

# **Convolutional Neural Network**

## **With Metal & Swift**

**We have to install some package first**

**Step 1 install Anaconda**

**Step 2 type “pip install tensorflow” on terminal**

**Step 3 type “pip install keras” on terminal**

```
vickykuo — pip install tensorflow — 80x24
Last login: Sat Apr 21 13:26:37 on console
[guopinyude-MBP:~ vickykuo] $ import tensorflow
-bash: import: command not found
[guopinyude-MBP:~ vickykuo] $ import keras
-bash: import: command not found
[guopinyude-MBP:~ vickykuo] $ install tensorflow
usage: install [-bCcpSsv] [-B suffix] [-f flags] [-g group] [-m mode]
        [-o owner] file1 file2
        install [-bCcpSsv] [-B suffix] [-f flags] [-g group] [-m mode]
        [-o owner] file1 ... fileN directory
        install -d [-v] [-g group] [-m mode] [-o owner] directory ...
[guopinyude-MBP:~ vickykuo] $ install keras
usage: install [-bCcpSsv] [-B suffix] [-f flags] [-g group] [-m mode]
        [-o owner] file1 file2
        install [-bCcpSsv] [-B suffix] [-f flags] [-g group] [-m mode]
        [-o owner] file1 ... fileN directory
        install -d [-v] [-g group] [-m mode] [-o owner] directory ...
[guopinyude-MBP:~ vickykuo] $ pip install tensorflow
Collecting tensorflow
  Downloading https://files.pythonhosted.org/packages/64/6a/c0681f99098edc2ac32
7485ca5046cd47461b6ac379f65932c817913b34/tensorflow-1.7.0-cp36-cp36m-macosx_10_
1_x86_64.whl (45.3MB)
    97% |██████████████████████████████████████████████████████████████████████████| 45.3MB 9.3MB/s eta 0:00:01
```

```
vickykuo — -bash — 80x24
Uninstalling bleach-2.1.2:
  Successfully uninstalled bleach-2.1.2
Successfully installed absl-py-0.2.0 astor-0.6.2 bleach-1.5.0 gast-0.2.0 grpcio-
1.11.0 html5lib-0.9999999 markdown-2.6.11 protobuf-3.5.2.post1 tensorboard-1.7.0
tensorflow-1.7.0 termcolor-1.1.0
You are using pip version 9.0.1, however version 10.0.1 is available.
You should consider upgrading via the 'pip install --upgrade pip' command.
[guopinyude-MBP:~ vickykuo] $ pip install keras
Collecting keras
  Downloading https://files.pythonhosted.org/packages/ba/6b/e4aff762b8695ec0626a
6654b1b73b396fcc8b7cc6b98d78a1bc53b85b48/Keras-2.1.5-py2.py3-none-any.whl (334kB)
    100% |██████████████████████████████████████████████████████████████████████████| 337kB 1.2MB/s
Requirement already satisfied: numpy>=1.9.1 in /anaconda3/lib/python3.6/site-pac
kages (from keras)
Requirement already satisfied: pyyaml in /anaconda3/lib/python3.6/site-packages
 (from keras)
Requirement already satisfied: scipy>=0.14 in /anaconda3/lib/python3.6/site-pack
ages (from keras)
Requirement already satisfied: six>=1.9.0 in /anaconda3/lib/python3.6/site-packa
ges (from keras)
Installing collected packages: keras
Successfully installed keras-2.1.5
You are using pip version 9.0.1, however version 10.0.1 is available.
```

# After the installation step we can run the train code on the python which can be exported into Caffe.

The screenshot shows the Spyder Python IDE interface. The editor window displays a Python script named 'temp.py' with the following code:

```
4 removed epochs from original code to deal with keras 1.2.2
5 ...
6
7 from __future__ import print_function
8
9 import keras
10 from keras.datasets import mnist
11 from keras.models import Sequential
12 from keras.layers import Dense, Dropout
13 from keras.optimizers import RMSprop
14 from keras.utils import np_utils
15
16 batch_size = 128
17 num_classes = 10
18 epochs = 20
19
20 # the data, shuffled and split between train and test sets
21 (x_train, y_train), (x_test, y_test) = mnist.load_data()
22
23 x_train = x_train.reshape(60000, 784)
24 x_test = x_test.reshape(10000, 784)
25 x_train = x_train.astype('float32')
26 x_test = x_test.astype('float32')
27 x_train /= 255
28 x_test /= 255
29 print(x_train.shape[0], 'train samples')
30 print(x_test.shape[0], 'test samples')
31
32 # convert class vectors to binary class matrices
33 y_train = np_utils.to_categorical(y_train, num_classes)
34 y_test = np_utils.to_categorical(y_test, num_classes)
35
36 model = Sequential()
37 model.add(Dense(512, activation='relu', input_shape=(784,)))
38 model.add(Dropout(0.2))
39 model.add(Dense(512, activation='relu'))
40 model.add(Dropout(0.2))
41 model.add(Dense(10, activation='softmax'))
42
43 model.summary()
44
45 model.compile(loss='categorical_crossentropy',
46               optimizer=RMSprop(),
47               metrics=['accuracy'])
48
49 history = model.fit(x_train, y_train,
50                    batch_size=batch_size,
51                    verbose=1,
52                    validation_data=(x_test, y_test))
53 score = model.evaluate(x_test, y_test, verbose=0)
```

The Variable explorer on the right shows the following variables:

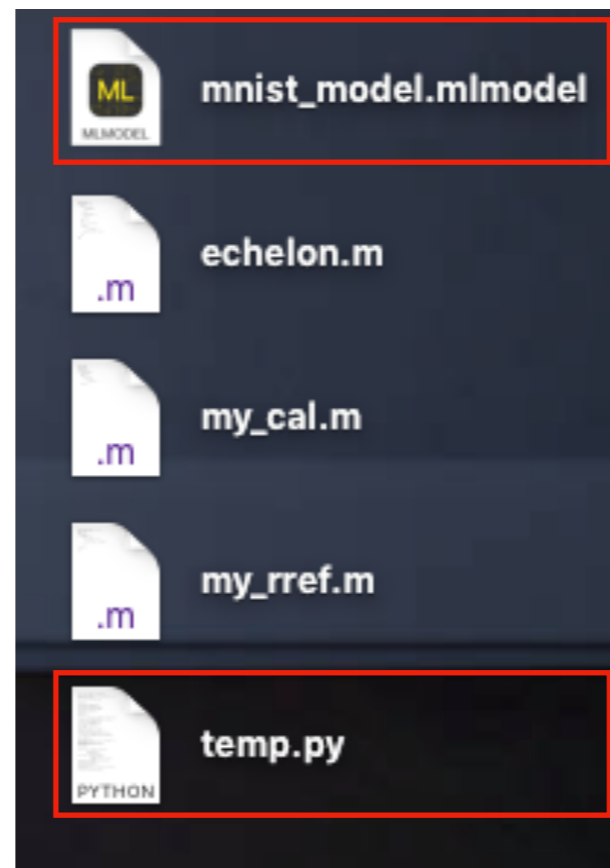
Name	Type	Size	Value
batch_size	int	1	128
epochs	int	1	20
num_classes	int	1	10

The Python console shows the output of the training process:

```
10000 test samples
Layer (type)                Output Shape         Param #
-----
dense_7 (Dense)              (None, 512)         401920
dropout_5 (Dropout)          (None, 512)         0
dense_8 (Dense)              (None, 512)         262656
dropout_6 (Dropout)          (None, 512)         0
dense_9 (Dense)              (None, 10)          5130
-----
Total params: 669,706
Trainable params: 669,706
Non-trainable params: 0

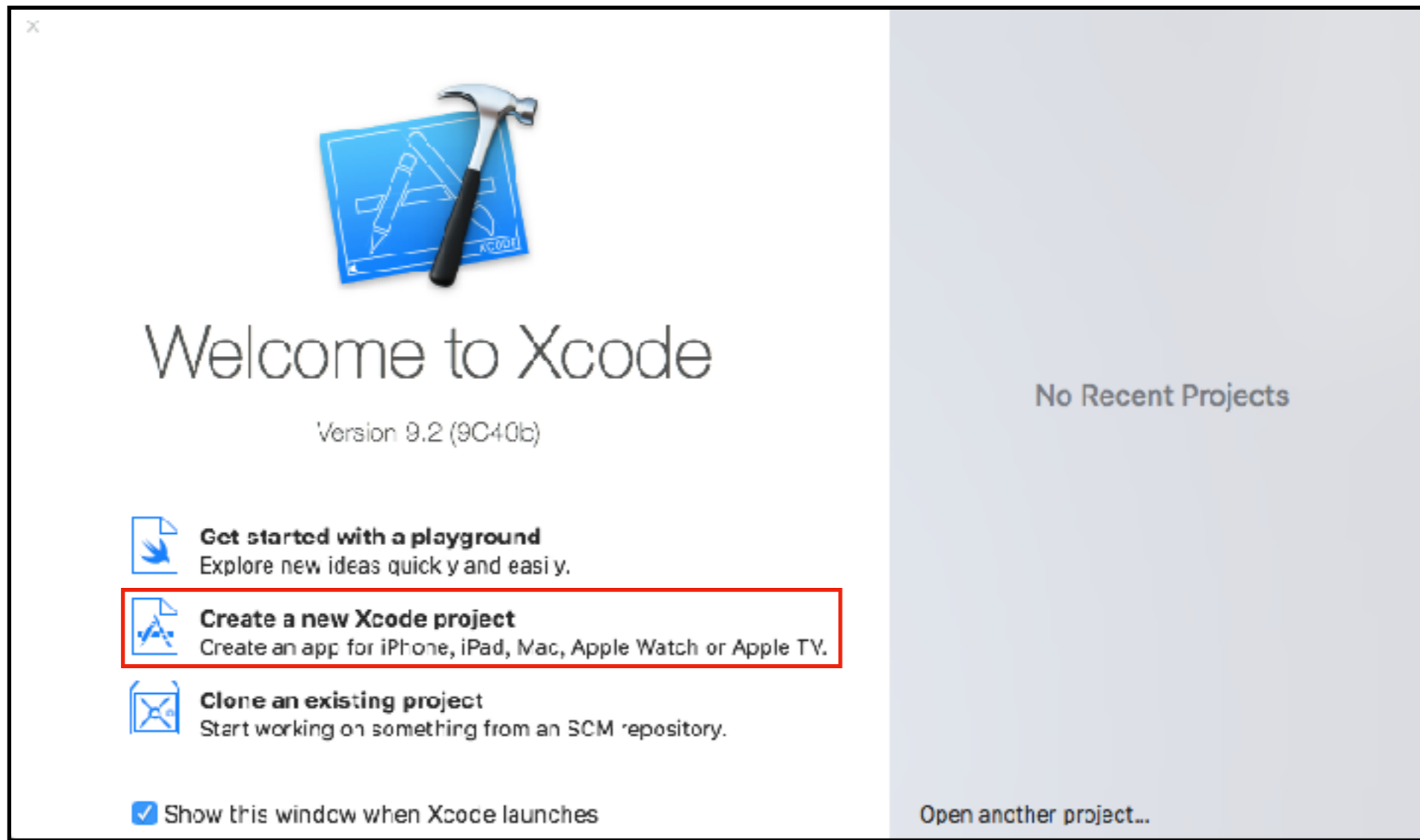
Train on 60000 samples, validate on 10000 samples
Epoch 1/1
60000/60000 [=====] - 11s 188ms/step - loss: 0.2475 - acc: 0.9237 - val_loss: 0.1153
- val_acc: 0.9641
Test loss: 0.11525626505585387
Test accuracy: 0.9641
Saving mnist model
WARNING:root:Keras version 2.1.5 detected. Last version known to be fully compatible of Keras is 2.1.3 .
WARNING:root:TensorFlow version 1.7.0 detected. Last version known to be fully compatible is 1.5.0 .
0 : dense_7_input, <keras.engine.topology.InputLayer object at 0x114ae4160>
1 : dense_7, <keras.layers.core.Dense object at 0x1149e4980>
2 : dense_7_activation, <keras.layers.core.Activation object at 0x110d7ffd0>
3 : dense_8, <keras.layers.core.Dense object at 0x114ae4668>
4 : dense_8_activation, <keras.layers.core.Activation object at 0x1028449f98>
5 : dense_9, <keras.layers.core.Dense object at 0x114ad2198>
6 : dense_9_activation, <keras.layers.core.Activation object at 0x1028449fd0>
```

**When you save your run test result, it will save into two different file, one is for your model and the other is for your training code.**



This is CoreML which can be imported in to Swift.

**We need to create a new Xcode “project” because we are going to create a app on mobile.**



# We need to pull “CoreML” under this project.



# Then we can test our trained model on Swift now.

Trained data in CoreML.

```
1 //  
2 //  
3 //  
4 //  
5 // Created by  
6 // Brett Koonce  
7 // on 6/11/17.  
8 // Copyright ©  
9 // 2017 Brett  
10 // Koonce. All  
11 // rights  
12 // reserved.  
13  
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21  
22 func mnist_with_keras(inputDataVector:[Int]) -> () {  
23     guard let input_data = try? MLMultiArray(shape:[784],  
24         dataType:MLMultiArrayDataType.float32) else {  
25         fatalError("MLMultiArray init barfed")  
26     }  
27  
28     for i in 1...784 {  
29         let data = NSNumber(value: inputDataVector[i - 1])  
30         // @koonce: normalize MNIST inputs here  
31         input_data[i - 1] = NSNumber(value: (data.floatValue/255.0))  
32     }  
33  
34     let i = mnist_modelInput(input1: input_data)  
35  
36     guard let digit_prediction = try? model.prediction(input: i) else {  
37         fatalError("something went wrong when doing the model prediction  
38             step")  
39     }  
40 }  
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testing 7  
mnist digit prediction 7  
testing 2  
mnist digit prediction 2  
2018-04-22 23:55:14.281994+0000 keras_mnist_demo[38186:1445266] [process_info] Exiting because the workspace server has disconnected.  
Message from debugger: Terminated due to signal 9
```

Test result will be show on mobile if we have connected.