In [1]:

```
print("""
Immadi Shyam Prasad    (AM.EN.U4CSE19164)
D B R S Praneeth Varma (AM.EN.U4CSE19265)
D S K Phani Chyavan    (AM.EN.U4CSE19163)
""")
```

```
Immadi Shyam Prasad    (AM.EN.U4CSE19164)
D B R S Praneeth Varma (AM.EN.U4CSE19265)
D S K Phani Chyavan    (AM.EN.U4CSE19163)
```

In [1]:

```
import torch
import torchvision
from torchvision import transforms, datasets
import torch.nn as nn
import torch.nn.functional as F
import torch.optim as optim
from torch.autograd import Variable
from torch.utils.data import DataLoader
from torch.utils.data import sampler
from torch.utils.data import random_split
from torch.utils.data import SubsetRandomSampler
from random import sample


import matplotlib.pyplot as plt

import glob
from PIL import Image as I

import pandas as pd

import os

import numpy as np

import timeit
```

In [2]:

```
pwd
```

Out[2]:

```
'/mnt/batch/tasks/shared/LS_root/mounts/clusters/mmahadevareddy1/code/User
s/mmahadevareddy/cvision/project1'
```

In [3]:

```
#https://www.kaggle.com/c/state-farm-distracted-driver-detection/data

#path of test,train,validation
train_dataset_path = "/mnt/batch/tasks/shared/LS_root/mounts/clusters/mmahade
test_dataset_path = "/mnt/batch/tasks/shared/LS_root/mounts/clusters/mmahadev
val_dataset_path = "/mnt/batch/tasks/shared/LS_root/mounts/clusters/mmahadeva



mean = [0.3124, 0.3782, 0.3708] # found by caliculation net.batch_mean_and_sa
std = [0.2778, 0.3213, 0.3222]

#data argumentaion resizing,normalizing,converting to tensor

train_transforms = transforms.Compose([
    transforms.Resize((224,224)),
    transforms.ToTensor(),
    transforms.Normalize(torch.Tensor(mean),
    torch.Tensor(std))
])

test_transforms = transforms.Compose([
    transforms.Resize((224,224)),
    transforms.ToTensor(),
    transforms.Normalize(torch.Tensor(mean),
    torch.Tensor(std))
])
val_transforms = transforms.Compose([
    transforms.Resize((224,224)),
    transforms.ToTensor(),
    transforms.Normalize(torch.Tensor(mean),
    torch.Tensor(std))
])


train_dataset = datasets.ImageFolder(root=train_dataset_path,transform=train_
test_dataset = datasets.ImageFolder(root=test_dataset_path,transform=test_tra
val_dataset = datasets.ImageFolder(root=val_dataset_path,transform=val_transf

#data loading
train_loader = torch.utils.data.DataLoader(dataset = train_dataset,batch_size
test_loader = torch.utils.data.DataLoader(dataset = test_dataset,batch_size=1
val_loader = torch.utils.data.DataLoader(dataset = val_dataset,batch_size=10
```

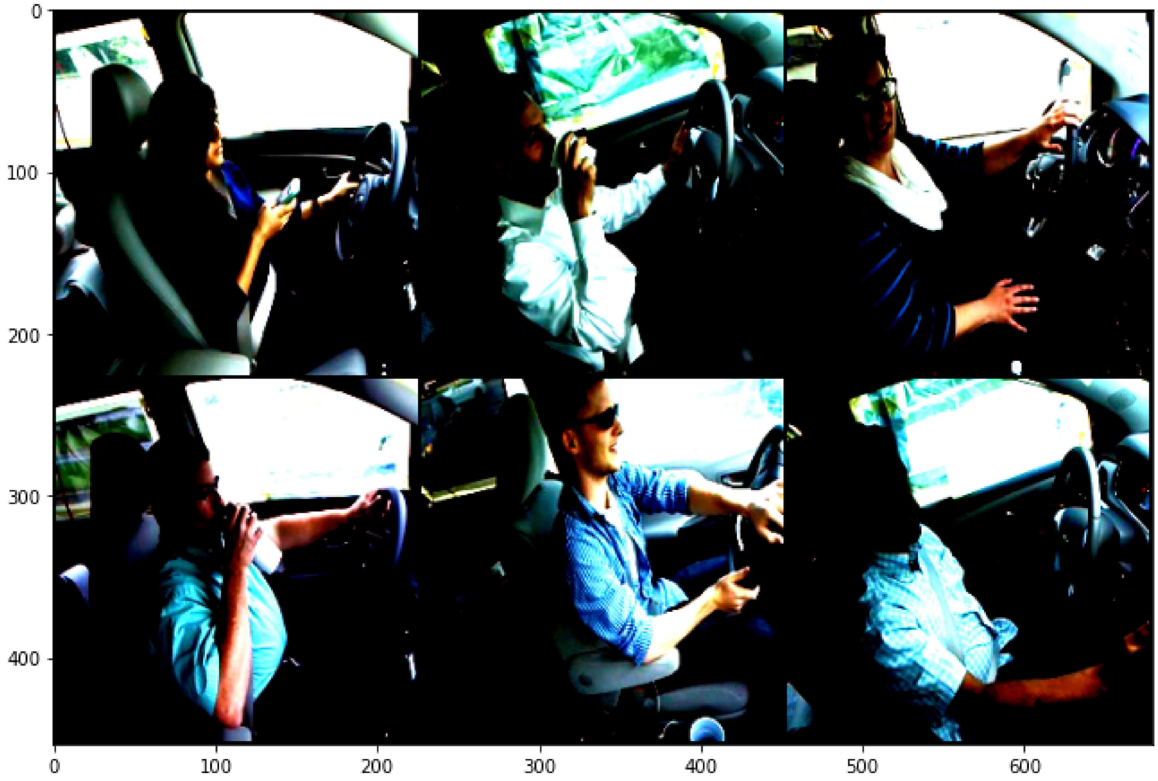
In [4]:

```
#function for printing images in grid
def show_transformed_images(dataset):
  loader = torch.utils.data.DataLoader(dataset, batch_size=6,shuffle=True)
  for data in loader:
    images , labels = data
    break
  print(labels)
  print(images.view(-1,224*224).shape)
  grid = torchvision.utils.make_grid(images,nrow=3)
  plt.figure(figsize=(11,11))
  plt.imshow(np.transpose(grid,(1,2,0)))
  plt.show()


show_transformed_images(train_dataset)
```

```
Clipping input data to the valid range for imshow with RGB data ([0..1] for
floats or [0..255] for integers).

tensor([1, 6, 9, 6, 0, 5])
torch.Size([18, 50176])
```



In [5]:

```
torch.cuda.is_available()
```

Out[5]:

```
True
```

In [6]:

```
def my_plot(epochs, loss,title1,x_label1,y_label1):
    plt.plot(epochs, loss)
    plt.title(title1)
    plt.xlabel(x_label1)
    plt.ylabel(y_label1)
    return plt.show()
def just_plot(accu,accu1,title1,y_label1):
    epochs = range(1,4)
    plt.plot(epochs, accu, 'g', label='Training accuracy')
    plt.plot(epochs, accu1, 'b', label='validation accuracy')
    plt.title(title1)
    plt.xlabel('Epochs')
    plt.ylabel(y_label1)
    plt.legend()
    return plt.show()
```

In [7]:

```


num_classes = 10
net = torchvision.models.alexnet()
net.fc = nn.Linear(100, num_classes)
gpu_net = net.to('cuda')

import torch.optim as optim
from sklearn.metrics import accuracy_score

criterion = nn.CrossEntropyLoss()
optimizer = optim.SGD(gpu_net.parameters(), lr=0.001, momentum=0.9, nesterov=
```

In [8]:

```
train_loss=  []
train_accuracy=[]

num_epochs = 3
for epoch in range(num_epochs):  # Loop over the dataset multiple times
    epoch_loss= []
    running_train_loss = 0.0
    total=0
    correct = 0
    print('train load')
    for i, data in enumerate(train_loader):
        # get the inputs; data is a list of [inputs, labels]
        inputs, labels = data
        inputs = inputs.to('cuda')
        labels = labels.to('cuda')

        # zero the parameter gradients
        optimizer.zero_grad()

        # forward + backward + optimize
        outputs = gpu_net(inputs)

        loss = criterion(outputs, labels)
        epoch_loss.append(loss.item())


        loss.backward()
        optimizer.step()

        for idx, k in enumerate(outputs):
          if torch.argmax(k) == labels[idx]:
            correct += 1
          total += 1

        # print statistics
        running_train_loss += loss.item()
        if i % 50 == 49:    # print every 50 mini-batches
            print('[%d, %5d] Train loss: %.3f' %
                  (epoch + 1, i + 1, running_train_loss / 50))
            running_train_loss = 0.0

    train_accuracy.append(round(correct/total,3))
    train_loss.append(sum(epoch_loss)/len(epoch_loss))
    running_val_loss = 0.0



print('Finished Training')
```

```
[1,  1200] Train loss: 1.400
train load
[2,    50] Train loss: 1.273
[2,   100] Train loss: 1.289
```

```
[2,   100] Train loss: 1.289
[2,   150] Train loss: 1.207
[2,   200] Train loss: 1.220
[2,   250] Train loss: 1.226
[2,   300] Train loss: 1.022
[2,   350] Train loss: 0.918
[2,   400] Train loss: 0.987
[2,   450] Train loss: 0.996
[2,   500] Train loss: 0.982
[2,   550] Train loss: 0.944
[2,   600] Train loss: 0.829
[2,   650] Train loss: 0.823
[2,   700] Train loss: 0.743
[2,   750] Train loss: 0.725
[2,   800] Train loss: 0.606
[2,   850] Train loss: 0.734
[2,   900] Train loss: 0.701
```

In [9]:

```
val_loss=  []
val_accuracy=[]

num_epochs = 3
for epoch in range(num_epochs):
    print('val load')
    epoch_loss= []
    running_val_loss = 0.0
    correct = 0
    total=0
    for i, data in enumerate(val_loader):
        # get the inputs; data is a list of [inputs, labels]
        inputs, labels = data
        inputs = inputs.to('cuda')
        labels = labels.to('cuda')

        # zero the parameter gradients
        optimizer.zero_grad()

        # forward + backward + optimize
        outputs = gpu_net(inputs)

        loss = criterion(outputs, labels)
        epoch_loss.append(loss.item())
        loss.backward()
        optimizer.step()
        for idx, j in enumerate(outputs):
          if torch.argmax(j) == labels[idx]:
            correct += 1
          total += 1

        running_train_loss += loss.item()
        if i % 50 == 49:    # print every 50 mini-batches
            print('[%d, %5d] Train loss: %.3f' %
                  (epoch + 1, i + 1, running_train_loss / 50))
            running_train_loss = 0.0


    val_accuracy.append(round(correct/total,3))
    val_loss.append(sum(epoch_loss)/len(epoch_loss))
    running_val_loss = 0.0
print('validation')
```

```
[1,   100] Train loss: 0.301
[1,   150] Train loss: 0.279
[1,   200] Train loss: 0.326
[1,   250] Train loss: 0.265
[1,   300] Train loss: 0.339
val load
[2,    50] Train loss: 0.448
[2,   100] Train loss: 0.150
[2,   150] Train loss: 0.250
[2,   200] Train loss: 0.225
[2,   250] Train loss: 0.197
[2,   300] Train loss: 0.208
val load
[3,    50] Train loss: 0.425
```

```
[3,   100] Train loss: 0.190
[3,   150] Train loss: 0.138
[3,   200] Train loss: 0.150
[3,   250] Train loss: 0.192
[3,   300] Train loss: 0.192
validation
```

In [11]:

```
print(train_accuracy,val_accuracy)
```

```
[0.232, 0.692, 0.864] [0.906, 0.935, 0.946]
```

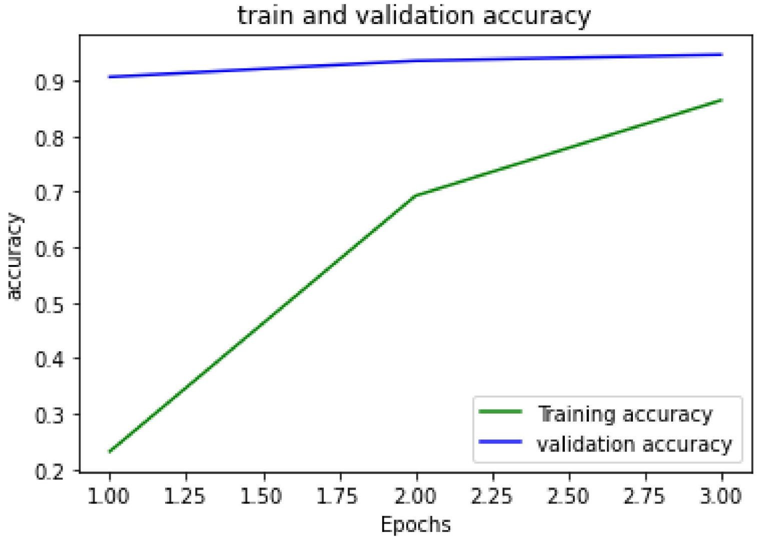
In [12]:

```
print(train_loss,val_loss)
```

```
[2.385819746556337, 0.8672663599325865, 0.41273387137468165] [0.29770814210
98237, 0.21012411083836632, 0.17033227367585466]
```

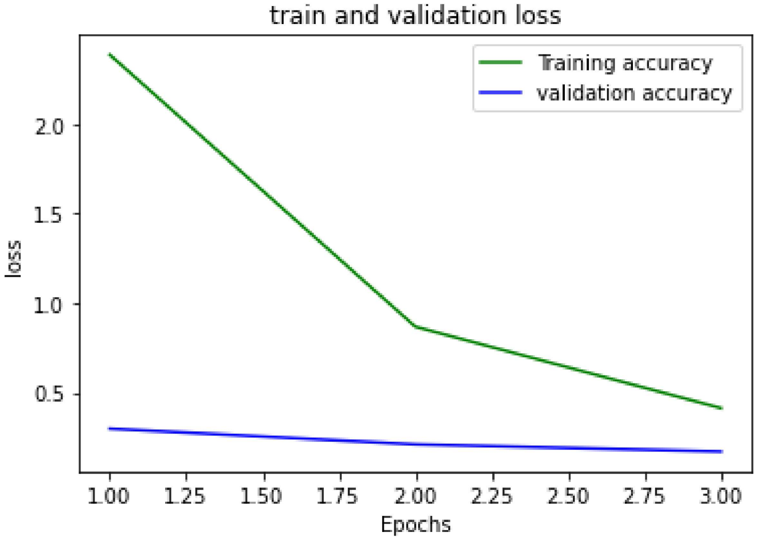
In [13]:

```
just_plot(train_accuracy, val_accuracy,"train and validation accuracy","accur
```



In [14]:

```
just_plot(train_loss, val_loss,"train and validation loss","loss")
```



In [15]:

```
#testing model
correct = 0
total = 0
with torch.no_grad():
    for data in test_loader:
        x, y = data
        output = gpu_net(x.to('cuda'))
        for idx, i in enumerate(output):
          if torch.argmax(i) == y[idx]:
            correct += 1
          total += 1
    print('accuracy:\t',round(correct/total,3))
```

```
accuracy:        0.937
```

In [16]:

```
x, y = next(iter(test_loader))
```

In [17]:

```
x[0]
```

Out[17]:

```
tensor([[[-0.8987, -0.8987, -0.8987,  ...,  2.1928,  2.2069,  1.8964],
         [-0.8987, -0.8987, -0.8987,  ...,  2.0940,  2.2493,  2.2493],
         [-0.8987, -0.8987, -0.8987,  ...,  1.8540,  2.0517,  2.1505],
         ...,
         [-0.7293, -0.7575, -0.7999,  ..., -0.9693, -0.9834, -0.9834],
         [-0.7716, -0.7999, -0.8422,  ..., -0.9834, -0.9834, -0.9834],
         [-0.8563, -0.8846, -0.9128,  ..., -0.9834, -0.9834, -0.9834]],

        [[-0.9696, -0.9696, -0.9696,  ...,  1.9231,  1.8742,  1.5813],
         [-0.9696, -0.9696, -0.9696,  ...,  1.8620,  1.9231,  1.9109],
         [-0.9696, -0.9696, -0.9696,  ...,  1.7034,  1.8376,  1.8986],
         ...,
         [-0.7621, -0.7865, -0.8231,  ..., -1.0672, -1.0795, -1.0672],
         [-0.7987, -0.8231, -0.8598,  ..., -1.0795, -1.0795, -1.0672],
         [-0.8720, -0.8964, -0.9208,  ..., -1.0795, -1.0795, -1.0672]],

        [[-1.0048, -1.0048, -1.0048,  ...,  1.6729,  1.6972,  1.4538],
         [-1.0048, -1.0048, -1.0048,  ...,  1.5999,  1.7581,  1.7703],
         [-1.0048, -1.0048, -1.0048,  ...,  1.4295,  1.6120,  1.6972],
         ...,
         [-0.7370, -0.7614, -0.7979,  ..., -1.0291, -1.0535, -1.0656],
         [-0.7735, -0.7979, -0.8344,  ..., -1.0413, -1.0535, -1.0656],
         [-0.8466, -0.8709, -0.8952,  ..., -1.0413, -1.0535, -1.0656]]])
```

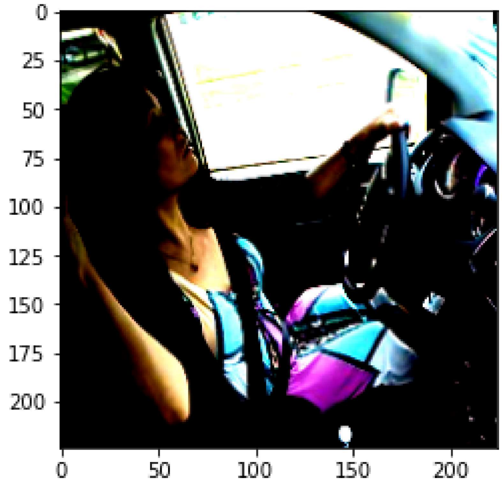
In [18]:

```
#checking for single images

print(y[8])
plt.imshow(np.transpose(x[8],(1,2,0)))
plt.show()
```

```
Clipping input data to the valid range for imshow with RGB data ([0..1] for
floats or [0..255] for integers).

tensor(8)
```



In [19]:

```python
output = gpu_net(x.to('cuda'))
print(torch.max(output.data,1))
for idx, i in enumerate(output):
    if torch.argmax(i) == y[idx]:
        print('  correct',torch.argmax(i),y[idx])
    else:
        print('uncorrect',torch.argmax(i),y[idx])
```

```
torch.return_types.max(
values=tensor([17.5003, 28.5840, 41.8555, 18.6444, 28.8190, 28.0235, 20.824
3, 21.7966,
        25.3960, 29.9994], device='cuda:0'),
indices=tensor([3, 4, 6, 9, 3, 3, 7, 7, 8, 7], device='cuda:0'))
uncorrect tensor(3, device='cuda:0') tensor(0)
  correct tensor(4, device='cuda:0') tensor(4)
  correct tensor(6, device='cuda:0') tensor(6)
  correct tensor(9, device='cuda:0') tensor(9)
  correct tensor(3, device='cuda:0') tensor(3)
  correct tensor(3, device='cuda:0') tensor(3)
  correct tensor(7, device='cuda:0') tensor(7)
  correct tensor(7, device='cuda:0') tensor(7)
  correct tensor(8, device='cuda:0') tensor(8)
  correct tensor(7, device='cuda:0') tensor(7)
```

In [ ]:

In [ ]: