Distracted Driving Detection

Load the Data

In [1]:
```
#dictionary for distraction category to numerical value
catLabels = {
    'c0': 'safe driving',
    'c1': 'texting - right',
    'c2': 'talking on the phone - right',
    'c3': 'texting - left',
    'c4': 'talking on the phone - left',
    'c5': 'operating the radio',
    'c6': 'drinking',
    'c7': 'reaching behind',
    'c8': 'hair and makeup',
    'c9': 'talking to passenger'
}

def getClass(value):
    index = 'c' + str(value)
    return catLabels[index]
```

In [2]:
```
from sklearn.datasets import load_files
from keras.utils import np_utils
import numpy as np
from glob import glob
import os
from sklearn.model_selection import train_test_split

import tensorflow as tf
hello = tf.constant('Hello, TensorFlow!')
sess = tf.Session()
print(sess.run(hello))

# import tensorflow as tf
# from keras import backend as K

# num_cores = 4
# GPU = 1
# CPU = 0

# if GPU:
#     num_GPU = 1
#     num_CPU = 1
# if CPU:
#     num_CPU = 1
#     num_GPU = 0

# config = tf.ConfigProto(intra_op_parallelism_threads=num_cores,\
```

```
#         inter_op_parallelism_threads=num_cores, allow_soft_placement=True,\
#         device_count = {'CPU' : num_CPU, 'GPU' : num_GPU})
# session = tf.Session(config=config)
# K.set_session(session)

def loadImages(path):
        data = load_files(path)
        files = data['filenames']
        targets = data['target']
        target_names = data['target_names']
        return files, targets, target_names

path = "images/train"
files,targets,target_names = loadImages(path)
predict_files = np.array(glob("images/test/*"))[1:10]
print('Number of Categories: ', len(target_names))
print('Categories: ', target_names)
print('Number of images by category: ')
for c in target_names:
    print(c + ':' + str(len( os.listdir(path+'/'+c))))
    # train_data = np.vstack((files, targets)).T
    # print(train_data.shape)

#Split the original training sets into training & validation sets
train_files, test_files, train_targets, test_targets = train_test_split(files,
 targets, test_size=0.20, random_state=40)

print(train_files.shape, test_files.shape, train_targets.shape, test_targets.s
hape)
print(len(test_files))
```

```
Using TensorFlow backend.
```

```
b'Hello, TensorFlow!'
Number of Categories:  10
Categories:  ['c0', 'c1', 'c2', 'c3', 'c4', 'c5', 'c6', 'c7', 'c8', 'c9']
Number of images by category:
c0:1900
c1:1900
c2:1900
c3:1900
c4:1900
c5:1900
c6:1900
c7:1900
c8:1900
c9:1900
(15200,) (3800,) (15200,) (3800,)
3800
```

Data Analysis

In [3]:
```
import cv2
import matplotlib.pyplot as plt
%matplotlib inline

def displayImage(sample_image):
    gray = cv2.cvtColor(sample_image, cv2.COLOR_BGR2GRAY)

    # convert BGR image to RGB for plotting
    cv_rgb = cv2.cvtColor(sample_image, cv2.COLOR_BGR2RGB)
    plt.imshow(cv_rgb)
    plt.show()

for i in range(1,5):
    sample_image = cv2.imread(train_files[i])
    print(train_targets[i])
    print(getClass(train_targets[i]))
    displayImage(sample_image)
```

```
8
hair and makeup
```


```
9
talking to passenger
```


```
0
safe driving
```


```
0
safe driving
```

In [4]:
```
#(nb_samples,rows,columns,channels)
#nb_samples - total number of images
# Resize image to 224x224
# Convert image to an array -> resized to a 4D tensor used by Keras CNN
# Tensor will be (1,224,224,3)

#Adopted from the Deep Learning Project
from keras.preprocessing import image
from tqdm import tqdm

def path_to_tensor(img_path):
    # loads RGB image as PIL.Image.Image type
    img = image.load_img(img_path, target_size=(224, 224))
    # convert PIL.Image.Image type to 3D tensor with shape (224, 224, 3)
    x = image.img_to_array(img)
    # convert 3D tensor to 4D tensor with shape (1, 224, 224, 3) and return 4D
 tensor
    return np.expand_dims(x, axis=0)

def paths_to_tensor(img_paths):
    print (img_paths)
    list_of_tensors = [path_to_tensor(img_path) for img_path in tqdm(img_paths
)]
    return np.vstack(list_of_tensors)
```

Pre-Process the Data

In [5]:
```
#Rescale the images

from PIL import ImageFile
ImageFile.LOAD_TRUNCATED_IMAGES = True

train_tensors = paths_to_tensor(train_files).astype('float32')/255
test_tensors = paths_to_tensor(test_files).astype('float32')/255
#predict_tensors = paths_to_tensor(predict_files).astype('float32')/255
```

```
['images/train\\c3\\img_24663.jpg' 'images/train\\c8\\img_98810.jpg'
 'images/train\\c9\\img_67390.jpg' ..., 'images/train\\c7\\img_31727.jpg'
 'images/train\\c7\\img_82756.jpg' 'images/train\\c5\\img_21995.jpg']

100%|████████████████████████████████████████████████████████████████
███| 15200/15200 [01:25<00:00, 177.75it/s]

['images/train\\c5\\img_68264.jpg' 'images/train\\c6\\img_69335.jpg'
 'images/train\\c2\\img_12280.jpg' ..., 'images/train\\c8\\img_6916.jpg'
 'images/train\\c6\\img_21610.jpg' 'images/train\\c5\\img_46343.jpg']

100%|████████████████████████████████████████████████████████████████
████| 3800/3800 [00:23<00:00, 160.48it/s]
```

Baseline Model Architecture

In [19]:
```
from keras.layers import Conv2D, MaxPooling2D, GlobalAveragePooling2D
from keras.layers import Dropout, Flatten, Dense
from keras.models import Sequential
from keras.utils import plot_model

model = Sequential()

model.add(Conv2D(filters=10, kernel_size=(4,4), input_shape=(224,224,3)))
model.add(Dropout(.2))
model.add(MaxPooling2D(pool_size=(4, 4), strides=None, padding='valid', data_f
ormat=None))
model.add(Conv2D(filters=10, kernel_size=(4,4), input_shape=(224,224,3)))
model.add(MaxPooling2D(pool_size=(4, 4), strides=None, padding='valid', data_f
ormat=None))
model.add(Dropout(.2))
model.add(GlobalAveragePooling2D())
model.add(Dense(units=10, activation='softmax'))
model.add(Dropout(.2))
model.add(Dense(units=10, activation='softmax'))
model.summary()


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

# from IPython.display import SVG
# from keras.utils.vis_utils import model_to_dot
# plot_model(model, to_file='model.png')
# SVG(model_to_dot(model).create(prog='dot', format='svg'))
```

```
_________________________________________________________________
Layer (type)                 Output Shape              Param #   
=================================================================
conv2d_17 (Conv2D)           (None, 221, 221, 10)      490       
_________________________________________________________________
dropout_13 (Dropout)         (None, 221, 221, 10)      0         
_________________________________________________________________
max_pooling2d_16 (MaxPooling (None, 55, 55, 10)        0         
_________________________________________________________________
conv2d_18 (Conv2D)           (None, 52, 52, 10)        1610      
_________________________________________________________________
max_pooling2d_17 (MaxPooling (None, 13, 13, 10)        0         
_________________________________________________________________
dropout_14 (Dropout)         (None, 13, 13, 10)        0         
_________________________________________________________________
global_average_pooling2d_5 ( (None, 10)                0         
_________________________________________________________________
dense_11 (Dense)             (None, 10)                110       
_________________________________________________________________
dropout_15 (Dropout)         (None, 10)                0         
_________________________________________________________________
dense_12 (Dense)             (None, 10)                110       
=================================================================
Total params: 2,320
Trainable params: 2,320
Non-trainable params: 0
_________________________________________________________________
```

Train the Model

In [21]:
```
from keras.callbacks import ModelCheckpoint
from keras.utils import np_utils

print("Train Targets", train_targets)
print ("Test Targets", test_targets)
train_targets_onehot = np_utils.to_categorical(np.array(train_targets),1
0)
test_targets_onehot = np_utils.to_categorical(np.array(test_targets),10)
print ("Train Targets One-hot encoded", train_targets_onehot)
print ("Test Targets One-hot encoded", test_targets_onehot)

print(train_targets_onehot.shape)
print(test_targets_onehot.shape)

checkpointer = ModelCheckpoint(filepath='C:/Users/pushkar/ML/machine-lea
rning/projects/capstone/saved_models/weights.best.from_scratch.hdf5',
                               verbose=1, save_best_only=True)

def train_model(_epochs):
    epochs = _epochs

    history = model.fit(train_tensors, train_targets_onehot, validation_
split=.20,
          epochs=epochs, batch_size=32, callbacks=[checkpointer], verbos
e=2)
    return history

history = train_model(250)
```

```
Train Targets [3 8 9 ..., 7 7 5]
Test Targets [5 6 2 ..., 8 6 5]
Train Targets One-hot encoded [[ 0.  0.  0. ...,  0.  0.  0.]
 [ 0.  0.  0. ...,  0.  1.  0.]
 [ 0.  0.  0. ...,  0.  0.  1.]
 ...,
 [ 0.  0.  0. ...,  1.  0.  0.]
 [ 0.  0.  0. ...,  1.  0.  0.]
 [ 0.  0.  0. ...,  0.  0.  0.]]
Test Targets One-hot encoded [[ 0.  0.  0. ...,  0.  0.  0.]
 [ 0.  0.  0. ...,  0.  0.  0.]
 [ 0.  0.  1. ...,  0.  0.  0.]
 ...,
 [ 0.  0.  0. ...,  0.  1.  0.]
 [ 0.  0.  0. ...,  0.  0.  0.]
 [ 0.  0.  0. ...,  0.  0.  0.]]
(15200, 10)
(3800, 10)
Train on 12160 samples, validate on 3040 samples
Epoch 1/250
 - 105s - loss: 2.3041 - acc: 0.0985 - val_loss: 2.3028 - val_acc: 0.093
1

Epoch 00001: val_loss improved from inf to 2.30276, saving model to C:/U
sers/pushkar/ML/machine-learning/projects/capstone/saved_models/weights.
best.from_scratch.hdf5
Epoch 2/250
 - 92s - loss: 2.3044 - acc: 0.0968 - val_loss: 2.3028 - val_acc: 0.0914

Epoch 00002: val_loss did not improve
Epoch 3/250
 - 91s - loss: 2.3026 - acc: 0.1005 - val_loss: 2.3056 - val_acc: 0.1003

Epoch 00003: val_loss did not improve
Epoch 4/250
 - 92s - loss: 2.3022 - acc: 0.1025 - val_loss: 2.3013 - val_acc: 0.1049

Epoch 00004: val_loss improved from 2.30276 to 2.30126, saving model to
C:/Users/pushkar/ML/machine-learning/projects/capstone/saved_models/weig
hts.best.from_scratch.hdf5
Epoch 5/250
 - 91s - loss: 2.2999 - acc: 0.1130 - val_loss: 2.2999 - val_acc: 0.1174

Epoch 00005: val_loss improved from 2.30126 to 2.29987, saving model to
C:/Users/pushkar/ML/machine-learning/projects/capstone/saved_models/weig
hts.best.from_scratch.hdf5
Epoch 6/250
 - 91s - loss: 2.2944 - acc: 0.1160 - val_loss: 2.3012 - val_acc: 0.1059

Epoch 00006: val_loss did not improve
Epoch 7/250
 - 91s - loss: 2.2877 - acc: 0.1202 - val_loss: 2.2809 - val_acc: 0.1493

Epoch 00007: val_loss improved from 2.29987 to 2.28085, saving model to
C:/Users/pushkar/ML/machine-learning/projects/capstone/saved_models/weig
hts.best.from_scratch.hdf5
Epoch 8/250
```

```
 - 91s - loss: 2.2785 - acc: 0.1248 - val_loss: 2.2990 - val_acc: 0.1171

Epoch 00008: val_loss did not improve
Epoch 9/250
 - 92s - loss: 2.2674 - acc: 0.1340 - val_loss: 2.2858 - val_acc: 0.1132

Epoch 00009: val_loss did not improve
Epoch 10/250
 - 91s - loss: 2.2530 - acc: 0.1430 - val_loss: 2.2746 - val_acc: 0.1171

Epoch 00010: val_loss improved from 2.28085 to 2.27458, saving model to
C:/Users/pushkar/ML/machine-learning/projects/capstone/saved_models/weig
hts.best.from_scratch.hdf5
Epoch 11/250
 - 91s - loss: 2.2433 - acc: 0.1518 - val_loss: 2.2797 - val_acc: 0.1207

Epoch 00011: val_loss did not improve
Epoch 12/250
 - 91s - loss: 2.2290 - acc: 0.1557 - val_loss: 2.2975 - val_acc: 0.1086

Epoch 00012: val_loss did not improve
Epoch 13/250
 - 91s - loss: 2.2180 - acc: 0.1607 - val_loss: 2.3677 - val_acc: 0.1013

Epoch 00013: val_loss did not improve
Epoch 14/250
 - 91s - loss: 2.2033 - acc: 0.1611 - val_loss: 2.3926 - val_acc: 0.1007

Epoch 00014: val_loss did not improve
Epoch 15/250
 - 91s - loss: 2.1985 - acc: 0.1620 - val_loss: 2.3580 - val_acc: 0.1053

Epoch 00015: val_loss did not improve
Epoch 16/250
 - 91s - loss: 2.1829 - acc: 0.1735 - val_loss: 2.4203 - val_acc: 0.1007

Epoch 00016: val_loss did not improve
Epoch 17/250
 - 91s - loss: 2.1685 - acc: 0.1768 - val_loss: 2.3727 - val_acc: 0.1079

Epoch 00017: val_loss did not improve
Epoch 18/250
 - 91s - loss: 2.1680 - acc: 0.1723 - val_loss: 2.4610 - val_acc: 0.1007

Epoch 00018: val_loss did not improve
Epoch 19/250
 - 91s - loss: 2.1554 - acc: 0.1781 - val_loss: 2.4766 - val_acc: 0.1003

Epoch 00019: val_loss did not improve
Epoch 20/250
 - 91s - loss: 2.1509 - acc: 0.1844 - val_loss: 2.4889 - val_acc: 0.1003

Epoch 00020: val_loss did not improve
Epoch 21/250
 - 91s - loss: 2.1445 - acc: 0.1859 - val_loss: 2.5045 - val_acc: 0.1003

Epoch 00021: val_loss did not improve
```

```
Epoch 22/250
 - 91s - loss: 2.1363 - acc: 0.1906 - val_loss: 2.5159 - val_acc: 0.1003

Epoch 00022: val_loss did not improve
Epoch 23/250
 - 91s - loss: 2.1295 - acc: 0.1897 - val_loss: 2.5351 - val_acc: 0.1003

Epoch 00023: val_loss did not improve
Epoch 24/250
 - 91s - loss: 2.1229 - acc: 0.1957 - val_loss: 2.5365 - val_acc: 0.1003

Epoch 00024: val_loss did not improve
Epoch 25/250
 - 91s - loss: 2.1121 - acc: 0.1956 - val_loss: 2.5635 - val_acc: 0.1003

Epoch 00025: val_loss did not improve
Epoch 26/250
 - 91s - loss: 2.1090 - acc: 0.1981 - val_loss: 2.5751 - val_acc: 0.1003

Epoch 00026: val_loss did not improve
Epoch 27/250
 - 91s - loss: 2.1001 - acc: 0.1991 - val_loss: 2.5820 - val_acc: 0.1003

Epoch 00027: val_loss did not improve
Epoch 28/250
 - 91s - loss: 2.0953 - acc: 0.2000 - val_loss: 2.6064 - val_acc: 0.1003

Epoch 00028: val_loss did not improve
Epoch 29/250
 - 91s - loss: 2.0860 - acc: 0.2131 - val_loss: 2.6295 - val_acc: 0.1003

Epoch 00029: val_loss did not improve
Epoch 30/250
 - 91s - loss: 2.0833 - acc: 0.2084 - val_loss: 2.6383 - val_acc: 0.1007

Epoch 00030: val_loss did not improve
Epoch 31/250
 - 91s - loss: 2.0769 - acc: 0.2133 - val_loss: 2.6194 - val_acc: 0.1007

Epoch 00031: val_loss did not improve
Epoch 32/250
 - 91s - loss: 2.0703 - acc: 0.2120 - val_loss: 2.6669 - val_acc: 0.1007

Epoch 00032: val_loss did not improve
Epoch 33/250
 - 91s - loss: 2.0654 - acc: 0.2191 - val_loss: 2.6831 - val_acc: 0.1007

Epoch 00033: val_loss did not improve
Epoch 34/250
 - 91s - loss: 2.0618 - acc: 0.2177 - val_loss: 2.6309 - val_acc: 0.1069

Epoch 00034: val_loss did not improve
Epoch 35/250
 - 91s - loss: 2.0583 - acc: 0.2185 - val_loss: 2.7062 - val_acc: 0.1007

Epoch 00035: val_loss did not improve
Epoch 36/250
```

```
 - 91s - loss: 2.0520 - acc: 0.2262 - val_loss: 2.6641 - val_acc: 0.1056

Epoch 00036: val_loss did not improve
Epoch 37/250
 - 91s - loss: 2.0438 - acc: 0.2257 - val_loss: 2.7505 - val_acc: 0.1003

Epoch 00037: val_loss did not improve
Epoch 38/250
 - 91s - loss: 2.0392 - acc: 0.2332 - val_loss: 2.7623 - val_acc: 0.1007

Epoch 00038: val_loss did not improve
Epoch 39/250
 - 91s - loss: 2.0399 - acc: 0.2281 - val_loss: 2.7673 - val_acc: 0.1109

Epoch 00039: val_loss did not improve
Epoch 40/250
 - 91s - loss: 2.0248 - acc: 0.2340 - val_loss: 2.7237 - val_acc: 0.1145

Epoch 00040: val_loss did not improve
Epoch 41/250
 - 91s - loss: 2.0247 - acc: 0.2313 - val_loss: 2.7944 - val_acc: 0.1003

Epoch 00041: val_loss did not improve
Epoch 42/250
 - 91s - loss: 2.0218 - acc: 0.2359 - val_loss: 2.4448 - val_acc: 0.1533

Epoch 00042: val_loss did not improve
Epoch 43/250
 - 91s - loss: 2.0205 - acc: 0.2343 - val_loss: 2.6795 - val_acc: 0.1230

Epoch 00043: val_loss did not improve
Epoch 44/250
 - 91s - loss: 2.0094 - acc: 0.2373 - val_loss: 2.6815 - val_acc: 0.1243

Epoch 00044: val_loss did not improve
Epoch 45/250
 - 91s - loss: 2.0125 - acc: 0.2429 - val_loss: 2.8445 - val_acc: 0.0997

Epoch 00045: val_loss did not improve
Epoch 46/250
 - 91s - loss: 2.0009 - acc: 0.2390 - val_loss: 2.7984 - val_acc: 0.1109

Epoch 00046: val_loss did not improve
Epoch 47/250
 - 91s - loss: 1.9992 - acc: 0.2473 - val_loss: 2.8508 - val_acc: 0.1039

Epoch 00047: val_loss did not improve
Epoch 48/250
 - 91s - loss: 1.9965 - acc: 0.2428 - val_loss: 2.8861 - val_acc: 0.1030

Epoch 00048: val_loss did not improve
Epoch 49/250
 - 91s - loss: 1.9867 - acc: 0.2502 - val_loss: 2.6501 - val_acc: 0.1211

Epoch 00049: val_loss did not improve
Epoch 50/250
 - 91s - loss: 1.9855 - acc: 0.2483 - val_loss: 2.7933 - val_acc: 0.1082
```

```
Epoch 00050: val_loss did not improve
Epoch 51/250
 - 91s - loss: 1.9813 - acc: 0.2543 - val_loss: 2.8528 - val_acc: 0.1076

Epoch 00051: val_loss did not improve
Epoch 52/250
 - 91s - loss: 1.9739 - acc: 0.2536 - val_loss: 2.9417 - val_acc: 0.0997

Epoch 00052: val_loss did not improve
Epoch 53/250
 - 91s - loss: 1.9691 - acc: 0.2608 - val_loss: 2.6376 - val_acc: 0.1303

Epoch 00053: val_loss did not improve
Epoch 54/250
 - 91s - loss: 1.9667 - acc: 0.2618 - val_loss: 2.8819 - val_acc: 0.1086

Epoch 00054: val_loss did not improve
Epoch 55/250
 - 91s - loss: 1.9574 - acc: 0.2584 - val_loss: 2.9743 - val_acc: 0.1036

Epoch 00055: val_loss did not improve
Epoch 56/250
 - 91s - loss: 1.9586 - acc: 0.2608 - val_loss: 2.7869 - val_acc: 0.1115

Epoch 00056: val_loss did not improve
Epoch 57/250
 - 91s - loss: 1.9520 - acc: 0.2660 - val_loss: 3.0336 - val_acc: 0.1010

Epoch 00057: val_loss did not improve
Epoch 58/250
 - 91s - loss: 1.9444 - acc: 0.2639 - val_loss: 2.8758 - val_acc: 0.1066

Epoch 00058: val_loss did not improve
Epoch 59/250
 - 91s - loss: 1.9413 - acc: 0.2680 - val_loss: 2.8886 - val_acc: 0.1062

Epoch 00059: val_loss did not improve
Epoch 60/250
 - 91s - loss: 1.9405 - acc: 0.2665 - val_loss: 2.7604 - val_acc: 0.1135

Epoch 00060: val_loss did not improve
Epoch 61/250
 - 91s - loss: 1.9319 - acc: 0.2703 - val_loss: 2.6595 - val_acc: 0.1260

Epoch 00061: val_loss did not improve
Epoch 62/250
 - 91s - loss: 1.9290 - acc: 0.2721 - val_loss: 2.2564 - val_acc: 0.1842

Epoch 00062: val_loss improved from 2.27458 to 2.25636, saving model to
C:/Users/pushkar/ML/machine-learning/projects/capstone/saved_models/weig
hts.best.from_scratch.hdf5
Epoch 63/250
 - 91s - loss: 1.9220 - acc: 0.2786 - val_loss: 2.6031 - val_acc: 0.1437

Epoch 00063: val_loss did not improve
Epoch 64/250
```

```
 - 91s - loss: 1.9126 - acc: 0.2749 - val_loss: 2.5948 - val_acc: 0.1484

Epoch 00064: val_loss did not improve
Epoch 65/250
 - 91s - loss: 1.9149 - acc: 0.2813 - val_loss: 3.0516 - val_acc: 0.1043

Epoch 00065: val_loss did not improve
Epoch 66/250
 - 91s - loss: 1.9083 - acc: 0.2809 - val_loss: 2.3569 - val_acc: 0.1674

Epoch 00066: val_loss did not improve
Epoch 67/250
 - 91s - loss: 1.8984 - acc: 0.2846 - val_loss: 2.4874 - val_acc: 0.1701

Epoch 00067: val_loss did not improve
Epoch 68/250
 - 91s - loss: 1.8917 - acc: 0.2903 - val_loss: 2.2697 - val_acc: 0.1882

Epoch 00068: val_loss did not improve
Epoch 69/250
 - 91s - loss: 1.8820 - acc: 0.2884 - val_loss: 2.4639 - val_acc: 0.1737

Epoch 00069: val_loss did not improve
Epoch 70/250
 - 91s - loss: 1.8881 - acc: 0.2840 - val_loss: 2.4214 - val_acc: 0.1829

Epoch 00070: val_loss did not improve
Epoch 71/250
 - 91s - loss: 1.8740 - acc: 0.2963 - val_loss: 2.6631 - val_acc: 0.1447

Epoch 00071: val_loss did not improve
Epoch 72/250
 - 91s - loss: 1.8642 - acc: 0.2983 - val_loss: 2.3756 - val_acc: 0.1934

Epoch 00072: val_loss did not improve
Epoch 73/250
 - 91s - loss: 1.8615 - acc: 0.2916 - val_loss: 2.3474 - val_acc: 0.1770

Epoch 00073: val_loss did not improve
Epoch 74/250
 - 91s - loss: 1.8532 - acc: 0.2999 - val_loss: 2.8886 - val_acc: 0.1503

Epoch 00074: val_loss did not improve
Epoch 75/250
 - 91s - loss: 1.8509 - acc: 0.2990 - val_loss: 2.5115 - val_acc: 0.1770

Epoch 00075: val_loss did not improve
Epoch 76/250
 - 91s - loss: 1.8371 - acc: 0.3031 - val_loss: 2.4442 - val_acc: 0.1803

Epoch 00076: val_loss did not improve
Epoch 77/250
 - 91s - loss: 1.8324 - acc: 0.3098 - val_loss: 3.2044 - val_acc: 0.1388

Epoch 00077: val_loss did not improve
Epoch 78/250
 - 91s - loss: 1.8313 - acc: 0.3136 - val_loss: 2.3865 - val_acc: 0.1826
```

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Epoch 00078: val_loss did not improve
Epoch 79/250
 - 91s - loss: 1.8280 - acc: 0.3064 - val_loss: 2.8390 - val_acc: 0.1582

Epoch 00079: val_loss did not improve
Epoch 80/250
 - 91s - loss: 1.8143 - acc: 0.3178 - val_loss: 2.5437 - val_acc: 0.1849

Epoch 00080: val_loss did not improve
Epoch 81/250
 - 91s - loss: 1.8114 - acc: 0.3113 - val_loss: 2.4290 - val_acc: 0.1970

Epoch 00081: val_loss did not improve
Epoch 82/250
 - 91s - loss: 1.8086 - acc: 0.3117 - val_loss: 3.4333 - val_acc: 0.1352

Epoch 00082: val_loss did not improve
Epoch 83/250
 - 91s - loss: 1.8051 - acc: 0.3158 - val_loss: 2.4632 - val_acc: 0.1993

Epoch 00083: val_loss did not improve
Epoch 84/250
 - 91s - loss: 1.7926 - acc: 0.3256 - val_loss: 2.6557 - val_acc: 0.1760

Epoch 00084: val_loss did not improve
Epoch 85/250
 - 91s - loss: 1.7857 - acc: 0.3203 - val_loss: 3.2994 - val_acc: 0.1470

Epoch 00085: val_loss did not improve
Epoch 86/250
 - 91s - loss: 1.7837 - acc: 0.3268 - val_loss: 2.8553 - val_acc: 0.1684

Epoch 00086: val_loss did not improve
Epoch 87/250
 - 91s - loss: 1.7799 - acc: 0.3252 - val_loss: 3.1374 - val_acc: 0.1589

Epoch 00087: val_loss did not improve
Epoch 88/250
 - 91s - loss: 1.7707 - acc: 0.3239 - val_loss: 2.8545 - val_acc: 0.1734

Epoch 00088: val_loss did not improve
Epoch 89/250
 - 91s - loss: 1.7620 - acc: 0.3275 - val_loss: 2.7955 - val_acc: 0.1757

Epoch 00089: val_loss did not improve
Epoch 90/250
 - 91s - loss: 1.7642 - acc: 0.3228 - val_loss: 2.8313 - val_acc: 0.1750

Epoch 00090: val_loss did not improve
Epoch 91/250
 - 91s - loss: 1.7542 - acc: 0.3306 - val_loss: 2.5407 - val_acc: 0.2003

Epoch 00091: val_loss did not improve
Epoch 92/250
 - 91s - loss: 1.7510 - acc: 0.3337 - val_loss: 3.4350 - val_acc: 0.1474
```

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Epoch 00092: val_loss did not improve
Epoch 93/250
 - 92s - loss: 1.7454 - acc: 0.3328 - val_loss: 3.1022 - val_acc: 0.1651

Epoch 00093: val_loss did not improve
Epoch 94/250
 - 92s - loss: 1.7389 - acc: 0.3399 - val_loss: 2.4423 - val_acc: 0.1970

Epoch 00094: val_loss did not improve
Epoch 95/250
 - 91s - loss: 1.7398 - acc: 0.3387 - val_loss: 2.4432 - val_acc: 0.1984

Epoch 00095: val_loss did not improve
Epoch 96/250
 - 91s - loss: 1.7331 - acc: 0.3419 - val_loss: 2.5119 - val_acc: 0.1895

Epoch 00096: val_loss did not improve
Epoch 97/250
 - 91s - loss: 1.7206 - acc: 0.3433 - val_loss: 2.5564 - val_acc: 0.1990

Epoch 00097: val_loss did not improve
Epoch 98/250
 - 91s - loss: 1.7197 - acc: 0.3494 - val_loss: 3.5248 - val_acc: 0.1480

Epoch 00098: val_loss did not improve
Epoch 99/250
 - 91s - loss: 1.7166 - acc: 0.3479 - val_loss: 2.7773 - val_acc: 0.1872

Epoch 00099: val_loss did not improve
Epoch 100/250
 - 91s - loss: 1.7121 - acc: 0.3456 - val_loss: 2.8645 - val_acc: 0.1852

Epoch 00100: val_loss did not improve
Epoch 101/250
 - 91s - loss: 1.7174 - acc: 0.3522 - val_loss: 3.0981 - val_acc: 0.1635

Epoch 00101: val_loss did not improve
Epoch 102/250
 - 91s - loss: 1.7045 - acc: 0.3512 - val_loss: 2.6891 - val_acc: 0.1859

Epoch 00102: val_loss did not improve
Epoch 103/250
 - 91s - loss: 1.7051 - acc: 0.3454 - val_loss: 3.0603 - val_acc: 0.1717

Epoch 00103: val_loss did not improve
Epoch 104/250
 - 91s - loss: 1.6915 - acc: 0.3571 - val_loss: 4.2545 - val_acc: 0.1240

Epoch 00104: val_loss did not improve
Epoch 105/250
 - 91s - loss: 1.6937 - acc: 0.3515 - val_loss: 2.7378 - val_acc: 0.1872

Epoch 00105: val_loss did not improve
Epoch 106/250
 - 91s - loss: 1.6803 - acc: 0.3642 - val_loss: 3.0663 - val_acc: 0.1684

Epoch 00106: val_loss did not improve
```

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Epoch 107/250
 - 91s - loss: 1.6808 - acc: 0.3606 - val_loss: 3.2018 - val_acc: 0.1661

Epoch 00107: val_loss did not improve
Epoch 108/250
 - 91s - loss: 1.6726 - acc: 0.3637 - val_loss: 2.6020 - val_acc: 0.2003

Epoch 00108: val_loss did not improve
Epoch 109/250
 - 91s - loss: 1.6771 - acc: 0.3658 - val_loss: 4.5776 - val_acc: 0.1201

Epoch 00109: val_loss did not improve
Epoch 110/250
 - 91s - loss: 1.6751 - acc: 0.3642 - val_loss: 2.8194 - val_acc: 0.1855

Epoch 00110: val_loss did not improve
Epoch 111/250
 - 91s - loss: 1.6718 - acc: 0.3679 - val_loss: 2.9459 - val_acc: 0.1796

Epoch 00111: val_loss did not improve
Epoch 112/250
 - 91s - loss: 1.6584 - acc: 0.3690 - val_loss: 3.7207 - val_acc: 0.1487

Epoch 00112: val_loss did not improve
Epoch 113/250
 - 91s - loss: 1.6551 - acc: 0.3704 - val_loss: 3.3409 - val_acc: 0.1628

Epoch 00113: val_loss did not improve
Epoch 114/250
 - 91s - loss: 1.6547 - acc: 0.3746 - val_loss: 4.5816 - val_acc: 0.1263

Epoch 00114: val_loss did not improve
Epoch 115/250
 - 91s - loss: 1.6327 - acc: 0.3766 - val_loss: 3.5120 - val_acc: 0.1589

Epoch 00115: val_loss did not improve
Epoch 116/250
 - 91s - loss: 1.6387 - acc: 0.3743 - val_loss: 4.6956 - val_acc: 0.1253

Epoch 00116: val_loss did not improve
Epoch 117/250
 - 91s - loss: 1.6470 - acc: 0.3718 - val_loss: 3.5070 - val_acc: 0.1635

Epoch 00117: val_loss did not improve
Epoch 118/250
 - 91s - loss: 1.6356 - acc: 0.3788 - val_loss: 5.4388 - val_acc: 0.1092

Epoch 00118: val_loss did not improve
Epoch 119/250
 - 91s - loss: 1.6369 - acc: 0.3757 - val_loss: 5.0042 - val_acc: 0.1181

Epoch 00119: val_loss did not improve
Epoch 120/250
 - 91s - loss: 1.6311 - acc: 0.3746 - val_loss: 4.3414 - val_acc: 0.1368

Epoch 00120: val_loss did not improve
Epoch 121/250
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 - 91s - loss: 1.6215 - acc: 0.3851 - val_loss: 4.8885 - val_acc: 0.1191

Epoch 00121: val_loss did not improve
Epoch 122/250
 - 91s - loss: 1.6258 - acc: 0.3808 - val_loss: 4.5540 - val_acc: 0.1296

Epoch 00122: val_loss did not improve
Epoch 123/250
 - 91s - loss: 1.6188 - acc: 0.3801 - val_loss: 4.5181 - val_acc: 0.1316

Epoch 00123: val_loss did not improve
Epoch 124/250
 - 91s - loss: 1.6215 - acc: 0.3860 - val_loss: 5.8928 - val_acc: 0.1082

Epoch 00124: val_loss did not improve
Epoch 125/250
 - 91s - loss: 1.6306 - acc: 0.3818 - val_loss: 5.7533 - val_acc: 0.1089

Epoch 00125: val_loss did not improve
Epoch 126/250
 - 91s - loss: 1.5999 - acc: 0.3877 - val_loss: 4.8698 - val_acc: 0.1230

Epoch 00126: val_loss did not improve
Epoch 127/250
 - 91s - loss: 1.6052 - acc: 0.3901 - val_loss: 4.8849 - val_acc: 0.1257

Epoch 00127: val_loss did not improve
Epoch 128/250
 - 91s - loss: 1.6068 - acc: 0.3910 - val_loss: 5.9221 - val_acc: 0.1086

Epoch 00128: val_loss did not improve
Epoch 129/250
 - 91s - loss: 1.5936 - acc: 0.3918 - val_loss: 5.8381 - val_acc: 0.1089

Epoch 00129: val_loss did not improve
Epoch 130/250
 - 91s - loss: 1.5935 - acc: 0.3967 - val_loss: 5.9812 - val_acc: 0.1086

Epoch 00130: val_loss did not improve
Epoch 131/250
 - 91s - loss: 1.6001 - acc: 0.3890 - val_loss: 5.8798 - val_acc: 0.1086

Epoch 00131: val_loss did not improve
Epoch 132/250
 - 91s - loss: 1.5951 - acc: 0.3899 - val_loss: 5.5172 - val_acc: 0.1207

Epoch 00132: val_loss did not improve
Epoch 133/250
 - 91s - loss: 1.5906 - acc: 0.3974 - val_loss: 5.9878 - val_acc: 0.1095

Epoch 00133: val_loss did not improve
Epoch 134/250
 - 91s - loss: 1.5860 - acc: 0.4028 - val_loss: 5.8008 - val_acc: 0.1138

Epoch 00134: val_loss did not improve
Epoch 135/250
 - 91s - loss: 1.5831 - acc: 0.3940 - val_loss: 6.2934 - val_acc: 0.1082
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Epoch 00135: val_loss did not improve
Epoch 136/250
 - 91s - loss: 1.5836 - acc: 0.3941 - val_loss: 6.2796 - val_acc: 0.1086

Epoch 00136: val_loss did not improve
Epoch 137/250
 - 91s - loss: 1.5759 - acc: 0.4036 - val_loss: 6.0385 - val_acc: 0.1128

Epoch 00137: val_loss did not improve
Epoch 138/250
 - 91s - loss: 1.5727 - acc: 0.4012 - val_loss: 6.3612 - val_acc: 0.1086

Epoch 00138: val_loss did not improve
Epoch 139/250
 - 91s - loss: 1.5710 - acc: 0.4043 - val_loss: 6.3532 - val_acc: 0.1082

Epoch 00139: val_loss did not improve
Epoch 140/250
 - 91s - loss: 1.5645 - acc: 0.4058 - val_loss: 6.3120 - val_acc: 0.1082

Epoch 00140: val_loss did not improve
Epoch 141/250
 - 91s - loss: 1.5628 - acc: 0.4070 - val_loss: 6.0100 - val_acc: 0.1151

Epoch 00141: val_loss did not improve
Epoch 142/250
 - 91s - loss: 1.5702 - acc: 0.4056 - val_loss: 5.8115 - val_acc: 0.1217

Epoch 00142: val_loss did not improve
Epoch 143/250
 - 91s - loss: 1.5620 - acc: 0.4076 - val_loss: 6.2165 - val_acc: 0.1109

Epoch 00143: val_loss did not improve
Epoch 144/250
 - 91s - loss: 1.5472 - acc: 0.4130 - val_loss: 6.0698 - val_acc: 0.1145

Epoch 00144: val_loss did not improve
Epoch 145/250
 - 91s - loss: 1.5528 - acc: 0.4060 - val_loss: 5.7728 - val_acc: 0.1247

Epoch 00145: val_loss did not improve
Epoch 146/250
 - 91s - loss: 1.5528 - acc: 0.4077 - val_loss: 6.0349 - val_acc: 0.1194

Epoch 00146: val_loss did not improve
Epoch 147/250
 - 91s - loss: 1.5593 - acc: 0.4104 - val_loss: 6.3617 - val_acc: 0.1109

Epoch 00147: val_loss did not improve
Epoch 148/250
 - 91s - loss: 1.5485 - acc: 0.4114 - val_loss: 6.2158 - val_acc: 0.1128

Epoch 00148: val_loss did not improve
Epoch 149/250
 - 91s - loss: 1.5389 - acc: 0.4127 - val_loss: 6.1148 - val_acc: 0.1184
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Epoch 00149: val_loss did not improve
Epoch 150/250
 - 91s - loss: 1.5502 - acc: 0.4132 - val_loss: 6.2034 - val_acc: 0.1135

Epoch 00150: val_loss did not improve
Epoch 151/250
 - 91s - loss: 1.5451 - acc: 0.4145 - val_loss: 5.9027 - val_acc: 0.1250

Epoch 00151: val_loss did not improve
Epoch 152/250
 - 91s - loss: 1.5436 - acc: 0.4076 - val_loss: 6.2447 - val_acc: 0.1138

Epoch 00152: val_loss did not improve
Epoch 153/250
 - 91s - loss: 1.5411 - acc: 0.4115 - val_loss: 6.0558 - val_acc: 0.1227

Epoch 00153: val_loss did not improve
Epoch 154/250
 - 91s - loss: 1.5311 - acc: 0.4186 - val_loss: 6.0537 - val_acc: 0.1230

Epoch 00154: val_loss did not improve
Epoch 155/250
 - 91s - loss: 1.5281 - acc: 0.4174 - val_loss: 6.3651 - val_acc: 0.1125

Epoch 00155: val_loss did not improve
Epoch 156/250
 - 91s - loss: 1.5310 - acc: 0.4151 - val_loss: 5.8239 - val_acc: 0.1286

Epoch 00156: val_loss did not improve
Epoch 157/250
 - 91s - loss: 1.5303 - acc: 0.4199 - val_loss: 6.4177 - val_acc: 0.1125

Epoch 00157: val_loss did not improve
Epoch 158/250
 - 91s - loss: 1.5403 - acc: 0.4170 - val_loss: 5.9994 - val_acc: 0.1250

Epoch 00158: val_loss did not improve
Epoch 159/250
 - 91s - loss: 1.5217 - acc: 0.4254 - val_loss: 6.4206 - val_acc: 0.1148

Epoch 00159: val_loss did not improve
Epoch 160/250
 - 91s - loss: 1.5228 - acc: 0.4204 - val_loss: 6.2761 - val_acc: 0.1197

Epoch 00160: val_loss did not improve
Epoch 161/250
 - 91s - loss: 1.5355 - acc: 0.4198 - val_loss: 6.2240 - val_acc: 0.1220

Epoch 00161: val_loss did not improve
Epoch 162/250
 - 91s - loss: 1.5178 - acc: 0.4301 - val_loss: 5.9991 - val_acc: 0.1266

Epoch 00162: val_loss did not improve
Epoch 163/250
 - 91s - loss: 1.5133 - acc: 0.4245 - val_loss: 5.9403 - val_acc: 0.1293

Epoch 00163: val_loss did not improve
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Epoch 164/250
 - 91s - loss: 1.5119 - acc: 0.4255 - val_loss: 6.0930 - val_acc: 0.1243

Epoch 00164: val_loss did not improve
Epoch 165/250
 - 91s - loss: 1.5226 - acc: 0.4262 - val_loss: 6.4618 - val_acc: 0.1171

Epoch 00165: val_loss did not improve
Epoch 166/250
 - 91s - loss: 1.5159 - acc: 0.4248 - val_loss: 6.4213 - val_acc: 0.1184

Epoch 00166: val_loss did not improve
Epoch 167/250
 - 91s - loss: 1.5100 - acc: 0.4280 - val_loss: 5.3270 - val_acc: 0.1411

Epoch 00167: val_loss did not improve
Epoch 168/250
 - 91s - loss: 1.5095 - acc: 0.4262 - val_loss: 6.5915 - val_acc: 0.1128

Epoch 00168: val_loss did not improve
Epoch 169/250
 - 91s - loss: 1.5076 - acc: 0.4274 - val_loss: 6.0281 - val_acc: 0.1289

Epoch 00169: val_loss did not improve
Epoch 170/250
 - 91s - loss: 1.5009 - acc: 0.4277 - val_loss: 6.2205 - val_acc: 0.1243

Epoch 00170: val_loss did not improve
Epoch 171/250
 - 91s - loss: 1.4974 - acc: 0.4319 - val_loss: 5.9086 - val_acc: 0.1329

Epoch 00171: val_loss did not improve
Epoch 172/250
 - 91s - loss: 1.4975 - acc: 0.4279 - val_loss: 5.9287 - val_acc: 0.1299

Epoch 00172: val_loss did not improve
Epoch 173/250
 - 91s - loss: 1.5109 - acc: 0.4248 - val_loss: 6.2761 - val_acc: 0.1237

Epoch 00173: val_loss did not improve
Epoch 174/250
 - 91s - loss: 1.4990 - acc: 0.4322 - val_loss: 6.1547 - val_acc: 0.1273

Epoch 00174: val_loss did not improve
Epoch 175/250
 - 91s - loss: 1.4988 - acc: 0.4334 - val_loss: 6.6121 - val_acc: 0.1171

Epoch 00175: val_loss did not improve
Epoch 176/250
 - 91s - loss: 1.4897 - acc: 0.4353 - val_loss: 6.5036 - val_acc: 0.1214

Epoch 00176: val_loss did not improve
Epoch 177/250
 - 91s - loss: 1.4868 - acc: 0.4384 - val_loss: 6.4760 - val_acc: 0.1220

Epoch 00177: val_loss did not improve
Epoch 178/250
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 - 91s - loss: 1.4923 - acc: 0.4324 - val_loss: 6.3293 - val_acc: 0.1237

Epoch 00178: val_loss did not improve
Epoch 179/250
 - 91s - loss: 1.4892 - acc: 0.4345 - val_loss: 6.3949 - val_acc: 0.1227

Epoch 00179: val_loss did not improve
Epoch 180/250
 - 91s - loss: 1.4739 - acc: 0.4399 - val_loss: 5.5593 - val_acc: 0.1437

Epoch 00180: val_loss did not improve
Epoch 181/250
 - 91s - loss: 1.4817 - acc: 0.4375 - val_loss: 5.5142 - val_acc: 0.1454

Epoch 00181: val_loss did not improve
Epoch 182/250
 - 91s - loss: 1.4792 - acc: 0.4410 - val_loss: 4.9428 - val_acc: 0.1645

Epoch 00182: val_loss did not improve
Epoch 183/250
 - 91s - loss: 1.4731 - acc: 0.4368 - val_loss: 6.5514 - val_acc: 0.1237

Epoch 00183: val_loss did not improve
Epoch 184/250
 - 91s - loss: 1.4847 - acc: 0.4385 - val_loss: 6.1249 - val_acc: 0.1326

Epoch 00184: val_loss did not improve
Epoch 185/250
 - 91s - loss: 1.4712 - acc: 0.4406 - val_loss: 6.2436 - val_acc: 0.1293

Epoch 00185: val_loss did not improve
Epoch 186/250
 - 91s - loss: 1.4733 - acc: 0.4351 - val_loss: 6.2374 - val_acc: 0.1306

Epoch 00186: val_loss did not improve
Epoch 187/250
 - 91s - loss: 1.4749 - acc: 0.4423 - val_loss: 6.5068 - val_acc: 0.1243

Epoch 00187: val_loss did not improve
Epoch 188/250
 - 91s - loss: 1.4748 - acc: 0.4400 - val_loss: 5.7050 - val_acc: 0.1408

Epoch 00188: val_loss did not improve
Epoch 189/250
 - 91s - loss: 1.4777 - acc: 0.4416 - val_loss: 5.4774 - val_acc: 0.1500

Epoch 00189: val_loss did not improve
Epoch 190/250
 - 91s - loss: 1.4638 - acc: 0.4475 - val_loss: 5.5931 - val_acc: 0.1470

Epoch 00190: val_loss did not improve
Epoch 191/250
 - 91s - loss: 1.4650 - acc: 0.4501 - val_loss: 5.5680 - val_acc: 0.1500

Epoch 00191: val_loss did not improve
Epoch 192/250
 - 91s - loss: 1.4621 - acc: 0.4537 - val_loss: 5.2921 - val_acc: 0.1612
```

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Epoch 00192: val_loss did not improve
Epoch 193/250
 - 91s - loss: 1.4678 - acc: 0.4470 - val_loss: 6.2727 - val_acc: 0.1329

Epoch 00193: val_loss did not improve
Epoch 194/250
 - 91s - loss: 1.4758 - acc: 0.4419 - val_loss: 4.8081 - val_acc: 0.1773

Epoch 00194: val_loss did not improve
Epoch 195/250
 - 91s - loss: 1.4495 - acc: 0.4498 - val_loss: 5.6011 - val_acc: 0.1497

Epoch 00195: val_loss did not improve
Epoch 196/250
 - 91s - loss: 1.4595 - acc: 0.4455 - val_loss: 7.0131 - val_acc: 0.1158

Epoch 00196: val_loss did not improve
Epoch 197/250
 - 91s - loss: 1.4692 - acc: 0.4451 - val_loss: 6.5721 - val_acc: 0.1257

Epoch 00197: val_loss did not improve
Epoch 198/250
 - 91s - loss: 1.4585 - acc: 0.4459 - val_loss: 6.2056 - val_acc: 0.1355

Epoch 00198: val_loss did not improve
Epoch 199/250
 - 91s - loss: 1.4558 - acc: 0.4473 - val_loss: 6.1664 - val_acc: 0.1352

Epoch 00199: val_loss did not improve
Epoch 200/250
 - 91s - loss: 1.4486 - acc: 0.4552 - val_loss: 5.9504 - val_acc: 0.1414

Epoch 00200: val_loss did not improve
Epoch 201/250
 - 91s - loss: 1.4617 - acc: 0.4484 - val_loss: 5.2747 - val_acc: 0.1691

Epoch 00201: val_loss did not improve
Epoch 202/250
 - 91s - loss: 1.4426 - acc: 0.4513 - val_loss: 6.7736 - val_acc: 0.1227

Epoch 00202: val_loss did not improve
Epoch 203/250
 - 91s - loss: 1.4354 - acc: 0.4577 - val_loss: 5.9688 - val_acc: 0.1405

Epoch 00203: val_loss did not improve
Epoch 204/250
 - 91s - loss: 1.4496 - acc: 0.4528 - val_loss: 6.1884 - val_acc: 0.1365

Epoch 00204: val_loss did not improve
Epoch 205/250
 - 91s - loss: 1.4569 - acc: 0.4527 - val_loss: 5.8960 - val_acc: 0.1414

Epoch 00205: val_loss did not improve
Epoch 206/250
 - 91s - loss: 1.4486 - acc: 0.4538 - val_loss: 6.3736 - val_acc: 0.1349
```

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Epoch 00206: val_loss did not improve
Epoch 207/250
 - 91s - loss: 1.4401 - acc: 0.4583 - val_loss: 5.5375 - val_acc: 0.1595

Epoch 00207: val_loss did not improve
Epoch 208/250
 - 91s - loss: 1.4366 - acc: 0.4559 - val_loss: 6.2870 - val_acc: 0.1375

Epoch 00208: val_loss did not improve
Epoch 209/250
 - 91s - loss: 1.4402 - acc: 0.4598 - val_loss: 6.8064 - val_acc: 0.1250

Epoch 00209: val_loss did not improve
Epoch 210/250
 - 91s - loss: 1.4444 - acc: 0.4549 - val_loss: 7.4511 - val_acc: 0.1102

Epoch 00210: val_loss did not improve
Epoch 211/250
 - 91s - loss: 1.4353 - acc: 0.4593 - val_loss: 6.9568 - val_acc: 0.1217

Epoch 00211: val_loss did not improve
Epoch 212/250
 - 91s - loss: 1.4319 - acc: 0.4609 - val_loss: 7.4496 - val_acc: 0.1115

Epoch 00212: val_loss did not improve
Epoch 213/250
 - 91s - loss: 1.4390 - acc: 0.4609 - val_loss: 6.9796 - val_acc: 0.1237

Epoch 00213: val_loss did not improve
Epoch 214/250
 - 91s - loss: 1.4312 - acc: 0.4599 - val_loss: 6.9015 - val_acc: 0.1227

Epoch 00214: val_loss did not improve
Epoch 215/250
 - 91s - loss: 1.4385 - acc: 0.4569 - val_loss: 7.2424 - val_acc: 0.1174

Epoch 00215: val_loss did not improve
Epoch 216/250
 - 91s - loss: 1.4335 - acc: 0.4651 - val_loss: 6.9293 - val_acc: 0.1234

Epoch 00216: val_loss did not improve
Epoch 217/250
 - 91s - loss: 1.4358 - acc: 0.4533 - val_loss: 5.6677 - val_acc: 0.1566

Epoch 00217: val_loss did not improve
Epoch 218/250
 - 91s - loss: 1.4250 - acc: 0.4626 - val_loss: 7.1653 - val_acc: 0.1197

Epoch 00218: val_loss did not improve
Epoch 219/250
 - 91s - loss: 1.4324 - acc: 0.4606 - val_loss: 7.5767 - val_acc: 0.1105

Epoch 00219: val_loss did not improve
Epoch 220/250
 - 91s - loss: 1.4184 - acc: 0.4675 - val_loss: 7.0707 - val_acc: 0.1230

Epoch 00220: val_loss did not improve
```

```
Epoch 221/250
 - 91s - loss: 1.4212 - acc: 0.4637 - val_loss: 7.2193 - val_acc: 0.1207

Epoch 00221: val_loss did not improve
Epoch 222/250
 - 91s - loss: 1.4207 - acc: 0.4637 - val_loss: 7.2862 - val_acc: 0.1194

Epoch 00222: val_loss did not improve
Epoch 223/250
 - 91s - loss: 1.4147 - acc: 0.4623 - val_loss: 7.6915 - val_acc: 0.1092

Epoch 00223: val_loss did not improve
Epoch 224/250
 - 91s - loss: 1.4234 - acc: 0.4653 - val_loss: 7.0755 - val_acc: 0.1240

Epoch 00224: val_loss did not improve
Epoch 225/250
 - 91s - loss: 1.4128 - acc: 0.4684 - val_loss: 7.2967 - val_acc: 0.1197

Epoch 00225: val_loss did not improve
Epoch 226/250
 - 91s - loss: 1.4288 - acc: 0.4651 - val_loss: 6.8917 - val_acc: 0.1276

Epoch 00226: val_loss did not improve
Epoch 227/250
 - 91s - loss: 1.4075 - acc: 0.4707 - val_loss: 6.7645 - val_acc: 0.1283

Epoch 00227: val_loss did not improve
Epoch 228/250
 - 91s - loss: 1.4054 - acc: 0.4741 - val_loss: 7.1932 - val_acc: 0.1214

Epoch 00228: val_loss did not improve
Epoch 229/250
 - 91s - loss: 1.4214 - acc: 0.4664 - val_loss: 7.4579 - val_acc: 0.1178

Epoch 00229: val_loss did not improve
Epoch 230/250
 - 91s - loss: 1.4120 - acc: 0.4656 - val_loss: 6.9060 - val_acc: 0.1289

Epoch 00230: val_loss did not improve
Epoch 231/250
 - 91s - loss: 1.3958 - acc: 0.4764 - val_loss: 7.4273 - val_acc: 0.1194

Epoch 00231: val_loss did not improve
Epoch 232/250
 - 91s - loss: 1.3951 - acc: 0.4712 - val_loss: 7.3787 - val_acc: 0.1204

Epoch 00232: val_loss did not improve
Epoch 233/250
 - 91s - loss: 1.4012 - acc: 0.4718 - val_loss: 7.0060 - val_acc: 0.1283

Epoch 00233: val_loss did not improve
Epoch 234/250
 - 91s - loss: 1.4090 - acc: 0.4683 - val_loss: 6.1004 - val_acc: 0.1546

Epoch 00234: val_loss did not improve
Epoch 235/250
```

```
 - 91s - loss: 1.4126 - acc: 0.4655 - val_loss: 6.7820 - val_acc: 0.1349

Epoch 00235: val_loss did not improve
Epoch 236/250
 - 91s - loss: 1.4123 - acc: 0.4694 - val_loss: 7.0669 - val_acc: 0.1283

Epoch 00236: val_loss did not improve
Epoch 237/250
 - 91s - loss: 1.3891 - acc: 0.4701 - val_loss: 6.4300 - val_acc: 0.1457

Epoch 00237: val_loss did not improve
Epoch 238/250
 - 91s - loss: 1.3962 - acc: 0.4707 - val_loss: 6.9898 - val_acc: 0.1283

Epoch 00238: val_loss did not improve
Epoch 239/250
 - 91s - loss: 1.4053 - acc: 0.4719 - val_loss: 6.2175 - val_acc: 0.1543

Epoch 00239: val_loss did not improve
Epoch 240/250
 - 91s - loss: 1.4040 - acc: 0.4715 - val_loss: 6.8571 - val_acc: 0.1352

Epoch 00240: val_loss did not improve
Epoch 241/250
 - 91s - loss: 1.3931 - acc: 0.4752 - val_loss: 7.4371 - val_acc: 0.1211

Epoch 00241: val_loss did not improve
Epoch 242/250
 - 91s - loss: 1.3990 - acc: 0.4729 - val_loss: 7.2275 - val_acc: 0.1266

Epoch 00242: val_loss did not improve
Epoch 243/250
 - 91s - loss: 1.3914 - acc: 0.4730 - val_loss: 7.4708 - val_acc: 0.1217

Epoch 00243: val_loss did not improve
Epoch 244/250
 - 91s - loss: 1.4023 - acc: 0.4701 - val_loss: 6.7369 - val_acc: 0.1385

Epoch 00244: val_loss did not improve
Epoch 245/250
 - 91s - loss: 1.3882 - acc: 0.4831 - val_loss: 7.4818 - val_acc: 0.1220

Epoch 00245: val_loss did not improve
Epoch 246/250
 - 91s - loss: 1.3882 - acc: 0.4721 - val_loss: 7.6308 - val_acc: 0.1178

Epoch 00246: val_loss did not improve
Epoch 247/250
 - 91s - loss: 1.3847 - acc: 0.4817 - val_loss: 7.3067 - val_acc: 0.1250

Epoch 00247: val_loss did not improve
Epoch 248/250
 - 91s - loss: 1.3890 - acc: 0.4752 - val_loss: 7.5943 - val_acc: 0.1194

Epoch 00248: val_loss did not improve
Epoch 249/250
 - 91s - loss: 1.3836 - acc: 0.4736 - val_loss: 6.6283 - val_acc: 0.1437
```

```
Epoch 00249: val_loss did not improve
Epoch 250/250
 - 91s - loss: 1.4040 - acc: 0.4716 - val_loss: 6.8485 - val_acc: 0.1395

Epoch 00250: val_loss did not improve
```

In [22]:
```
import matplotlib.pyplot as plt
import numpy as py

print (history)

# history for accuracy
plt.plot(history.history['acc'])
plt.plot(history.history['val_acc'])
plt.title('model accuracy')
plt.ylabel('accuracy')
plt.xlabel('epoch')
plt.legend(['train', 'test'], loc='upper left')
plt.show()

#  history for loss
plt.plot(history.history['loss'])
plt.plot(history.history['val_loss'])
plt.title('model loss')
plt.ylabel('loss')
plt.xlabel('epoch')
plt.legend(['train', 'test'], loc='upper left')
plt.show()

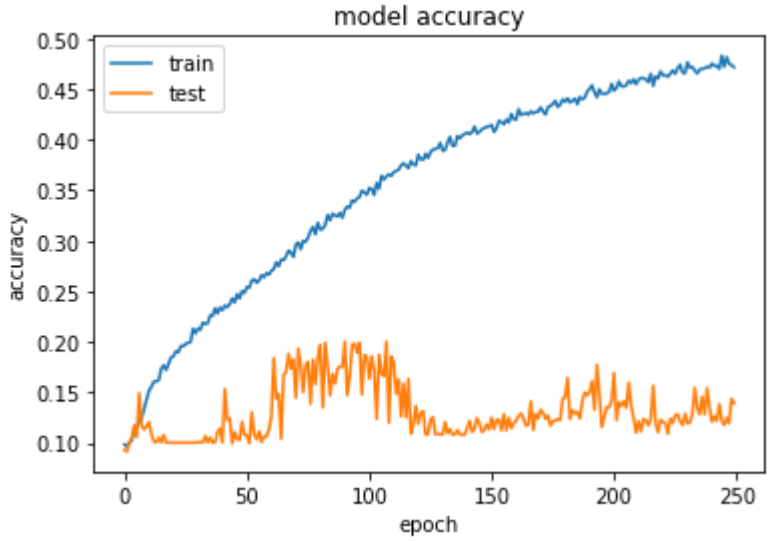
p = model.predict(test_tensors)
#print (p)
z=np.argmax(p,axis=1)
#print("z = ", z)
for i in range(1,15):
    img = np.squeeze(np.array(test_tensors[i]))
    displayImage(img)
    print("Predicted class", getClass(z[i]))
    print ("Actual Class", getClass(test_targets[i]))

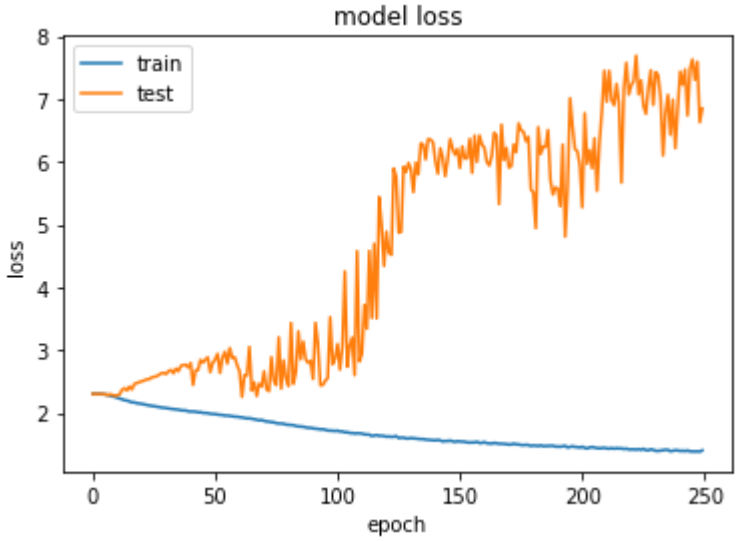
def predict_distraction():
    # get index of predicted distraction for each image in test set
    distraction_predictions = [np.argmax(model.predict(np.expand_dims(tensor,
axis=0))) for tensor in test_tensors]

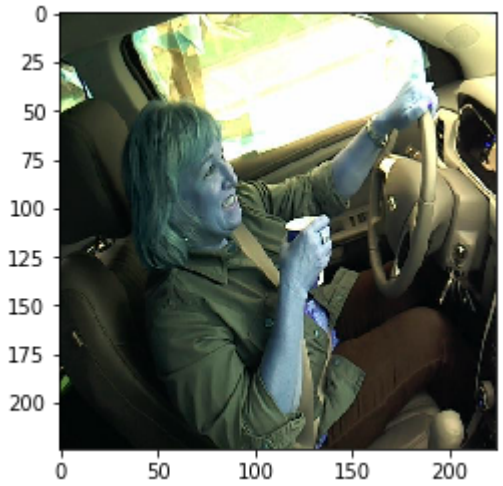
    # report test accuracy
    test_accuracy = 100*np.sum(np.array(distraction_predictions)==np.argmax(te
st_targets, axis=0))/len(distraction_predictions)
    print('Test accuracy: %.4f%%' % test_accuracy)
    return test_accuracy

predict_distraction()
```

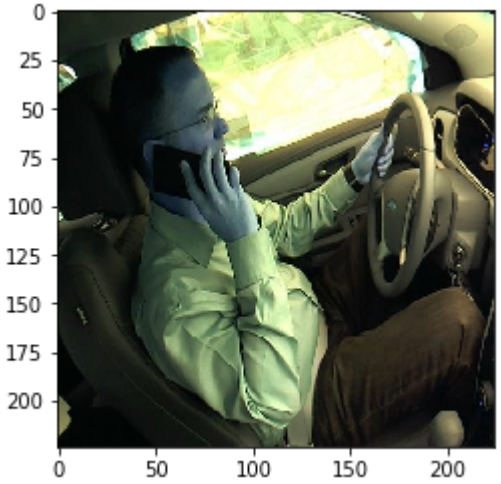
```
<keras.callbacks.History object at 0x000001D0CA40AFD0>
```



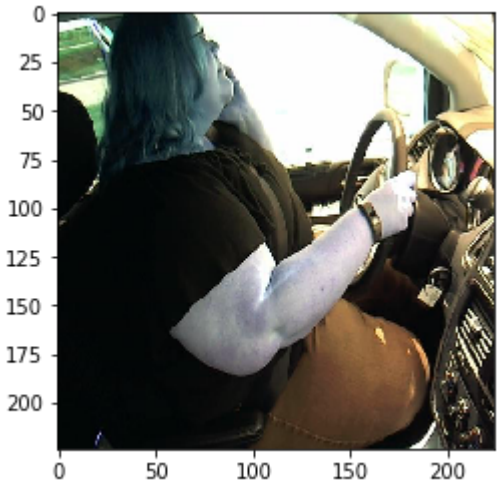




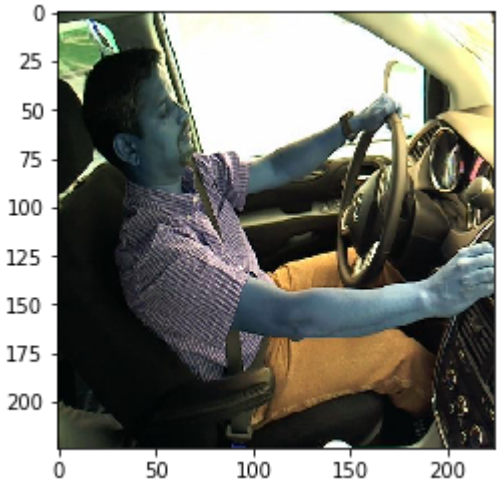

```
Predicted class talking on the phone - right
Actual Class drinking
```



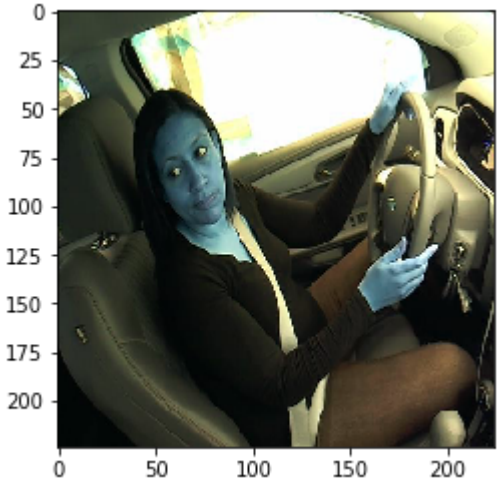

```
Predicted class talking on the phone - right
Actual Class talking on the phone - right
```



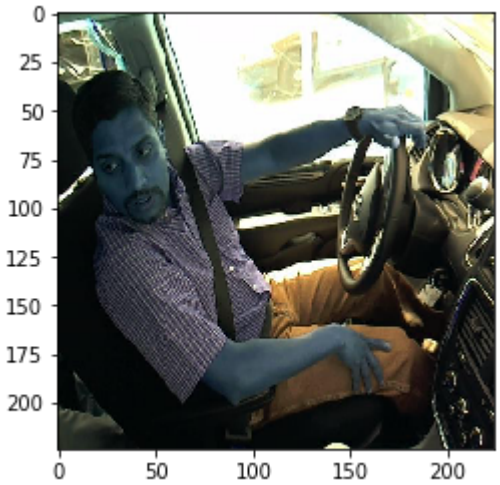

```
Predicted class operating the radio
Actual Class talking on the phone - left
```



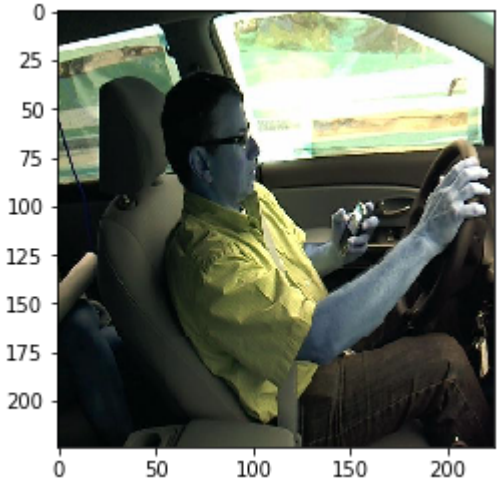

```
Predicted class operating the radio
Actual Class operating the radio
```



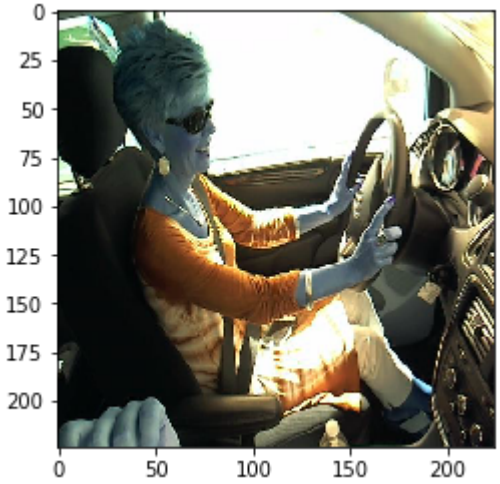

```
Predicted class operating the radio
Actual Class talking to passenger
```



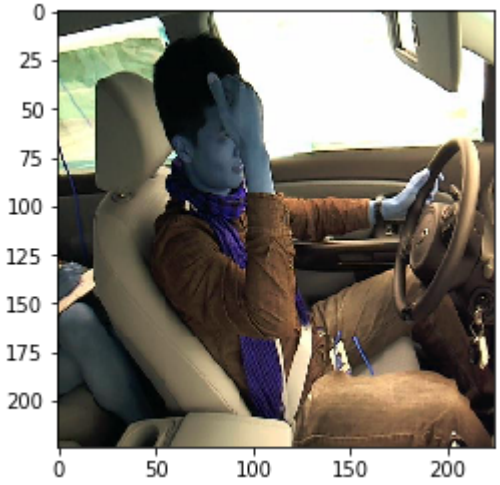

```
Predicted class operating the radio
Actual Class talking to passenger
```



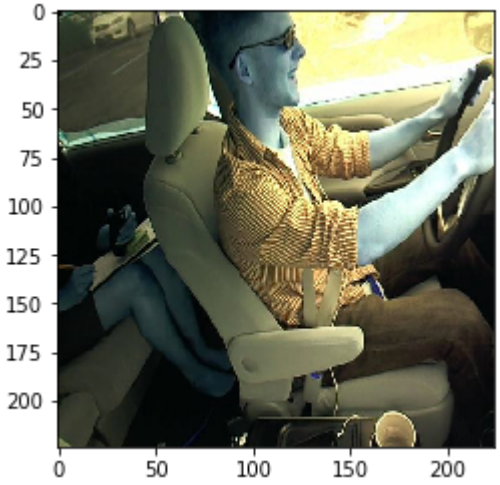

```
Predicted class operating the radio
Actual Class texting - left
```



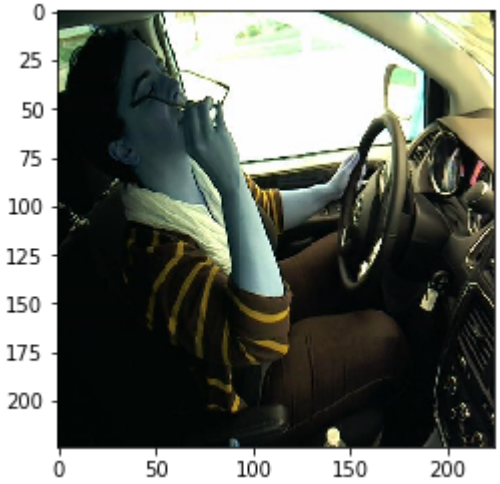

```
Predicted class operating the radio
Actual Class safe driving
```



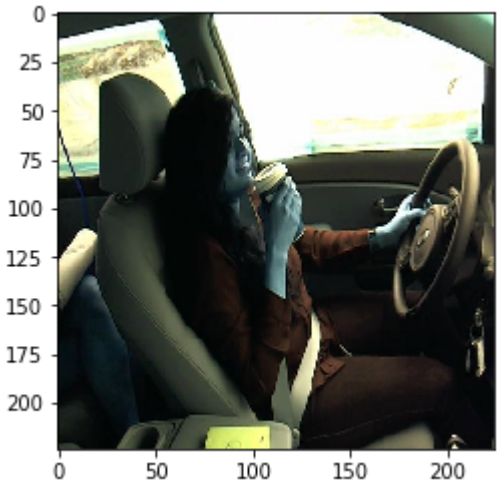

```
Predicted class operating the radio
Actual Class hair and makeup
```



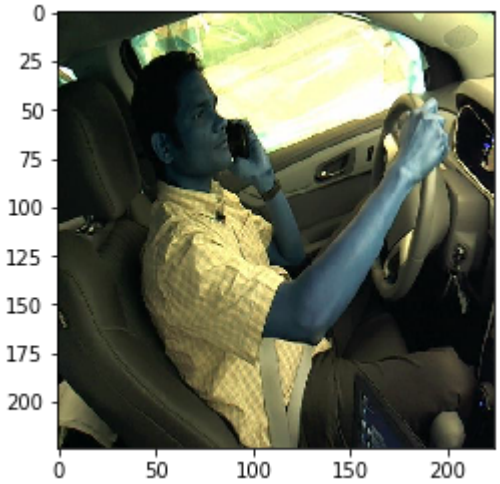

```
Predicted class operating the radio
Actual Class safe driving
```



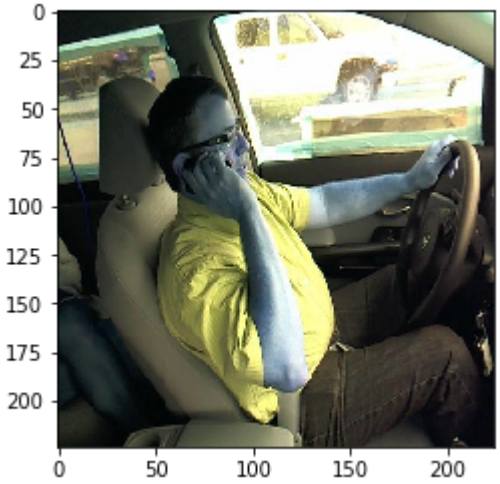

```
Predicted class hair and makeup
Actual Class hair and makeup
```




```
Predicted class talking on the phone - right
Actual Class drinking
```




```
Predicted class operating the radio
Actual Class talking on the phone - left
```




```
Predicted class operating the radio
Actual Class talking on the phone - right
Test accuracy: 84.5789%
```

Out[22]: 84.578947368421055