tensorflow

October 8, 2019

```
In [1]: import tensorflow as tf
```

```
d:\dev\python\python36\lib\site-packages\tensorflow\python\framework\dtypes.py:523: FutureWarni
  _np_qint8 = np.dtype([("qint8", np.int8, 1)])
d:\dev\python\python36\lib\site-packages\tensorflow\python\framework\dtypes.py:524: FutureWarni
  _np_quint8 = np.dtype([("quint8", np.uint8, 1)])
d:\dev\python\python36\lib\site-packages\tensorflow\python\framework\dtypes.py:525: FutureWarni
  _np_qint16 = np.dtype([("qint16", np.int16, 1)])
d:\dev\python\python36\lib\site-packages\tensorflow\python\framework\dtypes.py:526: FutureWarni
  _np_quint16 = np.dtype([("quint16", np.uint16, 1)])
d:\dev\python\python36\lib\site-packages\tensorflow\python\framework\dtypes.py:527: FutureWarni
  _np_qint32 = np.dtype([("qint32", np.int32, 1)])
d:\dev\python\python36\lib\site-packages\tensorflow\python\framework\dtypes.py:532: FutureWarni
  np_resource = np.dtype([("resource", np.ubyte, 1)])
```

```
In [2]: from tensorflow.examples.tutorials.mnist import input_data
```

```
In [3]: print(tf.__version__)
```

```
1.10.0
```

```
In [4]: data=input_data.read_data_sets('MNIST/', one_hot=True)
```

```
WARNING:tensorflow:From <ipython-input-4-a184fceb9859>:1: read_data_sets (from tensorflow.conti
Instructions for updating:
Please use alternatives such as official/mnist/dataset.py from tensorflow/models.
WARNING:tensorflow:From d:\dev\python\python36\lib\site-packages\tensorflow\contrib\learn\pytho
Instructions for updating:
Please write your own downloading logic.
WARNING:tensorflow:From d:\dev\python\python36\lib\site-packages\tensorflow\contrib\learn\pytho
Instructions for updating:
Please use tf.data to implement this functionality.
Extracting MNIST/train-images-idx3-ubyte.gz
WARNING:tensorflow:From d:\dev\python\python36\lib\site-packages\tensorflow\contrib\learn\pytho
Instructions for updating:
Please use tf.data to implement this functionality.
```

```
Extracting MNIST/train-labels-idx1-ubyte.gz
WARNING:tensorflow:From d:\dev\python\python36\lib\site-packages\tensorflow\contrib\learn\pytho
Instructions for updating:
Please use tf.one_hot on tensors.
Extracting MNIST/t10k-images-idx3-ubyte.gz
Extracting MNIST/t10k-labels-idx1-ubyte.gz
WARNING:tensorflow:From d:\dev\python\python36\lib\site-packages\tensorflow\contrib\learn\pytho
Instructions for updating:
Please use alternatives such as official/mnist/dataset.py from tensorflow/models.
```

```
In [5]: import os
        os.listdir('MNIST/')

Out[5]: ['images',
         't10k-images-idx3-ubyte.gz',
         't10k-labels-idx1-ubyte.gz',
         'train-images-idx3-ubyte.gz',
         'train-labels-idx1-ubyte.gz']

In [6]: print('Image Inventory')
        print('------------')
        print('Training: {}'.format(len(data.train.labels)))
        print('Testing:  {}'.format(len(data.test.labels)))
        print('------------')
```

```
Image Inventory
------------
Training: 55000
Testing:  10000
------------
```

```
In [7]: import numpy as np
        import matplotlib.pyplot as plt
        %matplotlib inline

In [8]: for i in range(2):
            image = data.train.images[i]
            image = np.array(image, dtype='float')
            label = data.train.labels[i]
            pixels = image.reshape((28,28))
            plt.imshow(pixels, cmap='gray')
            print('-----------------')
            print(label)
            plt.show()
```

```
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[0. 0. 0. 0. 0. 0. 0. 1. 0. 0.]
```
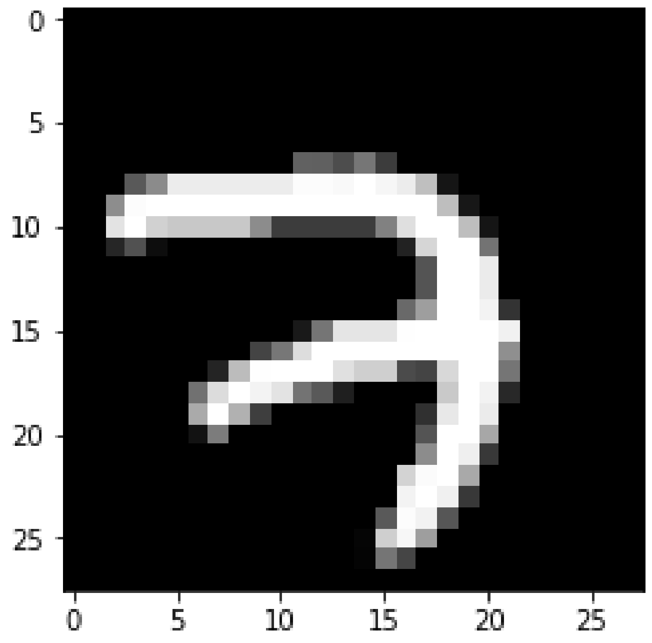
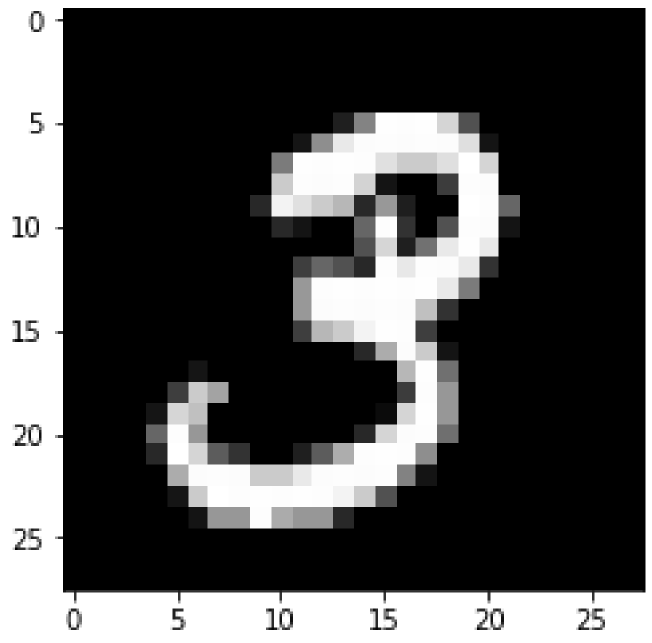



```
-----------------
[0. 0. 0. 1. 0. 0. 0. 0. 0. 0.]
```



```
In [9]: if not os.path.exists('MNIST/images'):
            os.makedirs('MNIST/images/')
        os.chdir('MNIST/images/')
```

```
In [10]: from matplotlib import image
         for i in range(1, 10):
             png = data.train.images[i]
             png = np.array(png, dtype='float')
             pixels = png.reshape((28,28))
             image.imsave('iamge_no_{}.png'.format(i), pixels, cmap='gray')
```

```
In [11]: print(os.listdir())
```

```
['iamge_no_1.png', 'iamge_no_2.png', 'iamge_no_3.png', 'iamge_no_4.png', 'iamge_no_5.png', 'iam
```

```
In [12]: from Augmentor import Pipeline
```

```
In [13]: augmentor = Pipeline('/workspace/PyCharmProjects/MNIST/images')
```

```
Initialised with 9 image(s) found.
Output directory set to /workspace/PyCharmProjects/MNIST/images\output.
```

```
In [14]: augmentor.rotate(probability=0.9,max_left_rotation=25,max_right_rotation=25)
```

```
In [15]: for i in range(1, 3):
             augmentor.sample(10)
```

```
Processing <PIL.Image.Image image mode=RGBA size=28x28 at 0x254A4A46748>: 100%|| 10/10 [00:00<
Processing <PIL.Image.Image image mode=RGBA size=28x28 at 0x254A4A53978>: 100%|| 10/10 [00:00<
```

```
In [16]: xtrain = data.train.images
         ytrain = np.asarray(data.train.labels)
         xtest = data.test.images
         ytest = np.asarray(data.test.labels)
```

```
In [17]: xtrain = xtrain.reshape(xtrain.shape[0],28,28,1)
         xtest = xtest.reshape(xtest.shape[0],28,28,1)
         ytest = ytest.reshape(ytest.shape[0],10)
         ytrain = ytrain.reshape(ytrain.shape[0],10)
```

```
In [18]: print(xtrain.shape)
         print(ytrain.shape)
         print(xtest.shape)
         print(ytest.shape)
```

```
(55000, 28, 28, 1)
(55000, 10)
(10000, 28, 28, 1)
(10000, 10)
```

```
In [19]: import keras

Using TensorFlow backend.


In [19]: import keras.backend as K
         from keras.models import Sequential
         from keras.layers import Dense, Flatten, Conv2D

         K.set_image_dim_ordering('tf')

         model = Sequential()

         model.add(Conv2D(32, kernel_size=(5,5), activation='relu', input_shape=(28,28,1)))
         model.add(Flatten())
         model.add(Dense(128, activation='relu'))
         model.add(Dense(10, activation='sigmoid'))

Using TensorFlow backend.


In [20]: model.compile(optimizer='adam', loss='categorical_crossentropy',
                      metrics=['accuracy'])

In [21]: model.fit(xtrain, ytrain, batch_size=512,
                   epochs=5,
                   validation_data=(xtest, ytest))

Train on 55000 samples, validate on 10000 samples
Epoch 1/5
55000/55000 [==============================] - ETA: 7:25 - loss: 2.3106 - acc: 0.099 - ETA: 1:
Epoch 2/5
55000/55000 [==============================] - ETA: 2s - loss: 0.0815 - acc: 0.986 - ETA: 2s -
Epoch 3/5
55000/55000 [==============================] - ETA: 2s - loss: 0.0528 - acc: 0.982 - ETA: 2s -
Epoch 4/5
55000/55000 [==============================] - ETA: 2s - loss: 0.0315 - acc: 0.988 - ETA: 2s -
Epoch 5/5
55000/55000 [==============================] - ETA: 2s - loss: 0.0279 - acc: 0.992 - ETA: 2s -


Out[21]: <keras.callbacks.History at 0x254a4949eb8>

In [25]: stats = model.evaluate(xtest, ytest)

10000/10000 [==============================] - ETA:  - ETA:  - ETA:  - ETA:  - ETA:  - ETA:  -


In [26]: print('The accuracy rate is {}%'.format(round(stats[1],3)*100))
         print('The loss rate is {}%'.format(round(stats[0],2)*100))
```

```
The accuracy rate is 98.6%
The loss rate is 4.0%
```

```
In [27]: model.summary()
```

```
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
conv2d_1 (Conv2D)            (None, 24, 24, 32)        832
_________________________________________________________________
flatten_1 (Flatten)          (None, 18432)             0
_________________________________________________________________
dense_1 (Dense)              (None, 128)               2359424
_________________________________________________________________
dense_2 (Dense)              (None, 10)                1290
=================================================================
Total params: 2,361,546
Trainable params: 2,361,546
Non-trainable params: 0
_________________________________________________________________
```

```
In [ ]:
```