

October 24, 2019

```
[1]: # Importing Libraries

[2]: import pandas as pd
import numpy as np

[3]: # Activities are the class labels
# It is a 6 class classification
ACTIVITIES = {
    0: 'WALKING',
    1: 'WALKING_UPSTAIRS',
    2: 'WALKING_DOWNSTAIRS',
    3: 'SITTING',
    4: 'STANDING',
    5: 'LAYING',
}

# Utility function to print the confusion matrix
def confusion_matrix(Y_true, Y_pred):
    Y_true = pd.Series([ACTIVITIES[y] for y in np.argmax(Y_true, axis=1)])
    Y_pred = pd.Series([ACTIVITIES[y] for y in np.argmax(Y_pred, axis=1)])

    return pd.crosstab(Y_true, Y_pred, rownames=['True'], colnames=['Pred'])
```

0.0.1 Data

```
[4]: # Data directory
DATADIR = 'UCI_HAR_Dataset'

[5]: # Raw data signals
# Signals are from Accelerometer and Gyroscope
# The signals are in x,y,z directions
# Sensor signals are filtered to have only body acceleration
# excluding the acceleration due to gravity
# Triaxial acceleration from the accelerometer is total acceleration
SIGNALS = [
    "body_acc_x",
    "body_acc_y",
    "body_acc_z",
```

```

"body_gyro_x",
"body_gyro_y",
"body_gyro_z",
"total_acc_x",
"total_acc_y",
"total_acc_z"
]

```

```

[6]: # Utility function to read the data from csv file
def _read_csv(filename):
    return pd.read_csv(filename, delim_whitespace=True, header=None)

# Utility function to load the load
def load_signals(subset):
    signals_data = []

    for signal in SIGNALS:
        filename = f'UCI_HAR_Dataset/{subset}/Inertial Signals/
→{signal}_{subset}.txt'
        signals_data.append(
            _read_csv(filename).as_matrix()
        )

    # Transpose is used to change the dimensionality of the output,
    # aggregating the signals by combination of sample/timestep.
    # Resultant shape is (7352 train/2947 test samples, 128 timesteps, 9
→signals)
    return np.transpose(signals_data, (1, 2, 0))

```

```

[7]: def load_y(subset):
    """
    The objective that we are trying to predict is a integer, from 1 to 6,
    that represents a human activity. We return a binary representation of
    every sample objective as a 6 bits vector using One Hot Encoding
    (https://pandas.pydata.org/pandas-docs/stable/generated/pandas.get\_dummies.
→html)
    """
    filename = f'UCI_HAR_Dataset/{subset}/y_{subset}.txt'
    y = _read_csv(filename)[0]

    return pd.get_dummies(y).as_matrix()

```

```

[8]: def load_data():
    """
    Obtain the dataset from multiple files.
    Returns: X_train, X_test, y_train, y_test
    """
    X_train, X_test = load_signals('train'), load_signals('test')

```

```

y_train, y_test = load_y('train'), load_y('test')

return X_train, X_test, y_train, y_test

```

```

[9]: # Importing tensorflow
np.random.seed(42)
import tensorflow as tf
tf.set_random_seed(42)

```

```

[10]: # Configuring a session
session_conf = tf.ConfigProto(
    intra_op_parallelism_threads=1,
    inter_op_parallelism_threads=1
)

```

```

[11]: # Import Keras
from keras import backend as K
sess = tf.Session(graph=tf.get_default_graph(), config=session_conf)
K.set_session(sess)

```

Using TensorFlow backend.

```

[12]: # Importing libraries
from keras.models import Sequential
from keras.layers import LSTM
from keras.layers.core import Dense, Dropout

```

```

[13]: # Initializing parameters
epochs = 30
batch_size = 16
n_hidden = 32

```

```

[14]: # Utility function to count the number of classes
def _count_classes(y):
    return len(set([tuple(category) for category in y]))

```

```

[15]: # Loading the train and test data
X_train, X_test, Y_train, Y_test = load_data()

```

```

C:\Users\user\Anaconda3\envs\tensorflow_gpu\lib\site-
packages\ipykernel_launcher.py:12: FutureWarning: Method .as_matrix will be
removed in a future version. Use .values instead.

```

```

if sys.path[0] == '':

```

```

C:\Users\user\Anaconda3\envs\tensorflow_gpu\lib\site-
packages\ipykernel_launcher.py:11: FutureWarning: Method .as_matrix will be
removed in a future version. Use .values instead.

```

```

# This is added back by InteractiveShellApp.init_path()

```

```
[16]: timesteps = len(X_train[0])
input_dim = len(X_train[0][0])
n_classes = _count_classes(Y_train)

print(timesteps)
print(input_dim)
print(len(X_train))
```

```
128
9
7352
```

- Defining the Architecture of LSTM

```
[17]: # # Initiliazing the sequential model
# model = Sequential()
# # Configuring the parameters
# model.add(LSTM(n_hidden, input_shape=(timesteps, input_dim)))
# # Adding a dropout layer
# model.add(Dropout(0.5))
# # Adding a dense output layer with sigmoid activation
# model.add(Dense(n_classes, activation='sigmoid'))
# model.summary()
```

```
[18]: # # Compiling the model
# model.compile(loss='categorical_crossentropy',
#               optimizer='rmsprop',
#               metrics=['accuracy'])
```

```
[19]: # # Training the model
# from datetime import datetime
# print(datetime.now())
# model.fit(X_train,
#          Y_train,
#          batch_size=batch_size,
#          validation_data=(X_test, Y_test),
#          epochs=epochs)
# print(datetime.now())
```

```
[20]: # # Confusion Matrix
# print(confusion_matrix(Y_test, model.predict(X_test)))
```

```
[21]: # score = model.evaluate(X_test, Y_test)
```

```
[22]: # score
```

- With a simple 2 layer architecture we got 90.09% accuracy and a loss of 0.30
- We can further improve the performance with Hyperparameter tuning

```

[23]: from keras.callbacks import ModelCheckpoint
      from keras.callbacks import Callback

      epochs = 50
      batch_size = 32
      n_hidden = 64

      # Initiliazing the sequential model
      model = Sequential()
      # Configuring the parameters
      model.add(LSTM(100, input_shape=(timesteps, input_dim), return_sequences=True))
      # Adding a dropout layer
      model.add(Dropout(0.7))

      model.add(LSTM(100, input_shape=(timesteps, input_dim)))
      # Adding a dropout layer
      model.add(Dropout(0.7))
      # Adding a dense output layer with sigmoid activation
      model.add(Dense(n_classes, activation='sigmoid'))
      model.summary()

      # Compiling the model
      model.compile(loss='categorical_crossentropy',
                    optimizer='rmsprop',
                    metrics=['accuracy'])

      filepath="weights-improvement-model1.hdf5"
      checkpoint = ModelCheckpoint(filepath, verbose=1, monitor="val_acc",
                                   ↪save_best_only=True, mode='max')
      callbacks_list = [checkpoint]

      # Training the model
      from datetime import datetime
      print(datetime.now())
      model.fit(X_train,
                Y_train,
                batch_size=batch_size,
                validation_data=(X_test, Y_test),
                epochs=epochs, callbacks=callbacks_list)
      print(datetime.now())
      print(confusion_matrix(Y_test, model.predict(X_test)))
      score = model.evaluate(X_test, Y_test)
      print(score)

```

WARNING: Logging before flag parsing goes to stderr.
W1023 23:43:42.524905 1276 deprecation_wrapper.py:119] From

C:\Users\user\Anaconda3\envs\tensorflow_gpu\lib\site-packages\keras\backend\tensorflow_backend.py:74: The name tf.get_default_graph is deprecated. Please use tf.compat.v1.get_default_graph instead.

W1023 23:43:42.526900 1276 deprecation_wrapper.py:119] From C:\Users\user\Anaconda3\envs\tensorflow_gpu\lib\site-packages\keras\backend\tensorflow_backend.py:519: The name tf.placeholder is deprecated. Please use tf.compat.v1.placeholder instead.

W1023 23:43:42.529892 1276 deprecation_wrapper.py:119] From C:\Users\user\Anaconda3\envs\tensorflow_gpu\lib\site-packages\keras\backend\tensorflow_backend.py:4140: The name tf.random_uniform is deprecated. Please use tf.random.uniform instead.

W1023 23:43:42.744337 1276 deprecation_wrapper.py:119] From C:\Users\user\Anaconda3\envs\tensorflow_gpu\lib\site-packages\keras\backend\tensorflow_backend.py:133: The name tf.placeholder_with_default is deprecated. Please use tf.compat.v1.placeholder_with_default instead.

W1023 23:43:42.753314 1276 deprecation.py:506] From C:\Users\user\Anaconda3\envs\tensorflow_gpu\lib\site-packages\keras\backend\tensorflow_backend.py:3447: calling dropout (from tensorflow.python.ops.nn_ops) with keep_prob is deprecated and will be removed in a future version.

Instructions for updating:

Please use `rate` instead of `keep_prob`. Rate should be set to `rate = 1 - keep_prob`.

W1023 23:43:42.754310 1276 nn_ops.py:4224] Large dropout rate: 0.7 (>0.5). In TensorFlow 2.x, dropout() uses dropout rate instead of keep_prob. Please ensure that this is intended.

W1023 23:43:43.053268 1276 nn_ops.py:4224] Large dropout rate: 0.7 (>0.5). In TensorFlow 2.x, dropout() uses dropout rate instead of keep_prob. Please ensure that this is intended.

W1023 23:43:43.084184 1276 deprecation_wrapper.py:119] From C:\Users\user\Anaconda3\envs\tensorflow_gpu\lib\site-packages\keras\optimizers.py:790: The name tf.train.Optimizer is deprecated. Please use tf.compat.v1.train.Optimizer instead.

W1023 23:43:43.110115 1276 deprecation_wrapper.py:119] From C:\Users\user\Anaconda3\envs\tensorflow_gpu\lib\site-packages\keras\backend\tensorflow_backend.py:3297: The name tf.log is deprecated. Please use tf.math.log instead.

W1023 23:43:43.239768 1276 deprecation.py:323] From C:\Users\user\Anaconda3\envs\tensorflow_gpu\lib\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`

Layer (type)	Output Shape	Param #
lstm_1 (LSTM)	(None, 128, 100)	44000
dropout_1 (Dropout)	(None, 128, 100)	0
lstm_2 (LSTM)	(None, 100)	80400
dropout_2 (Dropout)	(None, 100)	0
dense_1 (Dense)	(None, 6)	606

Total params: 125,006

Trainable params: 125,006

Non-trainable params: 0

2019-10-23 23:43:43.130061

Train on 7352 samples, validate on 2947 samples

Epoch 1/50

7352/7352 [=====] - 99s 13ms/step - loss: 1.1495 - acc: 0.4973 - val_loss: 0.9139 - val_acc: 0.5891

Epoch 00001: val_acc improved from -inf to 0.58907, saving model to weights-improvement-model1.hdf5

Epoch 2/50

7352/7352 [=====] - 97s 13ms/step - loss: 0.8102 - acc: 0.6055 - val_loss: 0.7867 - val_acc: 0.5881

Epoch 00002: val_acc did not improve from 0.58907

Epoch 3/50

7352/7352 [=====] - 126s 17ms/step - loss: 0.7107 - acc: 0.6595 - val_loss: 0.7640 - val_acc: 0.6810

Epoch 00003: val_acc improved from 0.58907 to 0.68103, saving model to weights-improvement-model1.hdf5

Epoch 4/50

7352/7352 [=====] - 159s 22ms/step - loss: 0.7212 - acc: 0.6593 - val_loss: 0.8491 - val_acc: 0.5979

Epoch 00004: val_acc did not improve from 0.68103

Epoch 5/50

7352/7352 [=====] - 203s 28ms/step - loss: 0.7137 - acc: 0.6711 - val_loss: 0.7349 - val_acc: 0.6946

Epoch 00005: val_acc improved from 0.68103 to 0.69460, saving model to weights-improvement-model11.hdf5

Epoch 6/50

7352/7352 [=====] - 201s 27ms/step - loss: 0.6485 -
acc: 0.6927 - val_loss: 0.7264 - val_acc: 0.6848

Epoch 00006: val_acc did not improve from 0.69460

Epoch 7/50

7352/7352 [=====] - 206s 28ms/step - loss: 0.6392 -
acc: 0.7078 - val_loss: 0.7728 - val_acc: 0.6552

Epoch 00007: val_acc did not improve from 0.69460

Epoch 8/50

7352/7352 [=====] - 206s 28ms/step - loss: 0.5895 -
acc: 0.7149 - val_loss: 0.6374 - val_acc: 0.7251

Epoch 00008: val_acc improved from 0.69460 to 0.72514, saving model to weights-improvement-model11.hdf5

Epoch 9/50

7352/7352 [=====] - 210s 29ms/step - loss: 0.4777 -
acc: 0.7912 - val_loss: 0.7598 - val_acc: 0.7387

Epoch 00009: val_acc improved from 0.72514 to 0.73872, saving model to weights-improvement-model11.hdf5

Epoch 10/50

7352/7352 [=====] - 210s 29ms/step - loss: 0.3275 -
acc: 0.8795 - val_loss: 0.6216 - val_acc: 0.8198

Epoch 00010: val_acc improved from 0.73872 to 0.81982, saving model to weights-improvement-model11.hdf5

Epoch 11/50

7352/7352 [=====] - 206s 28ms/step - loss: 0.2236 -
acc: 0.9248 - val_loss: 0.4046 - val_acc: 0.9033

Epoch 00011: val_acc improved from 0.81982 to 0.90329, saving model to weights-improvement-model11.hdf5

Epoch 12/50

7352/7352 [=====] - 144s 20ms/step - loss: 0.1764 -
acc: 0.9392 - val_loss: 0.4191 - val_acc: 0.9080

Epoch 00012: val_acc improved from 0.90329 to 0.90804, saving model to weights-improvement-model11.hdf5

Epoch 13/50

7352/7352 [=====] - 106s 14ms/step - loss: 0.1698 -
acc: 0.9416 - val_loss: 0.4965 - val_acc: 0.8853

Epoch 00013: val_acc did not improve from 0.90804

Epoch 14/50
7352/7352 [=====] - 111s 15ms/step - loss: 0.1695 -
acc: 0.9385 - val_loss: 0.5351 - val_acc: 0.8958

Epoch 00014: val_acc did not improve from 0.90804
Epoch 15/50
7352/7352 [=====] - 204s 28ms/step - loss: 0.1515 -
acc: 0.9474 - val_loss: 0.4908 - val_acc: 0.8989

Epoch 00015: val_acc did not improve from 0.90804
Epoch 16/50
7352/7352 [=====] - 217s 30ms/step - loss: 0.1496 -
acc: 0.9474 - val_loss: 0.4761 - val_acc: 0.9131

Epoch 00016: val_acc improved from 0.90804 to 0.91313, saving model to weights-
improvement-model11.hdf5
Epoch 17/50
7352/7352 [=====] - 229s 31ms/step - loss: 0.1427 -
acc: 0.9475 - val_loss: 0.3000 - val_acc: 0.9237

Epoch 00017: val_acc improved from 0.91313 to 0.92365, saving model to weights-
improvement-model11.hdf5
Epoch 18/50
7352/7352 [=====] - 219s 30ms/step - loss: 0.1402 -
acc: 0.9505 - val_loss: 0.4258 - val_acc: 0.9094

Epoch 00018: val_acc did not improve from 0.92365
Epoch 19/50
7352/7352 [=====] - 214s 29ms/step - loss: 0.1515 -
acc: 0.9486 - val_loss: 0.3171 - val_acc: 0.9108

Epoch 00019: val_acc did not improve from 0.92365
Epoch 20/50
7352/7352 [=====] - 221s 30ms/step - loss: 0.1388 -
acc: 0.9478 - val_loss: 0.4456 - val_acc: 0.8918

Epoch 00020: val_acc did not improve from 0.92365
Epoch 21/50
7352/7352 [=====] - 215s 29ms/step - loss: 0.1456 -
acc: 0.9483 - val_loss: 0.6249 - val_acc: 0.8894

Epoch 00021: val_acc did not improve from 0.92365
Epoch 22/50
7352/7352 [=====] - 185s 25ms/step - loss: 0.1440 -
acc: 0.9452 - val_loss: 0.2952 - val_acc: 0.9233

Epoch 00022: val_acc did not improve from 0.92365
Epoch 23/50

7352/7352 [=====] - 107s 15ms/step - loss: 0.1692 -
acc: 0.9455 - val_loss: 0.2908 - val_acc: 0.9277

Epoch 00023: val_acc improved from 0.92365 to 0.92772, saving model to weights-
improvement-model11.hdf5

Epoch 24/50

7352/7352 [=====] - 199s 27ms/step - loss: 0.1294 -
acc: 0.9480 - val_loss: 0.5060 - val_acc: 0.9108

Epoch 00024: val_acc did not improve from 0.92772

Epoch 25/50

7352/7352 [=====] - 206s 28ms/step - loss: 0.1726 -
acc: 0.9434 - val_loss: 0.3388 - val_acc: 0.9138

Epoch 00025: val_acc did not improve from 0.92772

Epoch 26/50

7352/7352 [=====] - 222s 30ms/step - loss: 0.1356 -
acc: 0.9516 - val_loss: 0.3752 - val_acc: 0.9175

Epoch 00026: val_acc did not improve from 0.92772

Epoch 27/50

7352/7352 [=====] - 227s 31ms/step - loss: 0.1391 -
acc: 0.9465 - val_loss: 0.4098 - val_acc: 0.9094

Epoch 00027: val_acc did not improve from 0.92772

Epoch 28/50

7352/7352 [=====] - 240s 33ms/step - loss: 0.1396 -
acc: 0.9510 - val_loss: 0.7434 - val_acc: 0.8955

Epoch 00028: val_acc did not improve from 0.92772

Epoch 29/50

7352/7352 [=====] - 234s 32ms/step - loss: 0.1220 -
acc: 0.9457 - val_loss: 0.3609 - val_acc: 0.9186

Epoch 00029: val_acc did not improve from 0.92772

Epoch 30/50

7352/7352 [=====] - 150s 20ms/step - loss: 0.1314 -
acc: 0.9453 - val_loss: 0.2820 - val_acc: 0.9335

Epoch 00030: val_acc improved from 0.92772 to 0.93349, saving model to weights-
improvement-model11.hdf5

Epoch 31/50

7352/7352 [=====] - 79s 11ms/step - loss: 0.1229 - acc:
0.9506 - val_loss: 0.3978 - val_acc: 0.9175

Epoch 00031: val_acc did not improve from 0.93349

Epoch 32/50

7352/7352 [=====] - 77s 10ms/step - loss: 0.1494 - acc:

0.9459 - val_loss: 0.4179 - val_acc: 0.9141

Epoch 00032: val_acc did not improve from 0.93349

Epoch 33/50

7352/7352 [=====] - 77s 10ms/step - loss: 0.1411 - acc:
0.9501 - val_loss: 0.5865 - val_acc: 0.9101

Epoch 00033: val_acc did not improve from 0.93349

Epoch 34/50

7352/7352 [=====] - 76s 10ms/step - loss: 0.1541 - acc:
0.9475 - val_loss: 0.7124 - val_acc: 0.9057

Epoch 00034: val_acc did not improve from 0.93349

Epoch 35/50

7352/7352 [=====] - 77s 10ms/step - loss: 0.1379 - acc:
0.9489 - val_loss: 0.3660 - val_acc: 0.9230

Epoch 00035: val_acc did not improve from 0.93349

Epoch 36/50

7352/7352 [=====] - 76s 10ms/step - loss: 0.1209 - acc:
0.9520 - val_loss: 0.3120 - val_acc: 0.9172

Epoch 00036: val_acc did not improve from 0.93349

Epoch 37/50

7352/7352 [=====] - 76s 10ms/step - loss: 0.1262 - acc:
0.9510 - val_loss: 0.4274 - val_acc: 0.9108

Epoch 00037: val_acc did not improve from 0.93349

Epoch 38/50

7352/7352 [=====] - 77s 10ms/step - loss: 0.1435 - acc:
0.9502 - val_loss: 0.4960 - val_acc: 0.9165

Epoch 00038: val_acc did not improve from 0.93349

Epoch 39/50

7352/7352 [=====] - 77s 10ms/step - loss: 1.3615 - acc:
0.3693 - val_loss: 1.7912 - val_acc: 0.1683

Epoch 00039: val_acc did not improve from 0.93349

Epoch 40/50

7352/7352 [=====] - 77s 10ms/step - loss: 1.7918 - acc:
0.1668 - val_loss: 1.7912 - val_acc: 0.1683

Epoch 00040: val_acc did not improve from 0.93349

Epoch 41/50

7352/7352 [=====] - 77s 10ms/step - loss: 1.7918 - acc:
0.1668 - val_loss: 1.7912 - val_acc: 0.1683

Epoch 00041: val_acc did not improve from 0.93349

Epoch 42/50
7352/7352 [=====] - 77s 10ms/step - loss: 1.7918 - acc: 0.1668 - val_loss: 1.7912 - val_acc: 0.1683

Epoch 00042: val_acc did not improve from 0.93349

Epoch 43/50
7352/7352 [=====] - 77s 10ms/step - loss: 1.7918 - acc: 0.1668 - val_loss: 1.7912 - val_acc: 0.1683

Epoch 00043: val_acc did not improve from 0.93349

Epoch 44/50
7352/7352 [=====] - 77s 10ms/step - loss: 1.7918 - acc: 0.1668 - val_loss: 1.7912 - val_acc: 0.1683

Epoch 00044: val_acc did not improve from 0.93349

Epoch 45/50
7352/7352 [=====] - 76s 10ms/step - loss: 1.7918 - acc: 0.1668 - val_loss: 1.7912 - val_acc: 0.1683

Epoch 00045: val_acc did not improve from 0.93349

Epoch 46/50
7352/7352 [=====] - 76s 10ms/step - loss: 1.7918 - acc: 0.1668 - val_loss: 1.7912 - val_acc: 0.1683

Epoch 00046: val_acc did not improve from 0.93349

Epoch 47/50
7352/7352 [=====] - 77s 10ms/step - loss: 1.7918 - acc: 0.1668 - val_loss: 1.7912 - val_acc: 0.1683

Epoch 00047: val_acc did not improve from 0.93349

Epoch 48/50
7352/7352 [=====] - 76s 10ms/step - loss: 1.7918 - acc: 0.1668 - val_loss: 1.7912 - val_acc: 0.1683

Epoch 00048: val_acc did not improve from 0.93349

Epoch 49/50
7352/7352 [=====] - 76s 10ms/step - loss: 1.7918 - acc: 0.1668 - val_loss: 1.7912 - val_acc: 0.1683

Epoch 00049: val_acc did not improve from 0.93349

Epoch 50/50
7352/7352 [=====] - 76s 10ms/step - loss: 1.7918 - acc: 0.1668 - val_loss: 1.7912 - val_acc: 0.1683

Epoch 00050: val_acc did not improve from 0.93349

2019-10-24 01:42:10.829501

Pred STANDING WALKING

True

LAYING	0	537
SITTING	0	491
STANDING	0	532
WALKING	0	496
WALKING_DOWNSTAIRS	0	420
WALKING_UPSTAIRS	1	470

2947/2947 [=====] - 10s 3ms/step
[1.7911514966496784, 0.168306752629793]

```
[25]: from keras.models import load_model
model1 = load_model('weights-improvement-model1.hdf5')
print(confusion_matrix(Y_test, model1.predict(X_test)))
score = model1.evaluate(X_test, Y_test)
print(score)
```

W1024 09:42:27.783489 2208 nn_ops.py:4224] Large dropout rate: 0.7 (>0.5). In TensorFlow 2.x, dropout() uses dropout rate instead of keep_prob. Please ensure that this is intended.

W1024 09:42:27.958022 2208 nn_ops.py:4224] Large dropout rate: 0.7 (>0.5). In TensorFlow 2.x, dropout() uses dropout rate instead of keep_prob. Please ensure that this is intended.

W1024 09:42:28.253257 2208 deprecation.py:323] From C:\Users\user\Anaconda3\envs\tensorflow_gpu\lib\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

Pred	LAYING	SITTING	STANDING	WALKING	WALKING_DOWNSTAIRS	\
True						
LAYING	537	0	0	0		0
SITTING	7	415	52	0		0
STANDING	0	73	456	1		0
WALKING	0	4	0	472		5
WALKING_DOWNSTAIRS	0	0	0	1		418
WALKING_UPSTAIRS	0	0	0	14		4

Pred	WALKING_UPSTAIRS
True	
LAYING	0
SITTING	17
STANDING	2
WALKING	15
WALKING_DOWNSTAIRS	1
WALKING_UPSTAIRS	453

2947/2947 [=====] - 11s 4ms/step
[0.28196676261670406, 0.9334916864608076]

```

[24]: from keras.callbacks import ModelCheckpoint
      from keras.callbacks import Callback

epochs = 300
batch_size = 32
n_hidden = 128
from keras.layers import   

    ↳BatchNormalization, Conv1D, Flatten, MaxPooling1D, Input, Embedding
from keras.models import Model, Sequential
from keras.optimizers import Adam, Adadelta
from keras.initializers import glorot_normal

#Configuring the parameters

inputIs = Input(shape=(timesteps, input_dim))

model = Conv1D(128, 7, activation='relu')(inputIs)
model = MaxPooling1D(3)(model)
model = Dropout(0.3)(model)

model = Conv1D(64, 7, activation='relu')(model)
model = MaxPooling1D(3)(model)
model = Dropout(0.3)(model)

model = Flatten()(model)
model = Dense(32, activation='relu')(model)
output1 = Dense(6, activation='sigmoid')(model)

model_final = Model(inputs= [inputIs], outputs=[output1])
print(model_final.summary())

# Compiling the model
model_final.compile(loss='mean_squared_error',
                    optimizer=Adam(lr=0.0001),
                    metrics=['accuracy'])

filepath="weights-improvement-model2.hdf5"
checkpoint = ModelCheckpoint(filepath, verbose=1, monitor="val_acc",   

    ↳save_best_only=True, mode='max')
callbacks_list = [checkpoint]

# Training the model
model_final.fit(X_train,
               Y_train,

```

```

        batch_size=batch_size,
        validation_data=(X_test, Y_test),
        epochs=epochs,callbacks=callbacks_list)
#print(confusion_matrix(Y_test, model_final.predict(X_test)))

```

```

-----
Layer (type)                Output Shape                Param #
=====
input_2 (InputLayer)        (None, 128, 9)             0
-----
conv1d_3 (Conv1D)           (None, 122, 128)           8192
-----
max_pooling1d_3 (MaxPooling1 (None, 40, 128)           0
-----
dropout_3 (Dropout)         (None, 40, 128)           0
-----
conv1d_4 (Conv1D)           (None, 34, 64)             57408
-----
max_pooling1d_4 (MaxPooling1 (None, 11, 64)           0
-----
dropout_4 (Dropout)         (None, 11, 64)           0
-----
flatten_2 (Flatten)         (None, 704)                0
-----
dense_3 (Dense)             (None, 32)                 22560
-----
dense_4 (Dense)             (None, 6)                  198
=====
Total params: 88,358
Trainable params: 88,358
Non-trainable params: 0
-----
None

```

```

W1024 09:35:53.982462 2208 deprecation_wrapper.py:119] From
C:\Users\user\Anaconda3\envs\tensorflow_gpu\lib\site-
packages\keras\backend\tensorflow_backend.py:988: The name tf.assign_add is
deprecated. Please use tf.compat.v1.assign_add instead.

```

Train on 7352 samples, validate on 2947 samples

Epoch 1/300

```

7352/7352 [=====] - 4s 571us/step - loss: 0.1242 - acc:
0.4820 - val_loss: 0.0874 - val_acc: 0.6220

```

Epoch 00001: val_acc improved from -inf to 0.62199, saving model to weights-
improvement-model2.hdf5

Epoch 2/300

7352/7352 [=====] - 1s 141us/step - loss: 0.0683 - acc: 0.7146 - val_loss: 0.0665 - val_acc: 0.7492

Epoch 00002: val_acc improved from 0.62199 to 0.74924, saving model to weights-improvement-model2.hdf5

Epoch 3/300

7352/7352 [=====] - 1s 144us/step - loss: 0.0508 - acc: 0.8240 - val_loss: 0.0560 - val_acc: 0.7981

Epoch 00003: val_acc improved from 0.74924 to 0.79810, saving model to weights-improvement-model2.hdf5

Epoch 4/300

7352/7352 [=====] - 1s 144us/step - loss: 0.0360 - acc: 0.8889 - val_loss: 0.0443 - val_acc: 0.8476

Epoch 00004: val_acc improved from 0.79810 to 0.84764, saving model to weights-improvement-model2.hdf5

Epoch 5/300

7352/7352 [=====] - 1s 142us/step - loss: 0.0254 - acc: 0.9237 - val_loss: 0.0374 - val_acc: 0.8666

Epoch 00005: val_acc improved from 0.84764 to 0.86664, saving model to weights-improvement-model2.hdf5

Epoch 6/300

7352/7352 [=====] - 1s 143us/step - loss: 0.0204 - acc: 0.9354 - val_loss: 0.0332 - val_acc: 0.8843

Epoch 00006: val_acc improved from 0.86664 to 0.88429, saving model to weights-improvement-model2.hdf5

Epoch 7/300

7352/7352 [=====] - 1s 143us/step - loss: 0.0175 - acc: 0.9425 - val_loss: 0.0317 - val_acc: 0.8789

Epoch 00007: val_acc did not improve from 0.88429

Epoch 8/300

7352/7352 [=====] - 1s 143us/step - loss: 0.0160 - acc: 0.9461 - val_loss: 0.0295 - val_acc: 0.8884

Epoch 00008: val_acc improved from 0.88429 to 0.88836, saving model to weights-improvement-model2.hdf5

Epoch 9/300

7352/7352 [=====] - 1s 143us/step - loss: 0.0148 - acc: 0.9486 - val_loss: 0.0280 - val_acc: 0.8924

Epoch 00009: val_acc improved from 0.88836 to 0.89243, saving model to weights-improvement-model2.hdf5

Epoch 10/300

7352/7352 [=====] - 1s 147us/step - loss: 0.0142 - acc:

0.9487 - val_loss: 0.0278 - val_acc: 0.8968

Epoch 00010: val_acc improved from 0.89243 to 0.89684, saving model to weights-improvement-model2.hdf5

Epoch 11/300

7352/7352 [=====] - 1s 144us/step - loss: 0.0136 - acc: 0.9493 - val_loss: 0.0271 - val_acc: 0.8928

Epoch 00011: val_acc did not improve from 0.89684

Epoch 12/300

7352/7352 [=====] - 1s 142us/step - loss: 0.0130 - acc: 0.9517 - val_loss: 0.0264 - val_acc: 0.9009

Epoch 00012: val_acc improved from 0.89684 to 0.90092, saving model to weights-improvement-model2.hdf5

Epoch 13/300

7352/7352 [=====] - 1s 148us/step - loss: 0.0128 - acc: 0.9512 - val_loss: 0.0250 - val_acc: 0.9002

Epoch 00013: val_acc did not improve from 0.90092

Epoch 14/300

7352/7352 [=====] - 1s 144us/step - loss: 0.0125 - acc: 0.9521 - val_loss: 0.0247 - val_acc: 0.9091

Epoch 00014: val_acc improved from 0.90092 to 0.90906, saving model to weights-improvement-model2.hdf5

Epoch 15/300

7352/7352 [=====] - 1s 144us/step - loss: 0.0123 - acc: 0.9535 - val_loss: 0.0242 - val_acc: 0.9016

Epoch 00015: val_acc did not improve from 0.90906

Epoch 16/300

7352/7352 [=====] - 1s 142us/step - loss: 0.0120 - acc: 0.9543 - val_loss: 0.0241 - val_acc: 0.9084

Epoch 00016: val_acc did not improve from 0.90906

Epoch 17/300

7352/7352 [=====] - 1s 142us/step - loss: 0.0117 - acc: 0.9553 - val_loss: 0.0232 - val_acc: 0.9067

Epoch 00017: val_acc did not improve from 0.90906

Epoch 18/300

7352/7352 [=====] - 1s 141us/step - loss: 0.0114 - acc: 0.9554 - val_loss: 0.0230 - val_acc: 0.9053

Epoch 00018: val_acc did not improve from 0.90906

Epoch 19/300

7352/7352 [=====] - 1s 139us/step - loss: 0.0113 - acc:

0.9548 - val_loss: 0.0228 - val_acc: 0.9135

Epoch 00019: val_acc improved from 0.90906 to 0.91347, saving model to weights-improvement-model2.hdf5

Epoch 20/300

7352/7352 [=====] - 1s 142us/step - loss: 0.0110 - acc: 0.9569 - val_loss: 0.0220 - val_acc: 0.9141

Epoch 00020: val_acc improved from 0.91347 to 0.91415, saving model to weights-improvement-model2.hdf5

Epoch 21/300

7352/7352 [=====] - 1s 144us/step - loss: 0.0109 - acc: 0.9565 - val_loss: 0.0216 - val_acc: 0.9158

Epoch 00021: val_acc improved from 0.91415 to 0.91585, saving model to weights-improvement-model2.hdf5

Epoch 22/300

7352/7352 [=====] - 1s 141us/step - loss: 0.0109 - acc: 0.9574 - val_loss: 0.0212 - val_acc: 0.9162

Epoch 00022: val_acc improved from 0.91585 to 0.91619, saving model to weights-improvement-model2.hdf5

Epoch 23/300

7352/7352 [=====] - 1s 141us/step - loss: 0.0107 - acc: 0.9587 - val_loss: 0.0208 - val_acc: 0.9175

Epoch 00023: val_acc improved from 0.91619 to 0.91754, saving model to weights-improvement-model2.hdf5

Epoch 24/300

7352/7352 [=====] - 1s 142us/step - loss: 0.0104 - acc: 0.9584 - val_loss: 0.0205 - val_acc: 0.9216

Epoch 00024: val_acc improved from 0.91754 to 0.92162, saving model to weights-improvement-model2.hdf5

Epoch 25/300

7352/7352 [=====] - 1s 141us/step - loss: 0.0103 - acc: 0.9589 - val_loss: 0.0207 - val_acc: 0.9179

Epoch 00025: val_acc did not improve from 0.92162

Epoch 26/300

7352/7352 [=====] - 1s 142us/step - loss: 0.0104 - acc: 0.9573 - val_loss: 0.0211 - val_acc: 0.9199

Epoch 00026: val_acc did not improve from 0.92162

Epoch 27/300

7352/7352 [=====] - 1s 141us/step - loss: 0.0103 - acc: 0.9581 - val_loss: 0.0218 - val_acc: 0.9070

Epoch 00027: val_acc did not improve from 0.92162
Epoch 28/300
7352/7352 [=====] - 1s 141us/step - loss: 0.0103 - acc: 0.9576 - val_loss: 0.0205 - val_acc: 0.9158

Epoch 00028: val_acc did not improve from 0.92162
Epoch 29/300
7352/7352 [=====] - 1s 140us/step - loss: 0.0100 - acc: 0.9596 - val_loss: 0.0214 - val_acc: 0.9243

Epoch 00029: val_acc improved from 0.92162 to 0.92433, saving model to weights-improvement-model2.hdf5
Epoch 30/300
7352/7352 [=====] - 1s 139us/step - loss: 0.0100 - acc: 0.9603 - val_loss: 0.0201 - val_acc: 0.9213

Epoch 00030: val_acc did not improve from 0.92433
Epoch 31/300
7352/7352 [=====] - 1s 139us/step - loss: 0.0098 - acc: 0.9603 - val_loss: 0.0206 - val_acc: 0.9196

Epoch 00031: val_acc did not improve from 0.92433
Epoch 32/300
7352/7352 [=====] - 1s 142us/step - loss: 0.0097 - acc: 0.9630 - val_loss: 0.0206 - val_acc: 0.9223

Epoch 00032: val_acc did not improve from 0.92433
Epoch 33/300
7352/7352 [=====] - 1s 139us/step - loss: 0.0096 - acc: 0.9615 - val_loss: 0.0205 - val_acc: 0.9220

Epoch 00033: val_acc did not improve from 0.92433
Epoch 34/300
7352/7352 [=====] - 1s 138us/step - loss: 0.0094 - acc: 0.9627 - val_loss: 0.0207 - val_acc: 0.9203

Epoch 00034: val_acc did not improve from 0.92433
Epoch 35/300
7352/7352 [=====] - 1s 140us/step - loss: 0.0092 - acc: 0.9614 - val_loss: 0.0197 - val_acc: 0.9203

Epoch 00035: val_acc did not improve from 0.92433
Epoch 36/300
7352/7352 [=====] - 1s 140us/step - loss: 0.0092 - acc: 0.9640 - val_loss: 0.0194 - val_acc: 0.9318

Epoch 00036: val_acc improved from 0.92433 to 0.93180, saving model to weights-improvement-model2.hdf5

Epoch 37/300
7352/7352 [=====] - 1s 140us/step - loss: 0.0092 - acc: 0.9635 - val_loss: 0.0192 - val_acc: 0.9298

Epoch 00037: val_acc did not improve from 0.93180
Epoch 38/300
7352/7352 [=====] - 1s 139us/step - loss: 0.0089 - acc: 0.9648 - val_loss: 0.0200 - val_acc: 0.9243

Epoch 00038: val_acc did not improve from 0.93180
Epoch 39/300
7352/7352 [=====] - 1s 139us/step - loss: 0.0089 - acc: 0.9635 - val_loss: 0.0187 - val_acc: 0.9281

Epoch 00039: val_acc did not improve from 0.93180
Epoch 40/300
7352/7352 [=====] - 1s 138us/step - loss: 0.0089 - acc: 0.9646 - val_loss: 0.0191 - val_acc: 0.9253

Epoch 00040: val_acc did not improve from 0.93180
Epoch 41/300
7352/7352 [=====] - 1s 138us/step - loss: 0.0086 - acc: 0.9641 - val_loss: 0.0186 - val_acc: 0.9287

Epoch 00041: val_acc did not improve from 0.93180
Epoch 42/300
7352/7352 [=====] - 1s 142us/step - loss: 0.0082 - acc: 0.9671 - val_loss: 0.0199 - val_acc: 0.9162

Epoch 00042: val_acc did not improve from 0.93180
Epoch 43/300
7352/7352 [=====] - 1s 141us/step - loss: 0.0083 - acc: 0.9675 - val_loss: 0.0185 - val_acc: 0.9352

Epoch 00043: val_acc improved from 0.93180 to 0.93519, saving model to weights-improvement-model2.hdf5
Epoch 44/300
7352/7352 [=====] - 1s 139us/step - loss: 0.0081 - acc: 0.9676 - val_loss: 0.0174 - val_acc: 0.9372

Epoch 00044: val_acc improved from 0.93519 to 0.93722, saving model to weights-improvement-model2.hdf5
Epoch 45/300
7352/7352 [=====] - 1s 139us/step - loss: 0.0079 - acc: 0.9674 - val_loss: 0.0163 - val_acc: 0.9352

Epoch 00045: val_acc did not improve from 0.93722
Epoch 46/300

7352/7352 [=====] - 1s 139us/step - loss: 0.0076 - acc:
0.9694 - val_loss: 0.0178 - val_acc: 0.9250

Epoch 00046: val_acc did not improve from 0.93722

Epoch 47/300

7352/7352 [=====] - 1s 138us/step - loss: 0.0076 - acc:
0.9703 - val_loss: 0.0159 - val_acc: 0.9376

Epoch 00047: val_acc improved from 0.93722 to 0.93756, saving model to weights-
improvement-model2.hdf5

Epoch 48/300

7352/7352 [=====] - 1s 139us/step - loss: 0.0074 - acc:
0.9723 - val_loss: 0.0179 - val_acc: 0.9311

Epoch 00048: val_acc did not improve from 0.93756

Epoch 49/300

7352/7352 [=====] - 1s 138us/step - loss: 0.0072 - acc:
0.9723 - val_loss: 0.0169 - val_acc: 0.9338

Epoch 00049: val_acc did not improve from 0.93756

Epoch 50/300

7352/7352 [=====] - 1s 142us/step - loss: 0.0070 - acc:
0.9748 - val_loss: 0.0162 - val_acc: 0.9369

Epoch 00050: val_acc did not improve from 0.93756

Epoch 51/300

7352/7352 [=====] - 1s 140us/step - loss: 0.0068 - acc:
0.9742 - val_loss: 0.0157 - val_acc: 0.9396

Epoch 00051: val_acc improved from 0.93756 to 0.93960, saving model to weights-
improvement-model2.hdf5

Epoch 52/300

7352/7352 [=====] - 1s 141us/step - loss: 0.0067 - acc:
0.9757 - val_loss: 0.0163 - val_acc: 0.9379

Epoch 00052: val_acc did not improve from 0.93960

Epoch 53/300

7352/7352 [=====] - 1s 138us/step - loss: 0.0065 - acc:
0.9747 - val_loss: 0.0162 - val_acc: 0.9416

Epoch 00053: val_acc improved from 0.93960 to 0.94164, saving model to weights-
improvement-model2.hdf5

Epoch 54/300

7352/7352 [=====] - 1s 142us/step - loss: 0.0065 - acc:
0.9763 - val_loss: 0.0153 - val_acc: 0.9433

Epoch 00054: val_acc improved from 0.94164 to 0.94333, saving model to weights-
improvement-model2.hdf5

Epoch 55/300
7352/7352 [=====] - 1s 139us/step - loss: 0.0062 - acc: 0.9771 - val_loss: 0.0156 - val_acc: 0.9433

Epoch 00055: val_acc did not improve from 0.94333
Epoch 56/300
7352/7352 [=====] - 1s 140us/step - loss: 0.0063 - acc: 0.9770 - val_loss: 0.0148 - val_acc: 0.9454

Epoch 00056: val_acc improved from 0.94333 to 0.94537, saving model to weights-improvement-model2.hdf5
Epoch 57/300
7352/7352 [=====] - 1s 142us/step - loss: 0.0060 - acc: 0.9770 - val_loss: 0.0153 - val_acc: 0.9403

Epoch 00057: val_acc did not improve from 0.94537
Epoch 58/300
7352/7352 [=====] - 1s 141us/step - loss: 0.0059 - acc: 0.9782 - val_loss: 0.0164 - val_acc: 0.9386

Epoch 00058: val_acc did not improve from 0.94537
Epoch 59/300
7352/7352 [=====] - 1s 139us/step - loss: 0.0057 - acc: 0.9780 - val_loss: 0.0157 - val_acc: 0.9406

Epoch 00059: val_acc did not improve from 0.94537
Epoch 60/300
7352/7352 [=====] - 1s 143us/step - loss: 0.0060 - acc: 0.9771 - val_loss: 0.0162 - val_acc: 0.9410

Epoch 00060: val_acc did not improve from 0.94537
Epoch 61/300
7352/7352 [=====] - 1s 141us/step - loss: 0.0054 - acc: 0.9784 - val_loss: 0.0153 - val_acc: 0.9423

Epoch 00061: val_acc did not improve from 0.94537
Epoch 62/300
7352/7352 [=====] - 1s 144us/step - loss: 0.0054 - acc: 0.9793 - val_loss: 0.0160 - val_acc: 0.9393

Epoch 00062: val_acc did not improve from 0.94537
Epoch 63/300
7352/7352 [=====] - 1s 142us/step - loss: 0.0054 - acc: 0.9789 - val_loss: 0.0171 - val_acc: 0.9369

Epoch 00063: val_acc did not improve from 0.94537
Epoch 64/300
7352/7352 [=====] - 1s 142us/step - loss: 0.0053 - acc:

0.9791 - val_loss: 0.0157 - val_acc: 0.9430

Epoch 00064: val_acc did not improve from 0.94537

Epoch 65/300

7352/7352 [=====] - 1s 143us/step - loss: 0.0052 - acc: 0.9812 - val_loss: 0.0174 - val_acc: 0.9348

Epoch 00065: val_acc did not improve from 0.94537

Epoch 66/300

7352/7352 [=====] - 1s 141us/step - loss: 0.0052 - acc: 0.9799 - val_loss: 0.0157 - val_acc: 0.9427

Epoch 00066: val_acc did not improve from 0.94537

Epoch 67/300

7352/7352 [=====] - 1s 141us/step - loss: 0.0049 - acc: 0.9826 - val_loss: 0.0148 - val_acc: 0.9474

Epoch 00067: val_acc improved from 0.94537 to 0.94740, saving model to weights-improvement-model2.hdf5

Epoch 68/300

7352/7352 [=====] - 1s 143us/step - loss: 0.0051 - acc: 0.9803 - val_loss: 0.0142 - val_acc: 0.9508

Epoch 00068: val_acc improved from 0.94740 to 0.95080, saving model to weights-improvement-model2.hdf5

Epoch 69/300

7352/7352 [=====] - 1s 144us/step - loss: 0.0048 - acc: 0.9810 - val_loss: 0.0149 - val_acc: 0.9501

Epoch 00069: val_acc did not improve from 0.95080

Epoch 70/300

7352/7352 [=====] - 1s 142us/step - loss: 0.0047 - acc: 0.9822 - val_loss: 0.0152 - val_acc: 0.9433

Epoch 00070: val_acc did not improve from 0.95080

Epoch 71/300

7352/7352 [=====] - 1s 146us/step - loss: 0.0045 - acc: 0.9819 - val_loss: 0.0151 - val_acc: 0.9464

Epoch 00071: val_acc did not improve from 0.95080

Epoch 72/300

7352/7352 [=====] - 1s 143us/step - loss: 0.0046 - acc: 0.9822 - val_loss: 0.0158 - val_acc: 0.9423

Epoch 00072: val_acc did not improve from 0.95080

Epoch 73/300

7352/7352 [=====] - 1s 143us/step - loss: 0.0045 - acc: 0.9827 - val_loss: 0.0147 - val_acc: 0.9494

Epoch 00073: val_acc did not improve from 0.95080
Epoch 74/300
7352/7352 [=====] - 1s 142us/step - loss: 0.0044 - acc: 0.9835 - val_loss: 0.0177 - val_acc: 0.9294

Epoch 00074: val_acc did not improve from 0.95080
Epoch 75/300
7352/7352 [=====] - 1s 144us/step - loss: 0.0043 - acc: 0.9842 - val_loss: 0.0148 - val_acc: 0.9464

Epoch 00075: val_acc did not improve from 0.95080
Epoch 76/300
7352/7352 [=====] - 1s 143us/step - loss: 0.0043 - acc: 0.9835 - val_loss: 0.0157 - val_acc: 0.9413

Epoch 00076: val_acc did not improve from 0.95080
Epoch 77/300
7352/7352 [=====] - 1s 142us/step - loss: 0.0043 - acc: 0.9859 - val_loss: 0.0165 - val_acc: 0.9423

Epoch 00077: val_acc did not improve from 0.95080
Epoch 78/300
7352/7352 [=====] - 1s 141us/step - loss: 0.0040 - acc: 0.9861 - val_loss: 0.0159 - val_acc: 0.9430

Epoch 00078: val_acc did not improve from 0.95080
Epoch 79/300
7352/7352 [=====] - 1s 142us/step - loss: 0.0041 - acc: 0.9841 - val_loss: 0.0161 - val_acc: 0.9420

Epoch 00079: val_acc did not improve from 0.95080
Epoch 80/300
7352/7352 [=====] - 1s 141us/step - loss: 0.0039 - acc: 0.9848 - val_loss: 0.0160 - val_acc: 0.9406

Epoch 00080: val_acc did not improve from 0.95080
Epoch 81/300
7352/7352 [=====] - 1s 141us/step - loss: 0.0042 - acc: 0.9833 - val_loss: 0.0162 - val_acc: 0.9362

Epoch 00081: val_acc did not improve from 0.95080
Epoch 82/300
7352/7352 [=====] - 1s 142us/step - loss: 0.0040 - acc: 0.9850 - val_loss: 0.0160 - val_acc: 0.9393

Epoch 00082: val_acc did not improve from 0.95080
Epoch 83/300

7352/7352 [=====] - 1s 146us/step - loss: 0.0038 - acc:
0.9848 - val_loss: 0.0153 - val_acc: 0.9433

Epoch 00083: val_acc did not improve from 0.95080

Epoch 84/300

7352/7352 [=====] - 1s 148us/step - loss: 0.0038 - acc:
0.9860 - val_loss: 0.0153 - val_acc: 0.9457

Epoch 00084: val_acc did not improve from 0.95080

Epoch 85/300

7352/7352 [=====] - 1s 141us/step - loss: 0.0037 - acc:
0.9849 - val_loss: 0.0160 - val_acc: 0.9403

Epoch 00085: val_acc did not improve from 0.95080

Epoch 86/300

7352/7352 [=====] - 1s 141us/step - loss: 0.0036 - acc:
0.9868 - val_loss: 0.0165 - val_acc: 0.9362

Epoch 00086: val_acc did not improve from 0.95080

Epoch 87/300

7352/7352 [=====] - 1s 141us/step - loss: 0.0034 - acc:
0.9879 - val_loss: 0.0154 - val_acc: 0.9454

Epoch 00087: val_acc did not improve from 0.95080

Epoch 88/300

7352/7352 [=====] - 1s 141us/step - loss: 0.0034 - acc:
0.9872 - val_loss: 0.0163 - val_acc: 0.9386

Epoch 00088: val_acc did not improve from 0.95080

Epoch 89/300

7352/7352 [=====] - 1s 141us/step - loss: 0.0035 - acc:
0.9861 - val_loss: 0.0190 - val_acc: 0.9318

Epoch 00089: val_acc did not improve from 0.95080

Epoch 90/300

7352/7352 [=====] - 1s 141us/step - loss: 0.0035 - acc:
0.9867 - val_loss: 0.0158 - val_acc: 0.9444

Epoch 00090: val_acc did not improve from 0.95080

Epoch 91/300

7352/7352 [=====] - 1s 140us/step - loss: 0.0035 - acc:
0.9868 - val_loss: 0.0154 - val_acc: 0.9464

Epoch 00091: val_acc did not improve from 0.95080

Epoch 92/300

7352/7352 [=====] - 1s 141us/step - loss: 0.0034 - acc:
0.9874 - val_loss: 0.0166 - val_acc: 0.9437

Epoch 00092: val_acc did not improve from 0.95080
Epoch 93/300
7352/7352 [=====] - 1s 144us/step - loss: 0.0034 - acc:
0.9864 - val_loss: 0.0155 - val_acc: 0.9464

Epoch 00093: val_acc did not improve from 0.95080
Epoch 94/300
7352/7352 [=====] - 1s 139us/step - loss: 0.0033 - acc:
0.9875 - val_loss: 0.0159 - val_acc: 0.9460

Epoch 00094: val_acc did not improve from 0.95080
Epoch 95/300
7352/7352 [=====] - 1s 139us/step - loss: 0.0033 - acc:
0.9869 - val_loss: 0.0182 - val_acc: 0.9352

Epoch 00095: val_acc did not improve from 0.95080
Epoch 96/300
7352/7352 [=====] - 1s 139us/step - loss: 0.0032 - acc:
0.9875 - val_loss: 0.0164 - val_acc: 0.9450

Epoch 00096: val_acc did not improve from 0.95080
Epoch 97/300
7352/7352 [=====] - 1s 138us/step - loss: 0.0029 - acc:
0.9888 - val_loss: 0.0156 - val_acc: 0.9494

Epoch 00097: val_acc did not improve from 0.95080
Epoch 98/300
7352/7352 [=====] - 1s 139us/step - loss: 0.0029 - acc:
0.9894 - val_loss: 0.0166 - val_acc: 0.9399

Epoch 00098: val_acc did not improve from 0.95080
Epoch 99/300
7352/7352 [=====] - 1s 138us/step - loss: 0.0030 - acc:
0.9887 - val_loss: 0.0150 - val_acc: 0.9508

Epoch 00099: val_acc did not improve from 0.95080
Epoch 100/300
7352/7352 [=====] - 1s 138us/step - loss: 0.0029 - acc:
0.9894 - val_loss: 0.0156 - val_acc: 0.9437

Epoch 00100: val_acc did not improve from 0.95080
Epoch 101/300
7352/7352 [=====] - 1s 138us/step - loss: 0.0029 - acc:
0.9898 - val_loss: 0.0159 - val_acc: 0.9444

Epoch 00101: val_acc did not improve from 0.95080
Epoch 102/300
7352/7352 [=====] - 1s 138us/step - loss: 0.0032 - acc:

0.9871 - val_loss: 0.0154 - val_acc: 0.9467

Epoch 00102: val_acc did not improve from 0.95080

Epoch 103/300

7352/7352 [=====] - 1s 138us/step - loss: 0.0028 - acc:
0.9899 - val_loss: 0.0182 - val_acc: 0.9372

Epoch 00103: val_acc did not improve from 0.95080

Epoch 104/300

7352/7352 [=====] - 1s 139us/step - loss: 0.0028 - acc:
0.9899 - val_loss: 0.0170 - val_acc: 0.9376

Epoch 00104: val_acc did not improve from 0.95080

Epoch 105/300

7352/7352 [=====] - 1s 141us/step - loss: 0.0027 - acc:
0.9905 - val_loss: 0.0160 - val_acc: 0.9433

Epoch 00105: val_acc did not improve from 0.95080

Epoch 106/300

7352/7352 [=====] - 1s 142us/step - loss: 0.0029 - acc:
0.9883 - val_loss: 0.0182 - val_acc: 0.9311

Epoch 00106: val_acc did not improve from 0.95080

Epoch 107/300

7352/7352 [=====] - 1s 141us/step - loss: 0.0027 - acc:
0.9894 - val_loss: 0.0193 - val_acc: 0.9332

Epoch 00107: val_acc did not improve from 0.95080

Epoch 108/300

7352/7352 [=====] - 1s 142us/step - loss: 0.0028 - acc:
0.9894 - val_loss: 0.0158 - val_acc: 0.9437

Epoch 00108: val_acc did not improve from 0.95080

Epoch 109/300

7352/7352 [=====] - 1s 142us/step - loss: 0.0028 - acc:
0.9883 - val_loss: 0.0161 - val_acc: 0.9413

Epoch 00109: val_acc did not improve from 0.95080

Epoch 110/300

7352/7352 [=====] - 1s 141us/step - loss: 0.0026 - acc:
0.9898 - val_loss: 0.0160 - val_acc: 0.9440

Epoch 00110: val_acc did not improve from 0.95080

Epoch 111/300

7352/7352 [=====] - 1s 143us/step - loss: 0.0024 - acc:
0.9894 - val_loss: 0.0153 - val_acc: 0.9440

Epoch 00111: val_acc did not improve from 0.95080

Epoch 112/300
7352/7352 [=====] - 1s 142us/step - loss: 0.0026 - acc: 0.9908 - val_loss: 0.0167 - val_acc: 0.9410

Epoch 00112: val_acc did not improve from 0.95080

Epoch 113/300
7352/7352 [=====] - 1s 141us/step - loss: 0.0025 - acc: 0.9922 - val_loss: 0.0175 - val_acc: 0.9348

Epoch 00113: val_acc did not improve from 0.95080

Epoch 114/300
7352/7352 [=====] - 1s 141us/step - loss: 0.0026 - acc: 0.9908 - val_loss: 0.0152 - val_acc: 0.9474

Epoch 00114: val_acc did not improve from 0.95080

Epoch 115/300
7352/7352 [=====] - 1s 141us/step - loss: 0.0024 - acc: 0.9917 - val_loss: 0.0171 - val_acc: 0.9379

Epoch 00115: val_acc did not improve from 0.95080

Epoch 116/300
7352/7352 [=====] - 1s 141us/step - loss: 0.0025 - acc: 0.9897 - val_loss: 0.0161 - val_acc: 0.9464

Epoch 00116: val_acc did not improve from 0.95080

Epoch 117/300
7352/7352 [=====] - 1s 141us/step - loss: 0.0025 - acc: 0.9903 - val_loss: 0.0162 - val_acc: 0.9471

Epoch 00117: val_acc did not improve from 0.95080

Epoch 118/300
7352/7352 [=====] - 1s 144us/step - loss: 0.0025 - acc: 0.9893 - val_loss: 0.0177 - val_acc: 0.9362

Epoch 00118: val_acc did not improve from 0.95080

Epoch 119/300
7352/7352 [=====] - 1s 145us/step - loss: 0.0022 - acc: 0.9918 - val_loss: 0.0171 - val_acc: 0.9393

Epoch 00119: val_acc did not improve from 0.95080

Epoch 120/300
7352/7352 [=====] - 1s 142us/step - loss: 0.0026 - acc: 0.9897 - val_loss: 0.0151 - val_acc: 0.9498

Epoch 00120: val_acc did not improve from 0.95080

Epoch 121/300
7352/7352 [=====] - 1s 141us/step - loss: 0.0023 - acc: 0.9910 - val_loss: 0.0148 - val_acc: 0.9518

Epoch 00121: val_acc improved from 0.95080 to 0.95182, saving model to weights-improvement-model2.hdf5
Epoch 122/300
7352/7352 [=====] - 1s 141us/step - loss: 0.0023 - acc: 0.9906 - val_loss: 0.0164 - val_acc: 0.9467

Epoch 00122: val_acc did not improve from 0.95182
Epoch 123/300
7352/7352 [=====] - 1s 140us/step - loss: 0.0023 - acc: 0.9916 - val_loss: 0.0155 - val_acc: 0.9484

Epoch 00123: val_acc did not improve from 0.95182
Epoch 124/300
7352/7352 [=====] - 1s 140us/step - loss: 0.0022 - acc: 0.9917 - val_loss: 0.0163 - val_acc: 0.9423

Epoch 00124: val_acc did not improve from 0.95182
Epoch 125/300
7352/7352 [=====] - 1s 141us/step - loss: 0.0021 - acc: 0.9920 - val_loss: 0.0165 - val_acc: 0.9464

Epoch 00125: val_acc did not improve from 0.95182
Epoch 126/300
7352/7352 [=====] - 1s 141us/step - loss: 0.0021 - acc: 0.9924 - val_loss: 0.0159 - val_acc: 0.9444

Epoch 00126: val_acc did not improve from 0.95182
Epoch 127/300
7352/7352 [=====] - 1s 141us/step - loss: 0.0022 - acc: 0.9918 - val_loss: 0.0166 - val_acc: 0.9423

Epoch 00127: val_acc did not improve from 0.95182
Epoch 128/300
7352/7352 [=====] - 1s 144us/step - loss: 0.0018 - acc: 0.9937 - val_loss: 0.0172 - val_acc: 0.9396

Epoch 00128: val_acc did not improve from 0.95182
Epoch 129/300
7352/7352 [=====] - 1s 144us/step - loss: 0.0020 - acc: 0.9922 - val_loss: 0.0168 - val_acc: 0.9403

Epoch 00129: val_acc did not improve from 0.95182
Epoch 130/300
7352/7352 [=====] - 1s 144us/step - loss: 0.0022 - acc: 0.9924 - val_loss: 0.0156 - val_acc: 0.9488

Epoch 00130: val_acc did not improve from 0.95182

Epoch 131/300
7352/7352 [=====] - 1s 144us/step - loss: 0.0019 - acc: 0.9922 - val_loss: 0.0162 - val_acc: 0.9440

Epoch 00131: val_acc did not improve from 0.95182

Epoch 132/300
7352/7352 [=====] - 1s 145us/step - loss: 0.0020 - acc: 0.9922 - val_loss: 0.0161 - val_acc: 0.9457

Epoch 00132: val_acc did not improve from 0.95182

Epoch 133/300
7352/7352 [=====] - 1s 144us/step - loss: 0.0020 - acc: 0.9925 - val_loss: 0.0161 - val_acc: 0.9474

Epoch 00133: val_acc did not improve from 0.95182

Epoch 134/300
7352/7352 [=====] - 1s 142us/step - loss: 0.0019 - acc: 0.9940 - val_loss: 0.0145 - val_acc: 0.9518

Epoch 00134: val_acc did not improve from 0.95182

Epoch 135/300
7352/7352 [=====] - 1s 142us/step - loss: 0.0020 - acc: 0.9917 - val_loss: 0.0158 - val_acc: 0.9460

Epoch 00135: val_acc did not improve from 0.95182

Epoch 136/300
7352/7352 [=====] - 1s 144us/step - loss: 0.0017 - acc: 0.9940 - val_loss: 0.0140 - val_acc: 0.9552

Epoch 00136: val_acc improved from 0.95182 to 0.95521, saving model to weights-improvement-model2.hdf5

Epoch 137/300
7352/7352 [=====] - 1s 147us/step - loss: 0.0020 - acc: 0.9918 - val_loss: 0.0164 - val_acc: 0.9467

Epoch 00137: val_acc did not improve from 0.95521

Epoch 138/300
7352/7352 [=====] - 1s 149us/step - loss: 0.0019 - acc: 0.9928 - val_loss: 0.0160 - val_acc: 0.9457

Epoch 00138: val_acc did not improve from 0.95521

Epoch 139/300
7352/7352 [=====] - 1s 150us/step - loss: 0.0017 - acc: 0.9943 - val_loss: 0.0162 - val_acc: 0.9447

Epoch 00139: val_acc did not improve from 0.95521

Epoch 140/300
7352/7352 [=====] - 1s 142us/step - loss: 0.0017 - acc:

0.9931 - val_loss: 0.0158 - val_acc: 0.9450

Epoch 00140: val_acc did not improve from 0.95521

Epoch 141/300

7352/7352 [=====] - 1s 141us/step - loss: 0.0019 - acc:
0.9927 - val_loss: 0.0164 - val_acc: 0.9420

Epoch 00141: val_acc did not improve from 0.95521

Epoch 142/300

7352/7352 [=====] - 1s 141us/step - loss: 0.0016 - acc:
0.9933 - val_loss: 0.0163 - val_acc: 0.9420

Epoch 00142: val_acc did not improve from 0.95521

Epoch 143/300

7352/7352 [=====] - 1s 141us/step - loss: 0.0018 - acc:
0.9937 - val_loss: 0.0158 - val_acc: 0.9430

Epoch 00143: val_acc did not improve from 0.95521

Epoch 144/300

7352/7352 [=====] - 1s 141us/step - loss: 0.0015 - acc:
0.9948 - val_loss: 0.0177 - val_acc: 0.9403

Epoch 00144: val_acc did not improve from 0.95521

Epoch 145/300

7352/7352 [=====] - 1s 141us/step - loss: 0.0016 - acc:
0.9939 - val_loss: 0.0152 - val_acc: 0.9525

Epoch 00145: val_acc did not improve from 0.95521

Epoch 146/300

7352/7352 [=====] - 1s 143us/step - loss: 0.0020 - acc:
0.9918 - val_loss: 0.0167 - val_acc: 0.9433

Epoch 00146: val_acc did not improve from 0.95521

Epoch 147/300

7352/7352 [=====] - 1s 141us/step - loss: 0.0016 - acc:
0.9940 - val_loss: 0.0171 - val_acc: 0.9430

Epoch 00147: val_acc did not improve from 0.95521

Epoch 148/300

7352/7352 [=====] - 1s 142us/step - loss: 0.0015 - acc:
0.9940 - val_loss: 0.0157 - val_acc: 0.9498

Epoch 00148: val_acc did not improve from 0.95521

Epoch 149/300

7352/7352 [=====] - 1s 142us/step - loss: 0.0015 - acc:
0.9944 - val_loss: 0.0153 - val_acc: 0.9481

Epoch 00149: val_acc did not improve from 0.95521

Epoch 150/300
7352/7352 [=====] - 1s 142us/step - loss: 0.0013 - acc:
0.9955 - val_loss: 0.0155 - val_acc: 0.9474

Epoch 00150: val_acc did not improve from 0.95521

Epoch 151/300
7352/7352 [=====] - 1s 141us/step - loss: 0.0016 - acc:
0.9932 - val_loss: 0.0162 - val_acc: 0.9471

Epoch 00151: val_acc did not improve from 0.95521

Epoch 152/300
7352/7352 [=====] - 1s 145us/step - loss: 0.0014 - acc:
0.9954 - val_loss: 0.0151 - val_acc: 0.9508

Epoch 00152: val_acc did not improve from 0.95521

Epoch 153/300
7352/7352 [=====] - 1s 153us/step - loss: 0.0015 - acc:
0.9952 - val_loss: 0.0162 - val_acc: 0.9447

Epoch 00153: val_acc did not improve from 0.95521

Epoch 154/300
7352/7352 [=====] - 1s 154us/step - loss: 0.0012 - acc:
0.9958 - val_loss: 0.0162 - val_acc: 0.9454

Epoch 00154: val_acc did not improve from 0.95521

Epoch 155/300
7352/7352 [=====] - 1s 146us/step - loss: 0.0015 - acc:
0.9950 - val_loss: 0.0154 - val_acc: 0.9508

Epoch 00155: val_acc did not improve from 0.95521

Epoch 156/300
7352/7352 [=====] - 1s 156us/step - loss: 0.0015 - acc:
0.9942 - val_loss: 0.0157 - val_acc: 0.9464

Epoch 00156: val_acc did not improve from 0.95521

Epoch 157/300
7352/7352 [=====] - 1s 147us/step - loss: 0.0015 - acc:
0.9944 - val_loss: 0.0154 - val_acc: 0.9494

Epoch 00157: val_acc did not improve from 0.95521

Epoch 158/300
7352/7352 [=====] - 1s 149us/step - loss: 0.0016 - acc:
0.9933 - val_loss: 0.0157 - val_acc: 0.9464

Epoch 00158: val_acc did not improve from 0.95521

Epoch 159/300
7352/7352 [=====] - 1s 146us/step - loss: 0.0015 - acc:
0.9936 - val_loss: 0.0185 - val_acc: 0.9332

Epoch 00159: val_acc did not improve from 0.95521
Epoch 160/300
7352/7352 [=====] - 1s 149us/step - loss: 0.0013 - acc:
0.9942 - val_loss: 0.0149 - val_acc: 0.9511

Epoch 00160: val_acc did not improve from 0.95521
Epoch 161/300
7352/7352 [=====] - 1s 140us/step - loss: 0.0012 - acc:
0.9951 - val_loss: 0.0152 - val_acc: 0.9491

Epoch 00161: val_acc did not improve from 0.95521
Epoch 162/300
7352/7352 [=====] - 1s 165us/step - loss: 0.0015 - acc:
0.9940 - val_loss: 0.0156 - val_acc: 0.9471

Epoch 00162: val_acc did not improve from 0.95521
Epoch 163/300
7352/7352 [=====] - 1s 164us/step - loss: 0.0011 - acc:
0.9963 - val_loss: 0.0144 - val_acc: 0.9552

Epoch 00163: val_acc did not improve from 0.95521
Epoch 164/300
7352/7352 [=====] - 1s 160us/step - loss: 0.0012 - acc:
0.9961 - val_loss: 0.0157 - val_acc: 0.9467

Epoch 00164: val_acc did not improve from 0.95521
Epoch 165/300
7352/7352 [=====] - 1s 137us/step - loss: 0.0012 - acc:
0.9962 - val_loss: 0.0153 - val_acc: 0.9474

Epoch 00165: val_acc did not improve from 0.95521
Epoch 166/300
7352/7352 [=====] - 1s 141us/step - loss: 0.0012 - acc:
0.9955 - val_loss: 0.0153 - val_acc: 0.9471

Epoch 00166: val_acc did not improve from 0.95521
Epoch 167/300
7352/7352 [=====] - 1s 137us/step - loss: 0.0013 - acc:
0.9954 - val_loss: 0.0164 - val_acc: 0.9464

Epoch 00167: val_acc did not improve from 0.95521
Epoch 168/300
7352/7352 [=====] - 1s 137us/step - loss: 0.0010 - acc:
0.9963 - val_loss: 0.0151 - val_acc: 0.9518

Epoch 00168: val_acc did not improve from 0.95521
Epoch 169/300

7352/7352 [=====] - 1s 137us/step - loss: 0.0011 - acc: 0.9970 - val_loss: 0.0166 - val_acc: 0.9474

Epoch 00169: val_acc did not improve from 0.95521

Epoch 170/300

7352/7352 [=====] - 1s 135us/step - loss: 0.0012 - acc: 0.9963 - val_loss: 0.0172 - val_acc: 0.9440

Epoch 00170: val_acc did not improve from 0.95521

Epoch 171/300

7352/7352 [=====] - 1s 144us/step - loss: 0.0010 - acc: 0.9969 - val_loss: 0.0151 - val_acc: 0.9498

Epoch 00171: val_acc did not improve from 0.95521

Epoch 172/300

7352/7352 [=====] - 1s 141us/step - loss: 0.0011 - acc: 0.9959 - val_loss: 0.0158 - val_acc: 0.9488

Epoch 00172: val_acc did not improve from 0.95521

Epoch 173/300

7352/7352 [=====] - 1s 141us/step - loss: 9.7894e-04 - acc: 0.9961 - val_loss: 0.0145 - val_acc: 0.9542

Epoch 00173: val_acc did not improve from 0.95521

Epoch 174/300

7352/7352 [=====] - 1s 137us/step - loss: 9.3390e-04 - acc: 0.9970 - val_loss: 0.0147 - val_acc: 0.9525

Epoch 00174: val_acc did not improve from 0.95521

Epoch 175/300

7352/7352 [=====] - 1s 138us/step - loss: 9.7337e-04 - acc: 0.9971 - val_loss: 0.0146 - val_acc: 0.9535

Epoch 00175: val_acc did not improve from 0.95521

Epoch 176/300

7352/7352 [=====] - 1s 137us/step - loss: 0.0011 - acc: 0.9954 - val_loss: 0.0152 - val_acc: 0.9484

Epoch 00176: val_acc did not improve from 0.95521

Epoch 177/300

7352/7352 [=====] - 1s 138us/step - loss: 0.0011 - acc: 0.9956 - val_loss: 0.0133 - val_acc: 0.9569

Epoch 00177: val_acc improved from 0.95521 to 0.95691, saving model to weights-improvement-model2.hdf5

Epoch 178/300

7352/7352 [=====] - 1s 150us/step - loss: 0.0015 - acc: 0.9946 - val_loss: 0.0152 - val_acc: 0.9498

Epoch 00178: val_acc did not improve from 0.95691
Epoch 179/300
7352/7352 [=====] - 1s 137us/step - loss: 8.8711e-04 -
acc: 0.9971 - val_loss: 0.0149 - val_acc: 0.9511

Epoch 00179: val_acc did not improve from 0.95691
Epoch 180/300
7352/7352 [=====] - 1s 142us/step - loss: 0.0011 - acc:
0.9965 - val_loss: 0.0150 - val_acc: 0.9467

Epoch 00180: val_acc did not improve from 0.95691
Epoch 181/300
7352/7352 [=====] - 1s 144us/step - loss: 8.3220e-04 -
acc: 0.9976 - val_loss: 0.0151 - val_acc: 0.9501

Epoch 00181: val_acc did not improve from 0.95691
Epoch 182/300
7352/7352 [=====] - 1s 137us/step - loss: 8.5491e-04 -
acc: 0.9971 - val_loss: 0.0148 - val_acc: 0.9515

Epoch 00182: val_acc did not improve from 0.95691
Epoch 183/300
7352/7352 [=====] - 1s 141us/step - loss: 0.0010 - acc:
0.9961 - val_loss: 0.0148 - val_acc: 0.9511

Epoch 00183: val_acc did not improve from 0.95691
Epoch 184/300
7352/7352 [=====] - 1s 142us/step - loss: 7.6203e-04 -
acc: 0.9976 - val_loss: 0.0148 - val_acc: 0.9518

Epoch 00184: val_acc did not improve from 0.95691
Epoch 185/300
7352/7352 [=====] - 1s 140us/step - loss: 0.0011 - acc:
0.9959 - val_loss: 0.0153 - val_acc: 0.9464

Epoch 00185: val_acc did not improve from 0.95691
Epoch 186/300
7352/7352 [=====] - 1s 140us/step - loss: 0.0011 - acc:
0.9961 - val_loss: 0.0158 - val_acc: 0.9508

Epoch 00186: val_acc did not improve from 0.95691
Epoch 187/300
7352/7352 [=====] - 1s 142us/step - loss: 8.5008e-04 -
acc: 0.9970 - val_loss: 0.0148 - val_acc: 0.9494

Epoch 00187: val_acc did not improve from 0.95691
Epoch 188/300

7352/7352 [=====] - 1s 146us/step - loss: 8.0902e-04 -
acc: 0.9971 - val_loss: 0.0148 - val_acc: 0.9481

Epoch 00188: val_acc did not improve from 0.95691

Epoch 189/300

7352/7352 [=====] - 1s 142us/step - loss: 0.0011 - acc:
0.9955 - val_loss: 0.0150 - val_acc: 0.9511

Epoch 00189: val_acc did not improve from 0.95691

Epoch 190/300

7352/7352 [=====] - 1s 143us/step - loss: 7.3452e-04 -
acc: 0.9981 - val_loss: 0.0158 - val_acc: 0.9477

Epoch 00190: val_acc did not improve from 0.95691

Epoch 191/300

7352/7352 [=====] - 1s 144us/step - loss: 7.4921e-04 -
acc: 0.9974 - val_loss: 0.0155 - val_acc: 0.9511

Epoch 00191: val_acc did not improve from 0.95691

Epoch 192/300

7352/7352 [=====] - 1s 145us/step - loss: 6.6976e-04 -
acc: 0.9982 - val_loss: 0.0153 - val_acc: 0.9491

Epoch 00192: val_acc did not improve from 0.95691

Epoch 193/300

7352/7352 [=====] - 1s 141us/step - loss: 5.8834e-04 -
acc: 0.9977 - val_loss: 0.0153 - val_acc: 0.9481

Epoch 00193: val_acc did not improve from 0.95691

Epoch 194/300

7352/7352 [=====] - 1s 143us/step - loss: 8.4791e-04 -
acc: 0.9967 - val_loss: 0.0151 - val_acc: 0.9491

Epoch 00194: val_acc did not improve from 0.95691

Epoch 195/300

7352/7352 [=====] - 1s 145us/step - loss: 9.5562e-04 -
acc: 0.9962 - val_loss: 0.0146 - val_acc: 0.9511

Epoch 00195: val_acc did not improve from 0.95691

Epoch 196/300

7352/7352 [=====] - 1s 136us/step - loss: 8.5319e-04 -
acc: 0.9969 - val_loss: 0.0152 - val_acc: 0.9501

Epoch 00196: val_acc did not improve from 0.95691

Epoch 197/300

7352/7352 [=====] - 1s 146us/step - loss: 9.8515e-04 -
acc: 0.9962 - val_loss: 0.0157 - val_acc: 0.9471

Epoch 00197: val_acc did not improve from 0.95691
Epoch 198/300
7352/7352 [=====] - 1s 149us/step - loss: 6.9938e-04 -
acc: 0.9974 - val_loss: 0.0140 - val_acc: 0.9552

Epoch 00198: val_acc did not improve from 0.95691
Epoch 199/300
7352/7352 [=====] - 1s 144us/step - loss: 6.4745e-04 -
acc: 0.9980 - val_loss: 0.0145 - val_acc: 0.9508

Epoch 00199: val_acc did not improve from 0.95691
Epoch 200/300
7352/7352 [=====] - 1s 140us/step - loss: 9.9739e-04 -
acc: 0.9969 - val_loss: 0.0154 - val_acc: 0.9484

Epoch 00200: val_acc did not improve from 0.95691
Epoch 201/300
7352/7352 [=====] - 1s 139us/step - loss: 7.0606e-04 -
acc: 0.9978 - val_loss: 0.0150 - val_acc: 0.9511

Epoch 00201: val_acc did not improve from 0.95691
Epoch 202/300
7352/7352 [=====] - 1s 143us/step - loss: 8.3372e-04 -
acc: 0.9969 - val_loss: 0.0153 - val_acc: 0.9484

Epoch 00202: val_acc did not improve from 0.95691
Epoch 203/300
7352/7352 [=====] - 1s 144us/step - loss: 7.8217e-04 -
acc: 0.9976 - val_loss: 0.0162 - val_acc: 0.9467

Epoch 00203: val_acc did not improve from 0.95691
Epoch 204/300
7352/7352 [=====] - 1s 142us/step - loss: 5.8811e-04 -
acc: 0.9981 - val_loss: 0.0156 - val_acc: 0.9477

Epoch 00204: val_acc did not improve from 0.95691
Epoch 205/300
7352/7352 [=====] - 1s 139us/step - loss: 6.4197e-04 -
acc: 0.9984 - val_loss: 0.0166 - val_acc: 0.9433

Epoch 00205: val_acc did not improve from 0.95691
Epoch 206/300
7352/7352 [=====] - 1s 144us/step - loss: 6.7785e-04 -
acc: 0.9980 - val_loss: 0.0167 - val_acc: 0.9430

Epoch 00206: val_acc did not improve from 0.95691
Epoch 207/300
7352/7352 [=====] - 1s 142us/step - loss: 6.2987e-04 -

acc: 0.9981 - val_loss: 0.0153 - val_acc: 0.9488

Epoch 00207: val_acc did not improve from 0.95691
Epoch 208/300
7352/7352 [=====] - 1s 141us/step - loss: 7.8840e-04 -
acc: 0.9971 - val_loss: 0.0157 - val_acc: 0.9488

Epoch 00208: val_acc did not improve from 0.95691
Epoch 209/300
7352/7352 [=====] - 1s 141us/step - loss: 5.5917e-04 -
acc: 0.9982 - val_loss: 0.0152 - val_acc: 0.9484

Epoch 00209: val_acc did not improve from 0.95691
Epoch 210/300
7352/7352 [=====] - 1s 139us/step - loss: 8.0988e-04 -
acc: 0.9974 - val_loss: 0.0147 - val_acc: 0.9508

Epoch 00210: val_acc did not improve from 0.95691
Epoch 211/300
7352/7352 [=====] - 1s 142us/step - loss: 6.4212e-04 -
acc: 0.9974 - val_loss: 0.0151 - val_acc: 0.9505

Epoch 00211: val_acc did not improve from 0.95691
Epoch 212/300
7352/7352 [=====] - 1s 142us/step - loss: 5.8723e-04 -
acc: 0.9978 - val_loss: 0.0150 - val_acc: 0.9484

Epoch 00212: val_acc did not improve from 0.95691
Epoch 213/300
7352/7352 [=====] - 1s 141us/step - loss: 7.8247e-04 -
acc: 0.9971 - val_loss: 0.0166 - val_acc: 0.9447

Epoch 00213: val_acc did not improve from 0.95691
Epoch 214/300
7352/7352 [=====] - 1s 143us/step - loss: 5.1736e-04 -
acc: 0.9982 - val_loss: 0.0156 - val_acc: 0.9488

Epoch 00214: val_acc did not improve from 0.95691
Epoch 215/300
7352/7352 [=====] - 1s 143us/step - loss: 6.1195e-04 -
acc: 0.9978 - val_loss: 0.0158 - val_acc: 0.9467

Epoch 00215: val_acc did not improve from 0.95691
Epoch 216/300
7352/7352 [=====] - 1s 139us/step - loss: 4.4531e-04 -
acc: 0.9988 - val_loss: 0.0156 - val_acc: 0.9494

Epoch 00216: val_acc did not improve from 0.95691

Epoch 217/300
7352/7352 [=====] - 1s 144us/step - loss: 9.8012e-04 -
acc: 0.9963 - val_loss: 0.0153 - val_acc: 0.9488

Epoch 00217: val_acc did not improve from 0.95691

Epoch 218/300
7352/7352 [=====] - 1s 142us/step - loss: 6.3245e-04 -
acc: 0.9982 - val_loss: 0.0158 - val_acc: 0.9454

Epoch 00218: val_acc did not improve from 0.95691

Epoch 219/300
7352/7352 [=====] - 1s 140us/step - loss: 7.9037e-04 -
acc: 0.9973 - val_loss: 0.0155 - val_acc: 0.9471

Epoch 00219: val_acc did not improve from 0.95691

Epoch 220/300
7352/7352 [=====] - 1s 140us/step - loss: 7.1192e-04 -
acc: 0.9973 - val_loss: 0.0150 - val_acc: 0.9505

Epoch 00220: val_acc did not improve from 0.95691

Epoch 221/300
7352/7352 [=====] - 1s 144us/step - loss: 5.1633e-04 -
acc: 0.9982 - val_loss: 0.0155 - val_acc: 0.9491

Epoch 00221: val_acc did not improve from 0.95691

Epoch 222/300
7352/7352 [=====] - 1s 141us/step - loss: 4.2613e-04 -
acc: 0.9990 - val_loss: 0.0165 - val_acc: 0.9467

Epoch 00222: val_acc did not improve from 0.95691

Epoch 223/300
7352/7352 [=====] - 1s 141us/step - loss: 6.5953e-04 -
acc: 0.9980 - val_loss: 0.0164 - val_acc: 0.9450

Epoch 00223: val_acc did not improve from 0.95691

Epoch 224/300
7352/7352 [=====] - 1s 141us/step - loss: 4.0126e-04 -
acc: 0.9988 - val_loss: 0.0168 - val_acc: 0.9413

Epoch 00224: val_acc did not improve from 0.95691

Epoch 225/300
7352/7352 [=====] - 1s 142us/step - loss: 7.1916e-04 -
acc: 0.9976 - val_loss: 0.0156 - val_acc: 0.9491

Epoch 00225: val_acc did not improve from 0.95691

Epoch 226/300
7352/7352 [=====] - 1s 143us/step - loss: 7.0303e-04 -
acc: 0.9977 - val_loss: 0.0158 - val_acc: 0.9457

Epoch 00226: val_acc did not improve from 0.95691
Epoch 227/300
7352/7352 [=====] - 1s 144us/step - loss: 5.8921e-04 -
acc: 0.9976 - val_loss: 0.0155 - val_acc: 0.9464

Epoch 00227: val_acc did not improve from 0.95691
Epoch 228/300
7352/7352 [=====] - 1s 142us/step - loss: 5.1887e-04 -
acc: 0.9982 - val_loss: 0.0177 - val_acc: 0.9399

Epoch 00228: val_acc did not improve from 0.95691
Epoch 229/300
7352/7352 [=====] - 1s 142us/step - loss: 5.5064e-04 -
acc: 0.9982 - val_loss: 0.0161 - val_acc: 0.9423

Epoch 00229: val_acc did not improve from 0.95691
Epoch 230/300
7352/7352 [=====] - 1s 145us/step - loss: 4.9864e-04 -
acc: 0.9982 - val_loss: 0.0152 - val_acc: 0.9484

Epoch 00230: val_acc did not improve from 0.95691
Epoch 231/300
7352/7352 [=====] - 1s 145us/step - loss: 3.9278e-04 -
acc: 0.9989 - val_loss: 0.0183 - val_acc: 0.9382

Epoch 00231: val_acc did not improve from 0.95691
Epoch 232/300
7352/7352 [=====] - 1s 144us/step - loss: 6.7876e-04 -
acc: 0.9982 - val_loss: 0.0160 - val_acc: 0.9467

Epoch 00232: val_acc did not improve from 0.95691
Epoch 233/300
7352/7352 [=====] - 1s 141us/step - loss: 4.1520e-04 -
acc: 0.9989 - val_loss: 0.0152 - val_acc: 0.9477

Epoch 00233: val_acc did not improve from 0.95691
Epoch 234/300
7352/7352 [=====] - 1s 141us/step - loss: 3.9254e-04 -
acc: 0.9989 - val_loss: 0.0160 - val_acc: 0.9450

Epoch 00234: val_acc did not improve from 0.95691
Epoch 235/300
7352/7352 [=====] - 1s 140us/step - loss: 5.7121e-04 -
acc: 0.9982 - val_loss: 0.0166 - val_acc: 0.9396

Epoch 00235: val_acc did not improve from 0.95691
Epoch 236/300

7352/7352 [=====] - 1s 139us/step - loss: 3.9723e-04 -
acc: 0.9989 - val_loss: 0.0156 - val_acc: 0.9474

Epoch 00236: val_acc did not improve from 0.95691

Epoch 237/300

7352/7352 [=====] - 1s 140us/step - loss: 4.7494e-04 -
acc: 0.9984 - val_loss: 0.0200 - val_acc: 0.9345

Epoch 00237: val_acc did not improve from 0.95691

Epoch 238/300

7352/7352 [=====] - 1s 147us/step - loss: 5.2468e-04 -
acc: 0.9980 - val_loss: 0.0174 - val_acc: 0.9393

Epoch 00238: val_acc did not improve from 0.95691

Epoch 239/300

7352/7352 [=====] - 1s 144us/step - loss: 5.5961e-04 -
acc: 0.9982 - val_loss: 0.0154 - val_acc: 0.9484

Epoch 00239: val_acc did not improve from 0.95691

Epoch 240/300

7352/7352 [=====] - 1s 144us/step - loss: 6.3839e-04 -
acc: 0.9974 - val_loss: 0.0154 - val_acc: 0.9450

Epoch 00240: val_acc did not improve from 0.95691

Epoch 241/300

7352/7352 [=====] - 1s 142us/step - loss: 7.7773e-04 -
acc: 0.9971 - val_loss: 0.0143 - val_acc: 0.9532

Epoch 00241: val_acc did not improve from 0.95691

Epoch 242/300

7352/7352 [=====] - 1s 142us/step - loss: 4.3959e-04 -
acc: 0.9988 - val_loss: 0.0157 - val_acc: 0.9433

Epoch 00242: val_acc did not improve from 0.95691

Epoch 243/300

7352/7352 [=====] - 1s 144us/step - loss: 3.4061e-04 -
acc: 0.9992 - val_loss: 0.0160 - val_acc: 0.9464

Epoch 00243: val_acc did not improve from 0.95691

Epoch 244/300

7352/7352 [=====] - 1s 144us/step - loss: 3.7918e-04 -
acc: 0.9988 - val_loss: 0.0147 - val_acc: 0.9491

Epoch 00244: val_acc did not improve from 0.95691

Epoch 245/300

7352/7352 [=====] - 1s 143us/step - loss: 3.7813e-04 -
acc: 0.9990 - val_loss: 0.0151 - val_acc: 0.9508

Epoch 00245: val_acc did not improve from 0.95691
Epoch 246/300
7352/7352 [=====] - 1s 142us/step - loss: 3.9888e-04 -
acc: 0.9988 - val_loss: 0.0159 - val_acc: 0.9484

Epoch 00246: val_acc did not improve from 0.95691
Epoch 247/300
7352/7352 [=====] - 1s 142us/step - loss: 6.4220e-04 -
acc: 0.9977 - val_loss: 0.0159 - val_acc: 0.9457

Epoch 00247: val_acc did not improve from 0.95691
Epoch 248/300
7352/7352 [=====] - 1s 144us/step - loss: 4.3799e-04 -
acc: 0.9988 - val_loss: 0.0164 - val_acc: 0.9433

Epoch 00248: val_acc did not improve from 0.95691
Epoch 249/300
7352/7352 [=====] - 1s 143us/step - loss: 2.8903e-04 -
acc: 0.9995 - val_loss: 0.0155 - val_acc: 0.9454

Epoch 00249: val_acc did not improve from 0.95691
Epoch 250/300
7352/7352 [=====] - 1s 144us/step - loss: 4.7730e-04 -
acc: 0.9985 - val_loss: 0.0189 - val_acc: 0.9338

Epoch 00250: val_acc did not improve from 0.95691
Epoch 251/300
7352/7352 [=====] - 1s 141us/step - loss: 4.7993e-04 -
acc: 0.9982 - val_loss: 0.0164 - val_acc: 0.9457

Epoch 00251: val_acc did not improve from 0.95691
Epoch 252/300
7352/7352 [=====] - 1s 144us/step - loss: 3.3606e-04 -
acc: 0.9990 - val_loss: 0.0161 - val_acc: 0.9488

Epoch 00252: val_acc did not improve from 0.95691
Epoch 253/300
7352/7352 [=====] - 1s 144us/step - loss: 4.4670e-04 -
acc: 0.9989 - val_loss: 0.0154 - val_acc: 0.9477

Epoch 00253: val_acc did not improve from 0.95691
Epoch 254/300
7352/7352 [=====] - 1s 142us/step - loss: 4.6522e-04 -
acc: 0.9985 - val_loss: 0.0186 - val_acc: 0.9382

Epoch 00254: val_acc did not improve from 0.95691
Epoch 255/300
7352/7352 [=====] - 1s 143us/step - loss: 5.1232e-04 -

acc: 0.9977 - val_loss: 0.0161 - val_acc: 0.9488

Epoch 00255: val_acc did not improve from 0.95691
Epoch 256/300
7352/7352 [=====] - 1s 147us/step - loss: 8.0518e-04 -
acc: 0.9970 - val_loss: 0.0171 - val_acc: 0.9423

Epoch 00256: val_acc did not improve from 0.95691
Epoch 257/300
7352/7352 [=====] - 1s 152us/step - loss: 2.6289e-04 -
acc: 0.9996 - val_loss: 0.0159 - val_acc: 0.9467

Epoch 00257: val_acc did not improve from 0.95691
Epoch 258/300
7352/7352 [=====] - 1s 148us/step - loss: 3.1455e-04 -
acc: 0.9995 - val_loss: 0.0163 - val_acc: 0.9430

Epoch 00258: val_acc did not improve from 0.95691
Epoch 259/300
7352/7352 [=====] - 1s 148us/step - loss: 3.7906e-04 -
acc: 0.9989 - val_loss: 0.0169 - val_acc: 0.9413

Epoch 00259: val_acc did not improve from 0.95691
Epoch 260/300
7352/7352 [=====] - 1s 148us/step - loss: 3.8924e-04 -
acc: 0.9986 - val_loss: 0.0159 - val_acc: 0.9450

Epoch 00260: val_acc did not improve from 0.95691
Epoch 261/300
7352/7352 [=====] - 1s 142us/step - loss: 3.4276e-04 -
acc: 0.9992 - val_loss: 0.0168 - val_acc: 0.9467

Epoch 00261: val_acc did not improve from 0.95691
Epoch 262/300
7352/7352 [=====] - 1s 146us/step - loss: 6.1740e-04 -
acc: 0.9974 - val_loss: 0.0163 - val_acc: 0.9420

Epoch 00262: val_acc did not improve from 0.95691
Epoch 263/300
7352/7352 [=====] - 1s 136us/step - loss: 6.1783e-04 -
acc: 0.9977 - val_loss: 0.0156 - val_acc: 0.9494

Epoch 00263: val_acc did not improve from 0.95691
Epoch 264/300
7352/7352 [=====] - 1s 144us/step - loss: 5.9046e-04 -
acc: 0.9977 - val_loss: 0.0149 - val_acc: 0.9505

Epoch 00264: val_acc did not improve from 0.95691

Epoch 265/300
7352/7352 [=====] - 1s 141us/step - loss: 3.2093e-04 -
acc: 0.9989 - val_loss: 0.0161 - val_acc: 0.9447

Epoch 00265: val_acc did not improve from 0.95691
Epoch 266/300
7352/7352 [=====] - 1s 143us/step - loss: 3.2443e-04 -
acc: 0.9990 - val_loss: 0.0158 - val_acc: 0.9474

Epoch 00266: val_acc did not improve from 0.95691
Epoch 267/300
7352/7352 [=====] - 1s 144us/step - loss: 2.1759e-04 -
acc: 0.9995 - val_loss: 0.0177 - val_acc: 0.9396

Epoch 00267: val_acc did not improve from 0.95691
Epoch 268/300
7352/7352 [=====] - 1s 151us/step - loss: 2.8062e-04 -
acc: 0.9989 - val_loss: 0.0163 - val_acc: 0.9460

Epoch 00268: val_acc did not improve from 0.95691
Epoch 269/300
7352/7352 [=====] - 1s 144us/step - loss: 3.9067e-04 -
acc: 0.9986 - val_loss: 0.0160 - val_acc: 0.9460

Epoch 00269: val_acc did not improve from 0.95691
Epoch 270/300
7352/7352 [=====] - 1s 141us/step - loss: 2.1390e-04 -
acc: 0.9995 - val_loss: 0.0153 - val_acc: 0.9494

Epoch 00270: val_acc did not improve from 0.95691
Epoch 271/300
7352/7352 [=====] - 1s 143us/step - loss: 1.1411e-04 -
acc: 0.9999 - val_loss: 0.0161 - val_acc: 0.9454

Epoch 00271: val_acc did not improve from 0.95691
Epoch 272/300
7352/7352 [=====] - 1s 143us/step - loss: 9.7889e-04 -
acc: 0.9958 - val_loss: 0.0169 - val_acc: 0.9423

Epoch 00272: val_acc did not improve from 0.95691
Epoch 273/300
7352/7352 [=====] - 1s 143us/step - loss: 2.4410e-04 -
acc: 0.9995 - val_loss: 0.0161 - val_acc: 0.9447

Epoch 00273: val_acc did not improve from 0.95691
Epoch 274/300
7352/7352 [=====] - 1s 143us/step - loss: 4.0511e-04 -
acc: 0.9984 - val_loss: 0.0163 - val_acc: 0.9427

Epoch 00274: val_acc did not improve from 0.95691
Epoch 275/300
7352/7352 [=====] - 1s 142us/step - loss: 3.1733e-04 -
acc: 0.9989 - val_loss: 0.0178 - val_acc: 0.9403

Epoch 00275: val_acc did not improve from 0.95691
Epoch 276/300
7352/7352 [=====] - 1s 143us/step - loss: 6.2485e-04 -
acc: 0.9977 - val_loss: 0.0161 - val_acc: 0.9457

Epoch 00276: val_acc did not improve from 0.95691
Epoch 277/300
7352/7352 [=====] - 1s 153us/step - loss: 3.7476e-04 -
acc: 0.9990 - val_loss: 0.0182 - val_acc: 0.9362

Epoch 00277: val_acc did not improve from 0.95691
Epoch 278/300
7352/7352 [=====] - 1s 144us/step - loss: 2.4141e-04 -
acc: 0.9995 - val_loss: 0.0164 - val_acc: 0.9437

Epoch 00278: val_acc did not improve from 0.95691
Epoch 279/300
7352/7352 [=====] - 1s 143us/step - loss: 1.6657e-04 -
acc: 0.9999 - val_loss: 0.0165 - val_acc: 0.9447

Epoch 00279: val_acc did not improve from 0.95691
Epoch 280/300
7352/7352 [=====] - 1s 136us/step - loss: 2.8296e-04 -
acc: 0.9989 - val_loss: 0.0172 - val_acc: 0.9403

Epoch 00280: val_acc did not improve from 0.95691
Epoch 281/300
7352/7352 [=====] - 1s 135us/step - loss: 2.4202e-04 -
acc: 0.9995 - val_loss: 0.0166 - val_acc: 0.9450

Epoch 00281: val_acc did not improve from 0.95691
Epoch 282/300
7352/7352 [=====] - 1s 135us/step - loss: 3.3530e-04 -
acc: 0.9989 - val_loss: 0.0175 - val_acc: 0.9413

Epoch 00282: val_acc did not improve from 0.95691
Epoch 283/300
7352/7352 [=====] - 1s 138us/step - loss: 3.4441e-04 -
acc: 0.9989 - val_loss: 0.0169 - val_acc: 0.9433

Epoch 00283: val_acc did not improve from 0.95691
Epoch 284/300

7352/7352 [=====] - 1s 140us/step - loss: 4.0357e-04 -
acc: 0.9984 - val_loss: 0.0164 - val_acc: 0.9444

Epoch 00284: val_acc did not improve from 0.95691

Epoch 285/300

7352/7352 [=====] - 1s 136us/step - loss: 3.6321e-04 -
acc: 0.9989 - val_loss: 0.0159 - val_acc: 0.9467

Epoch 00285: val_acc did not improve from 0.95691

Epoch 286/300

7352/7352 [=====] - 1s 137us/step - loss: 1.3146e-04 -
acc: 1.0000 - val_loss: 0.0159 - val_acc: 0.9477

Epoch 00286: val_acc did not improve from 0.95691

Epoch 287/300

7352/7352 [=====] - 1s 138us/step - loss: 3.7253e-04 -
acc: 0.9986 - val_loss: 0.0169 - val_acc: 0.9430

Epoch 00287: val_acc did not improve from 0.95691

Epoch 288/300

7352/7352 [=====] - 1s 139us/step - loss: 2.4916e-04 -
acc: 0.9990 - val_loss: 0.0160 - val_acc: 0.9450

Epoch 00288: val_acc did not improve from 0.95691

Epoch 289/300

7352/7352 [=====] - 1s 144us/step - loss: 3.9769e-04 -
acc: 0.9985 - val_loss: 0.0149 - val_acc: 0.9481

Epoch 00289: val_acc did not improve from 0.95691

Epoch 290/300

7352/7352 [=====] - 1s 144us/step - loss: 5.3751e-04 -
acc: 0.9980 - val_loss: 0.0174 - val_acc: 0.9420

Epoch 00290: val_acc did not improve from 0.95691

Epoch 291/300

7352/7352 [=====] - 1s 142us/step - loss: 1.6893e-04 -
acc: 0.9996 - val_loss: 0.0162 - val_acc: 0.9467

Epoch 00291: val_acc did not improve from 0.95691

Epoch 292/300

7352/7352 [=====] - 1s 139us/step - loss: 3.2104e-04 -
acc: 0.9986 - val_loss: 0.0165 - val_acc: 0.9454

Epoch 00292: val_acc did not improve from 0.95691

Epoch 293/300

7352/7352 [=====] - 1s 146us/step - loss: 1.3612e-04 -
acc: 1.0000 - val_loss: 0.0152 - val_acc: 0.9491

Epoch 00293: val_acc did not improve from 0.95691
Epoch 294/300
7352/7352 [=====] - 1s 141us/step - loss: 2.7974e-04 -
acc: 0.9992 - val_loss: 0.0169 - val_acc: 0.9433

Epoch 00294: val_acc did not improve from 0.95691
Epoch 295/300
7352/7352 [=====] - 1s 153us/step - loss: 2.1023e-04 -
acc: 0.9992 - val_loss: 0.0164 - val_acc: 0.9464

Epoch 00295: val_acc did not improve from 0.95691
Epoch 296/300
7352/7352 [=====] - 1s 143us/step - loss: 1.9429e-04 -
acc: 0.9997 - val_loss: 0.0175 - val_acc: 0.9403

Epoch 00296: val_acc did not improve from 0.95691
Epoch 297/300
7352/7352 [=====] - 1s 141us/step - loss: 5.9529e-04 -
acc: 0.9977 - val_loss: 0.0152 - val_acc: 0.9484

Epoch 00297: val_acc did not improve from 0.95691
Epoch 298/300
7352/7352 [=====] - 1s 146us/step - loss: 1.7620e-04 -
acc: 0.9997 - val_loss: 0.0167 - val_acc: 0.9440

Epoch 00298: val_acc did not improve from 0.95691
Epoch 299/300
7352/7352 [=====] - 1s 151us/step - loss: 2.8918e-04 -
acc: 0.9992 - val_loss: 0.0167 - val_acc: 0.9471

Epoch 00299: val_acc did not improve from 0.95691
Epoch 300/300
7352/7352 [=====] - 1s 149us/step - loss: 2.2707e-04 -
acc: 0.9995 - val_loss: 0.0168 - val_acc: 0.9447

Epoch 00300: val_acc did not improve from 0.95691

[24]: <keras.callbacks.History at 0x25a06e08be0>

```
[26]: from keras.models import load_model
model2 = load_model('weights-improvement-model2.hdf5')
print(confusion_matrix(Y_test, model2.predict(X_test)))
score = model2.evaluate(X_test, Y_test)
print(score)
```

Pred	LAYING	SITTING	STANDING	WALKING	WALKING_DOWNSTAIRS	\
True						
LAYING	537	0	0	0		0

SITTING	0	409	71	0	0
STANDING	0	39	492	1	0
WALKING	0	0	0	494	1
WALKING_DOWNSTAIRS	0	0	0	0	419
WALKING_UPSTAIRS	0	0	0	0	2

```
Pred          WALKING_UPSTAIRS
True
LAYING          0
SITTING         11
STANDING         0
WALKING          1
WALKING_DOWNSTAIRS 1
WALKING_UPSTAIRS 469
2947/2947 [=====] - 0s 93us/step
[0.013335462281730605, 0.9569053274516457]
```

```
[28]: from prettytable import PrettyTable
x = PrettyTable()
x.field_names = ["Model", "Description", "dropout", "test accuracy"]
x.add_row(["Model 1", "2 LSTM layers with 100 hidden unit", "0.7", 0.9334])
x.add_row(["Model 2", "2 convolution layer with max pooling", "0.3", 0.9569])

x.border=True
print(x)
```

Model	Description	dropout	test accuracy
Model 1	2 LSTM layers with 100 hidden unit	0.7	0.9334
Model 2	2 convolution layer with max pooling	0.3	0.9569

```
[ ]:
```