - loss: 0.1463 -
acc:  0.9568
Epoch 7/10
60000/60000 [==============================] - 1s 22us/step - loss: 0.1355 -
acc:  0.9594
Epoch 8/10
60000/60000 [==============================] - 1s 23us/step - loss: 0.1279 -
acc:  0.9633
Epoch 9/10
60000/60000 [==============================] - 1s 22us/step - loss: 0.1221 -
acc:  0.9637
Epoch 10/10
60000/60000 [==============================] - 1s 22us/step - loss: 0.1162 -
acc:  0.9655
```

[44]: <keras.callbacks.History at 0x7f618e77d5d0>

[ ]:

[45]:
```
x_test.shape
```

[45]: (10000, 28, 28)

[46]:
```
plt.matshow(x_test[0])
```

[46]: <matplotlib.image.AxesImage at 0x7f6177cf6c10>

---

output_45_1.png

---

[47]:
```
y_test[0]
```

[47]: 7

[48]:
```
ypred=model.predict(x_test)
```

[49]:
```
ypred[0]
```

[49]: array([4.8810074e-07, 2.6584674e-12, 2.3065748e-05, 5.3829106e-04,
1.4790350e-10, 4.2961610e-06, 1.4156628e-16, 9.9943119e-01,
1.1552688e-06, 1.4655924e-06], dtype=float32)

[50]:
```
np.argmax(ypred[0])
```

[50]: 7

[51]:
```
model.evaluate(x_test,y_test)
```

```
10000/10000 [==============================] - 0s 14us/step
```

[51]: [0.13873274754919113, 0.9599]

[52]:
```
import time
import sys
start=time.time()
end=time.time()
elapsed=end-start
print(elapsed)
```

```
1.8596649169921875e-05
```

[ ]: