KaggleAZdataSet

November 5, 2020

[21]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
```

[2]:
```
df = pd.read_csv('KaggleAZ/archive/A_Z Handwritten Data.csv')
```

[3]:
```
df.head()
# zeroth column is the label
```

[3]:

	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	…	0.639	0.640	0.641	\
0	0	0	0	0	0	0	0	0	0	0	…	0	0	0	
1	0	0	0	0	0	0	0	0	0	0	…	0	0	0	
2	0	0	0	0	0	0	0	0	0	0	…	0	0	0	
3	0	0	0	0	0	0	0	0	0	0	…	0	0	0	
4	0	0	0	0	0	0	0	0	0	0	…	0	0	0	

	0.642	0.643	0.644	0.645	0.646	0.647	0.648
0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0

[5 rows x 785 columns]

[4]:
```
df.shape
```

[4]: (372450, 785)

[5]:
```
X = df.iloc[:,1:]
y = df.iloc[:,0]
```

[6]:
```
X
```

[6]:

	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	0.10	…	0.639	0.640	\
0	0	0	0	0	0	0	0	0	0	0	…	0	0	
1	0	0	0	0	0	0	0	0	0	0	…	0	0	

```
2          0    0    0    0    0    0    0    0    0    0  …       0       0
3          0    0    0    0    0    0    0    0    0    0  …       0       0
4          0    0    0    0    0    0    0    0    0    0  …       0       0
…        …   …   …   …   …   …   …   …   …   …   …   …   …   …
372445     0    0    0    0    0    0    0    0    0    0  …       0       0
372446     0    0    0    0    0    0    0    0    0    0  …       0       0
372447     0    0    0    0    0    0    0    0    0    0  …       0       0
372448     0    0    0    0    0    0    0    0    0    0  …       0       0
372449     0    0    0    0    0    0    0    0    0    0  …       0       0

           0.641  0.642  0.643  0.644  0.645  0.646  0.647  0.648
0              0      0      0      0      0      0      0      0
1              0      0      0      0      0      0      0      0
2              0      0      0      0      0      0      0      0
3              0      0      0      0      0      0      0      0
4              0      0      0      0      0      0      0      0
…          …      …      …      …      …      …      …      …
372445         0      0      0      0      0      0      0      0
372446         0      0      0      0      0      0      0      0
372447         0      0      0      0      0      0      0      0
372448         0      0      0      0      0      0      0      0
372449         0      0      0      0      0      0      0      0

[372450 rows x 784 columns]
```

[7]:
```
y
```

[7]:
```
0          0
1          0
2          0
3          0
4          0
           ..
372445    25
372446    25
372447    25
372448    25
372449    25
Name: 0, Length: 372450, dtype: int64
```

[8]:
```
X = X.astype('float32')
y = y.astype('float32')
```

[9]:
```
28*28
```

[9]:
```
784
```

[10]:
```
print(X.shape)
print(y.shape)
```

```
(372450, 784)
(372450,)
```

[11]:
```
X = X.values
y = y.values
X = X.reshape(X.shape[0],28,28,1)
X/=255
```

[12]:
```
input_shape = (28,28,1)
```

[13]:
```
from sklearn.model_selection import train_test_split
```

[14]:
```
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.33,␣
↪random_state=42)
```

[15]:
```
import tensorflow as tf
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense,Conv2D,Dropout,Flatten, MaxPooling2D
```

[16]:
```
model = Sequential()
model.add(Conv2D(28, kernel_size=(3,3), input_shape=input_shape))
model.add(MaxPooling2D(pool_size=(2, 2)))
model.add(Flatten()) # Flattening the 2D arrays for fully connected layers
model.add(Dense(128, activation=tf.nn.relu))
model.add(Dropout(0.2))
model.add(Dense(26,activation=tf.nn.softmax))
```

[17]:
```
model.compile(optimizer='adam',
              loss='sparse_categorical_crossentropy',
              metrics=['accuracy'])
model.fit(x=X_train,y=y_train, epochs=10)
```

```
Epoch 1/10
7799/7799 [==============================] - 85s 11ms/step - loss: 0.2519 -
accuracy: 0.9278
Epoch 2/10
7799/7799 [==============================] - 82s 10ms/step - loss: 0.1162 -
accuracy: 0.9663
Epoch 3/10
7799/7799 [==============================] - 81s 10ms/step - loss: 0.0925 -
accuracy: 0.9722
Epoch 4/10
7799/7799 [==============================] - 81s 10ms/step - loss: 0.0783 -
accuracy: 0.9765
```

```
Epoch 5/10
7799/7799 [==============================] - 82s 10ms/step - loss: 0.0691 -
accuracy: 0.9787
Epoch 6/10
7799/7799 [==============================] - 82s 10ms/step - loss: 0.0623 -
accuracy: 0.9804
Epoch 7/10
7799/7799 [==============================] - 82s 10ms/step - loss: 0.0576 -
accuracy: 0.9818
Epoch 8/10
7799/7799 [==============================] - 81s 10ms/step - loss: 0.0536 -
accuracy: 0.9831
Epoch 9/10
7799/7799 [==============================] - 83s 11ms/step - loss: 0.0506 -
accuracy: 0.9842
Epoch 10/10
7799/7799 [==============================] - 82s 11ms/step - loss: 0.0467 -
accuracy: 0.9850
```

[17]:
```
<tensorflow.python.keras.callbacks.History at 0x7f8a1957fd60>
```

[18]:
```
model.evaluate(X_test, y_test)
```

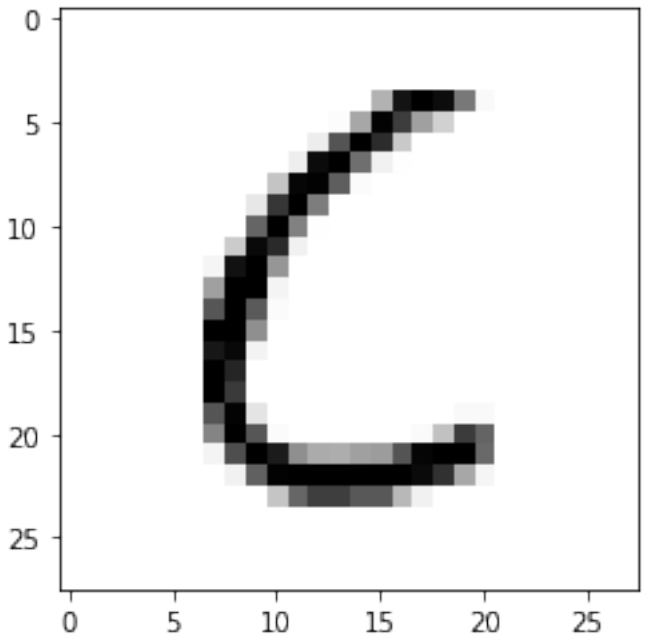
```
3841/3841 [==============================] - 13s 3ms/step - loss: 0.0549 -
accuracy: 0.9863
```

[18]:
```
[0.05487028881907463, 0.9863069653511047]
```

[22]:
```
input_map = dict()
c = 'a'
for i in range(26):
    input_map[i] = c
    c = chr(ord(c)+1)
```

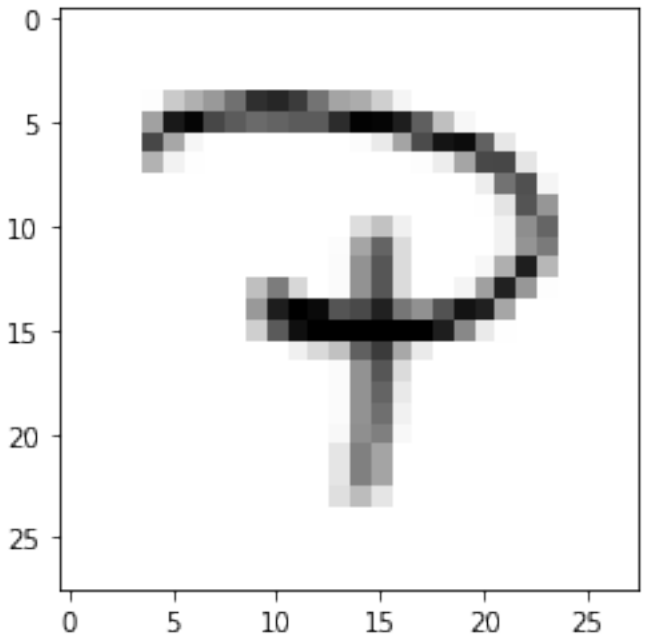
[23]:
```
image_index = 2
plt.imshow(X_test[image_index].reshape(28, 28),cmap='Greys')
pred = model.predict(X_test[image_index].reshape(1, 28, 28, 1))
print("Predicted Letter",input_map[pred.argmax()])
print("Correct Label ",input_map[y_test[image_index]])
```

```
Predicted Letter c
Correct Label  c
```



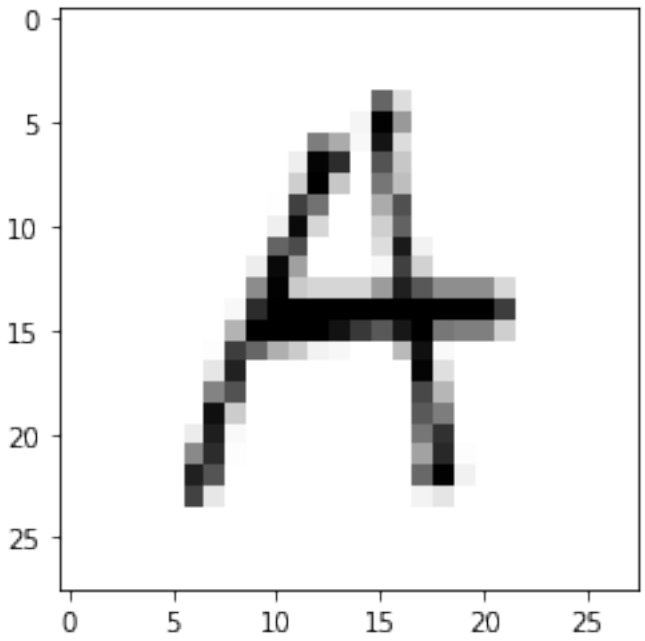
[24]:
```
image_index = 20000
plt.imshow(X_test[image_index].reshape(28, 28),cmap='Greys')
pred = model.predict(X_test[image_index].reshape(1, 28, 28, 1))
print("Predicted Letter",input_map[pred.argmax()])
print("Correct Label ",input_map[y_test[image_index]])
```

```
Predicted Letter p
Correct Label  p
```



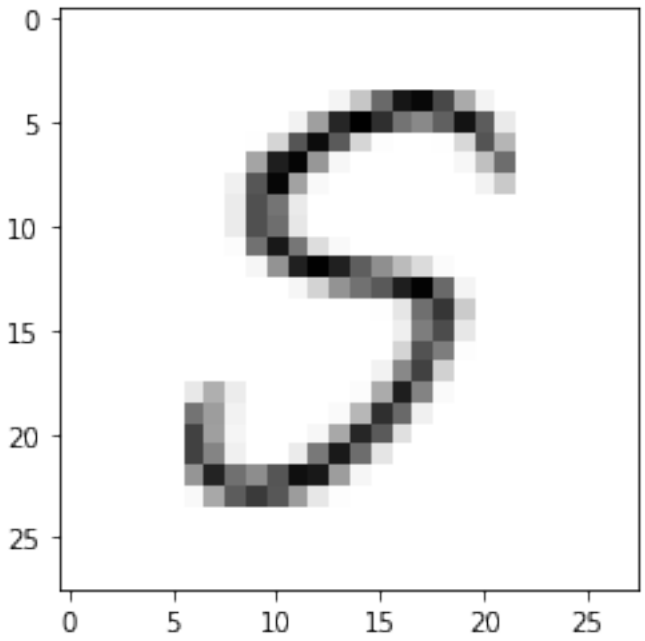
[25]:
```
image_index = 89898
plt.imshow(X_test[image_index].reshape(28, 28),cmap='Greys')
pred = model.predict(X_test[image_index].reshape(1, 28, 28, 1))
print("Predicted Letter",input_map[pred.argmax()])
print("Correct Label ",input_map[y_test[image_index]])
```

```
Predicted Letter a
Correct Label  a
```



[26]:
```
image_index = 1898
plt.imshow(X_test[image_index].reshape(28, 28),cmap='Greys')
pred = model.predict(X_test[image_index].reshape(1, 28, 28, 1))
print("Predicted Letter",input_map[pred.argmax()])
print("Correct Label ",input_map[y_test[image_index]])
```

```
Predicted Letter s
Correct Label  s
```



[27]:
```
model.save('charRecognization.h5')
```

[ ]:
```

```

[28]:
```
#Model 2
model = Sequential()
model.add(Conv2D(filters=32, kernel_size=(3,3),activation = 'relu'␣
↪,input_shape=input_shape))
model.add(MaxPooling2D(pool_size=(2, 2),strides=2))
model.add(Conv2D(filters=32, kernel_size=(3,3),activation = 'relu'))
model.add(MaxPooling2D(pool_size=(2, 2),strides=2))

model.add(Flatten()) # Flattening the 2D arrays for fully connected layers

model.add(Dense(128, activation=tf.nn.relu))
model.add(Dense(26,activation=tf.nn.softmax))

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

model.fit(x=X_train,y=y_train, epochs=15)
```

```
Epoch 1/15
7799/7799 [==============================] - 97s 12ms/step - loss: 0.1470 -
accuracy: 0.9579
```

```
Epoch 2/15
7799/7799 [==============================] - 96s 12ms/step - loss: 0.0581 -
accuracy: 0.9837
Epoch 3/15
7799/7799 [==============================] - 93s 12ms/step - loss: 0.0402 -
accuracy: 0.9881
Epoch 4/15
7799/7799 [==============================] - 94s 12ms/step - loss: 0.0306 -
accuracy: 0.9905
Epoch 5/15
7799/7799 [==============================] - 96s 12ms/step - loss: 0.0234 -
accuracy: 0.9927
Epoch 6/15
7799/7799 [==============================] - 95s 12ms/step - loss: 0.0189 -
accuracy: 0.9939
Epoch 7/15
7799/7799 [==============================] - 95s 12ms/step - loss: 0.0159 -
accuracy: 0.9949
Epoch 8/15
7799/7799 [==============================] - 95s 12ms/step - loss: 0.0133 -
accuracy: 0.9956
Epoch 9/15
7799/7799 [==============================] - 94s 12ms/step - loss: 0.0118 -
accuracy: 0.9961
Epoch 10/15
7799/7799 [==============================] - 94s 12ms/step - loss: 0.0106 -
accuracy: 0.9964
Epoch 11/15
7799/7799 [==============================] - 94s 12ms/step - loss: 0.0096 -
accuracy: 0.9969
Epoch 12/15
7799/7799 [==============================] - 97s 12ms/step - loss: 0.0092 -
accuracy: 0.9970
Epoch 13/15
7799/7799 [==============================] - 97s 12ms/step - loss: 0.0089 -
accuracy: 0.9971
Epoch 14/15
7799/7799 [==============================] - 98s 13ms/step - loss: 0.0084 -
accuracy: 0.9975
Epoch 15/15
7799/7799 [==============================] - 100s 13ms/step - loss: 0.0080 -
accuracy: 0.9975
```

[28]:
```
<tensorflow.python.keras.callbacks.History at 0x7f8926b915b0>
```

[29]:
```
model.evaluate(X_test, y_test)
model.save('charRecognization2.h5')
```

```
3841/3841 [==============================] - 14s 4ms/step - loss: 0.0548 -
accuracy: 0.9920
```

[ ]: