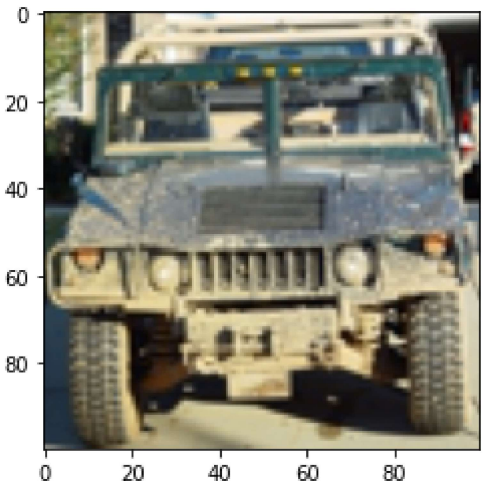
In [ ]:
```
!gdown 11gpLZOKw5-kJjYEaSaj613zaCA51eXVH
!unzip down_imagenet.zip -d down_imagenet
```

```
Streaming output truncated to the last 5000 lines.
  inflating: down_imagenet/train/car/car_0443.jpg
  inflating: down_imagenet/train/car/car_0444.jpg
  inflating: down_imagenet/train/car/car_0445.jpg
  inflating: down_imagenet/train/car/car_0446.jpg
  inflating: down_imagenet/train/car/car_0447.jpg
  inflating: down_imagenet/train/car/car_0448.jpg
  inflating: down_imagenet/train/car/car_0449.jpg
  inflating: down_imagenet/train/car/car_0450.jpg
  inflating: down_imagenet/train/car/car_0451.jpg
  inflating: down_imagenet/train/car/car_0452.jpg
  inflating: down_imagenet/train/car/car_0453.jpg
  inflating: down_imagenet/train/car/car_0454.jpg
  inflating: down_imagenet/train/car/car_0455.jpg
  inflating: down_imagenet/train/car/car_0456.jpg
  inflating: down_imagenet/train/car/car_0457.jpg
  inflating: down_imagenet/train/car/car_0458.jpg
  inflating: down_imagenet/train/car/car_0459.jpg
  inflating: down_imagenet/train/car/car_0460.jpg
```

In [ ]:
```
import os, random, string, cv2
import numpy as np
import matplotlib.pyplot as plt
from PIL import Image


# def genData(datapath, savepath):
#     with open(datapath) as fh:
#         for row in fh.read().split('\n')[1:]:
#             try:
#                 row = tuple(map(lambda val: int(float(val)), row.split(','
#             except:
#                 continue
#             label, img = row[0], Image.fromarray(np.reshape(row[1:], (28,2
#             path = savepath+'/'+str(label)
#             if not os.path.exists(path):
#                 os.makedirs(path)
#             img.save(path+'/'+''.join(random.choice(string.ascii_letters) 
#
# https://stackoverflow.com/questions/62581171/how-to-implement-kaze-and-a-k
#
# train = genData('Downloads/New folder/sign_mnist_train/sign_mnist_train.cs
# test = genData('Downloads/New folder/sign_mnist_test/sign_mnist_test.csv',
```

In [ ]:
```
plt.imshow(Image.open('/content/down_imagenet/train/car/car_0000.jpg'))
plt.show()
```

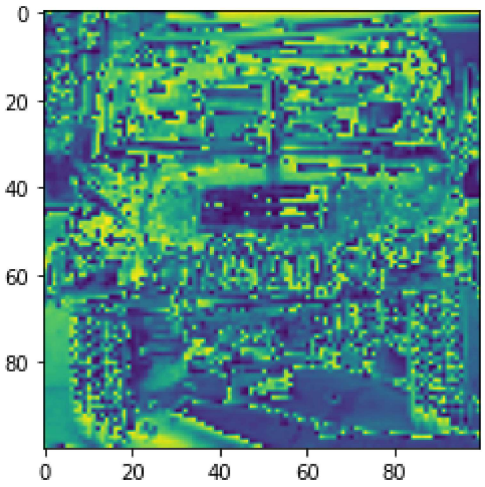


In [44]:
```
def single_channel_image(img):
  (B, G, R) = cv2.split(img)
  return B+G+R

plt.imshow(single_channel_image(cv2.imread('/content/down_imagenet/train/car
```

```
---------------------------------------------------------------------------
error                                     Traceback (most recent call last)
<ipython-input-44-be9b7fee2bee> in <module>
      5 plt.imshow(single_channel_image(cv2.imread('/content/down_imagenet/trai
n/car/car_0000.jpg')))
      6
----> 7 cv2.cvtColor(img, cv2.COLOR_BGR2GRAY)

error: OpenCV(4.6.0) :-1: error: (-5:Bad argument) in function 'cvtColor'
> Overload resolution failed:
>  - src is not a numpy array, neither a scalar
>  - Expected Ptr<cv::UMat> for argument 'src'
```



In [46]:
```
datasetdir = '/content/down_imagenet'
import os
os.chdir(datasetdir)

# import the needed packages
import matplotlib.pyplot as plt
import matplotlib.image as img
import tensorflow.keras as keras
import numpy as np
```

In [47]:

```
from tensorflow.keras.preprocessing.image import ImageDataGenerator

batch_size = 64

def generators(shape, preprocessing):
    '''Create the training and validation datasets for
    a given image shape.
    '''
    imgdatagen = ImageDataGenerator(
        preprocessing_function = preprocessing,
        horizontal_flip = True,
        validation_split = 0.1,
    )

    height, width = shape

    train_dataset = imgdatagen.flow_from_directory(
        datasetdir+'/train/',
        target_size = (height, width),
        class_mode = 'categorical',
        batch_size = batch_size
    )

    val_dataset = imgdatagen.flow_from_directory(
        datasetdir+'/test/',
        target_size = (height, width),
        class_mode = 'categorical',
        batch_size = batch_size
    )
    return train_dataset, val_dataset
```

In [48]:
```
def plot_history(history, yrange):
    '''Plot loss and accuracy as a function of the epoch,
    for the training and validation datasets.
    '''
    acc = history.history['acc']
    val_acc = history.history['val_acc']
    loss = history.history['loss']
    val_loss = history.history['val_loss']

    # Get number of epochs
    epochs = range(len(acc))

    # Plot training and validation accuracy per epoch
    plt.plot(epochs, acc)
    plt.plot(epochs, val_acc)
    plt.title('Training and validation accuracy')
    plt.ylim(yrange)

    # Plot training and validation loss per epoch
    plt.figure()

    plt.plot(epochs, loss)
    plt.plot(epochs, val_loss)
    plt.title('Training and validation loss')

    plt.show()
```

In [49]:
```
resnet50 = keras.applications.resnet50
conv_model = resnet50.ResNet50(weights='imagenet', include_top=False)
conv_model.summary()
```

...

In [50]:
```
def preprocess_input(img): #appling on the dataset
  img = np.array(img, dtype=np.uint8)
  query_img = single_channel_image(img)
  query_img = cv2.cvtColor(img, cv2.COLOR_BGR2GRAY)
  akaze=cv2.AKAZE_create()
  queryKeypoints, queryDescriptors = akaze.detectAndCompute(query_img,None)
  img = cv2.drawKeypoints(img,queryKeypoints,outImage = None,color=(255,0,0)
  return resnet50.preprocess_input(img)
```

In [51]:
```
train_dataset, val_dataset = generators((100, 100), preprocessing=preprocess
```

```
Found 5959 images belonging to 8 classes.
Found 940 images belonging to 8 classes.
```

In [52]:
```
conv_model = resnet50.ResNet50(weights='imagenet', include_top=False, input_
```

In [53]:
```
# flatten the output of the convolutional part:
x = keras.layers.Flatten()(conv_model.output)
# hidden layers
x = keras.layers.Dense(1024, activation='relu')(x)
x = keras.layers.Dense(256, activation='relu')(x)
x = keras.layers.Dense(64, activation='relu')(x)
# softmax
predictions = keras.layers.Dense(24, activation='softmax')(x)

# creating the full model:
full_model = keras.models.Model(inputs=conv_model.input, outputs=predictions
full_model.summary()
```

```
Model: "model_2"
_________________________________________________________________
 Layer (type)                Output Shape              Param #   Connected to
==================================================================================
 input_5 (InputLayer)        [(None, 100, 100, 3       0         []
                             )]

 conv1_pad (ZeroPadding2D)   (None, 106, 106, 3)       0         ['input_5[0]
[0]']

 conv1_conv (Conv2D)         (None, 50, 50, 64)        9472      ['conv1_pad
[0][0]']

 conv1_bn (BatchNormalization)  (None, 50, 50, 64)     256       ['conv1_conv
[0][0]']

 conv1_relu (Activation)      (None, 50, 50, 64)       0         ['conv1_bn
```

In [54]:
```
for layer in conv_model.layers:
    layer.trainable = False
```

In [ ]:
```
full_model.summary()
```

In [57]:
```
full_model.compile(loss='categorical_crossentropy',
                   optimizer=keras.optimizers.Adamax(lr=0.001),
                   metrics=['acc'])
early_stopping = keras.callbacks.EarlyStopping('val_loss', mode='auto', pati
history = full_model.fit(
    train_dataset,
    validation_data = val_dataset,
    workers=10,
    steps_per_epoch = 45,
    epochs=10,
    callbacks=[early_stopping],
)
```

```
Epoch 1/10
```

In [39]:
```
plot_history(history, yrange=(0.9,1))
```

```
---------------------------------------------------------------------------
NameError                                 Traceback (most recent call last)
<ipython-input-39-5b1ba4aeab55> in <module>
----> 1 plot_history(history, yrange=(0.9,1))

NameError: name 'history' is not defined
```

In [ ]:
```
full_model.save('/content/model.h5')
```

```
/usr/local/lib/python3.7/dist-packages/keras/engine/functional.py:1410: CustomM
askWarning: Custom mask layers require a config and must override get_config. W
hen loading, the custom mask layer must be passed to the custom_objects argumen
t.
  layer_config = serialize_layer_fn(layer)
```

In [ ]:

```
def predict_class(model, img_path, input_shape, class_indices=None):
    class_indices = {value: key for key, value in class_indices.items()} if
    data = np.expand_dims(preprocess_input(cv2.resize(cv2.imread(img_path),
    return class_indices.get(np.argmax(model.predict(data))) if class_indice

predict_class(full_model, "/content/sign_mnist/test/15/AktgOSSxjQ.png", (32,
```

Out[17]: '23'