Pegah givehchian- Project 4

In [2]:
```
import random
import numpy as np
import pandas as pd
import tensorflow as tf
import matplotlib.pyplot as plt
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense, Conv2D, MaxPool2D, Flatten,Bat
from tensorflow.keras.models import Model
from tensorflow.keras import layers, losses, models

```

In [3]:
```
(x_total, y_total), (x_test, y_test) = tf.keras.datasets.cifar10.load_dat
```

In [4]:
```
class_arr = ["airplane", "automobile", "bird", "cat", "deer", "dog", "fro
```

In [5]:
```
x_total.shape
```

Out[5]: (50000, 32, 32, 3)

In [6]:
```
y_total.shape
```

Out[6]: (50000, 1)

In [7]:
```
1 x_total[0]
```

Out[7]:
```
array([[[ 59,  62,  63],
        [ 43,  46,  45],
        [ 50,  48,  43],
        ...,
        [158, 132, 108],
        [152, 125, 102],
        [148, 124, 103]],

       [[ 16,  20,  20],
        [  0,   0,   0],
        [ 18,   8,   0],
        ...,
        [123,  88,  55],
        [119,  83,  50],
        [122,  87,  57]],

       [[ 25,  24,  21],
        [ 16,   7,   0],
        [ 49,  27,   8],
        ...,
        [118,  84,  50],
        [120,  84,  50],
        [109,  73,  42]],

       ...,

       [[208, 170,  96],
        [201, 153,  34],
        [198, 161,  26],
        ...,
        [160, 133,  70],
        [ 56,  31,   7],
        [ 53,  34,  20]],

       [[180, 139,  96],
        [173, 123,  42],
        [186, 144,  30],
        ...,
        [184, 148,  94],
        [ 97,  62,  34],
        [ 83,  53,  34]],

       [[177, 144, 116],
        [168, 129,  94],
        [179, 142,  87],
        ...,
        [216, 184, 140],
        [151, 118,  84],
        [123,  92,  72]]], dtype=uint8)
```

Normalize

In [8]:
```
x_total = x_total.astype('float32')/255
x_test = x_test.astype('float32')/255
```

In [9]:
```
def plot_image(x):
    plt.figure(figsize = (10,2))
    plt.imshow(x)
```

In [10]:
```
x_1000 = []
y_1000 = []
for i in range(1000):
    j = random.randrange(50000)
    x_1000.append(x_total[j])
    y_1000.append(y_total[j])
```

In [11]:
```
x_train = []
x_1 = []
x_2 = []
y_train = []

for i in range(1000):
    n1 = random.randrange(1000)
    n2 = random.randrange(1000)
    x_train.append((x_1000[n1] + x_1000[n2])/2)
    x_1.append(x_1000[n1])
    x_2.append(x_1000[n2])
    y_train.append([y_1000[n1][0], y_1000[n2][0]])
```

In [12]:
```
x_train[0].shape
```

Out[12]: (32, 32, 3)

In [13]:
```
len(x_train)
```

Out[13]: 1000

In [14]:
```
x_train = np.array(x_train)
x_1 = np.array(x_1)
x_2 = np.array(x_2)
y_train = np.array(y_train)
```

In [15]:
```
latent_dim = 64

class Autoencoder(Model):
    def __init__(self, latent_dim):
        super(Autoencoder, self).__init__()
        self.latent_dim = latent_dim
        self.encoder = tf.keras.Sequential([
            layers.Conv2D(16,(3,3), activation='relu', padding='same'),
            layers.MaxPooling2D((2,2), padding='same'),
            layers.Conv2D(8,(3,3), activation='relu', padding='same'),
            layers.MaxPooling2D((2,2), padding='same'),
            layers.Conv2D(8,(3,3), activation='relu', padding='same'),
            layers.MaxPooling2D((2,2), padding='same', name='encoder')
        ])
        self.decoder1 = tf.keras.Sequential([
            layers.Conv2D(8, (3, 3), activation='relu', padding='same'),
            layers.UpSampling2D((2, 2)),
            layers.Conv2D(8, (3, 3), activation='relu', padding='same'),
            layers.UpSampling2D((2, 2)),
            layers.Conv2D(16, (3, 3), activation='relu',padding='same'),
            layers.UpSampling2D((2, 2)),
            layers.Conv2D(3, (3, 3), activation='sigmoid', padding='same'
        ])
        self.decoder2 = tf.keras.Sequential([
            layers.Conv2D(8, (3, 3), activation='relu', padding='same'),
            layers.UpSampling2D((2, 2)),
            layers.Conv2D(8, (3, 3), activation='relu', padding='same'),
            layers.UpSampling2D((2, 2)),
            layers.Conv2D(16, (3, 3), activation='relu',padding='same'),
            layers.UpSampling2D((2, 2)),
            layers.Conv2D(3, (3, 3), activation='sigmoid', padding='same'
        ])

    def call(self, x):
        encoded = self.encoder(x)
        decoded1 = self.decoder1(encoded)
        decoded2 = self.decoder2(encoded)
        return [decoded1, decoded2]

autoencoder = Autoencoder(latent_dim)
```

In [16]:
```
autoencoder.compile(optimizer='adam', loss=losses.MeanSquaredError(), met

```

In [17]:
```
autoencoder.fit(x_train, [x_1, x_2],
                epochs=100)
```

```
Epoch 1/100
32/32 [==============================] - 7s 99ms/step - loss: 0.1279 - ou
tput_1_loss: 0.0639 - output_2_loss: 0.0641 - output_1_accuracy: 0.3556 -
output_2_accuracy: 0.4009
Epoch 2/100
32/32 [==============================] - 3s 108ms/step - loss: 0.1189 - o
utput_1_loss: 0.0593 - output_2_loss: 0.0596 - output_1_accuracy: 0.4179
- output_2_accuracy: 0.4892
Epoch 3/100
32/32 [==============================] - 4s 112ms/step - loss: 0.1048 - o
utput_1_loss: 0.0526 - output_2_loss: 0.0522 - output_1_accuracy: 0.4008
- output_2_accuracy: 0.4259
Epoch 4/100
32/32 [==============================] - 3s 99ms/step - loss: 0.0987 - ou
tput_1_loss: 0.0499 - output_2_loss: 0.0488 - output_1_accuracy: 0.3885 -
output_2_accuracy: 0.4384
Epoch 5/100
32/32 [==============================] - 3s 90ms/step - loss: 0.0960 - ou
tput_1_loss: 0.0486 - output_2_loss: 0.0474 - output_1_accuracy: 0.3739 -
```

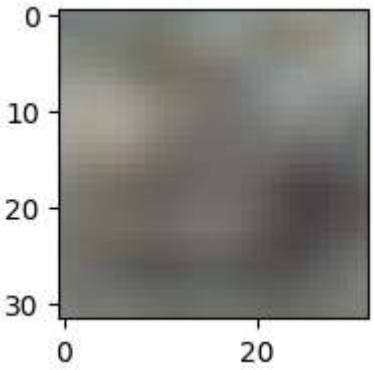
In [18]:
```
autoencoder.summary()
```

```
Model: "autoencoder"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 sequential (Sequential)     (None, 4, 4, 8)           2192

 sequential_1 (Sequential)   (None, 32, 32, 3)         2771

 sequential_2 (Sequential)   (None, 32, 32, 3)         2771

=================================================================
Total params: 7,734
Trainable params: 7,734
Non-trainable params: 0
_________________________________________________________________
```

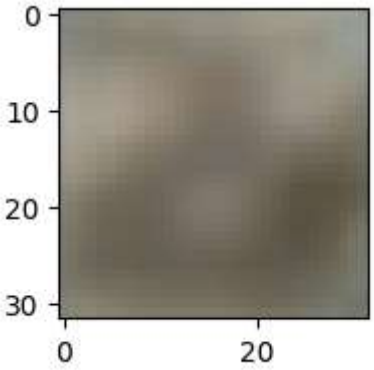
In [19]:
```
predicted = autoencoder.predict(x_train)
```

```
32/32 [==============================] - 1s 31ms/step
```

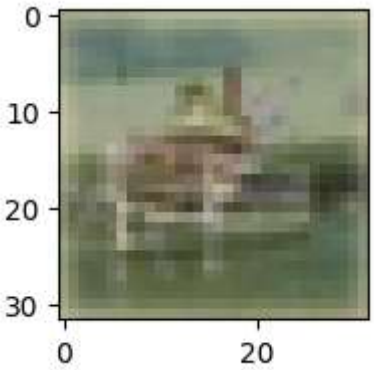
In [20]:
```
1 plot_image(predicted[0][12])
```



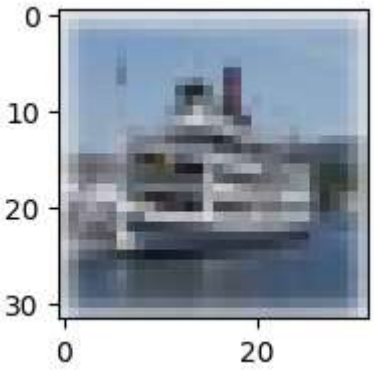
In [21]:
```
1 plot_image(predicted[1][12])
```



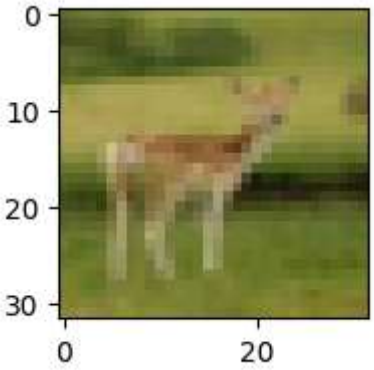
In [22]:
```
1 plot_image(x_train[12])
```



In [23]:
```
1 plot_image(x_1[12])
```



In [24]:
```
1 plot_image(x_2[12])
```



Here i have created an autoencoder, that is made of 2 decoders. One is to guess the first picture from x_1, and the other has to guess the picture from x_2. I spent a lot of time studying the different types of architechtures and came to the conclusion that unet, which is another type of autoencoder, would probably be a good choice to for this problem, because the same structure for converting an image to a vector is then used to map it to the image again, and this reduces the distortion, since the original structure is preserved. But i didn't have time to implement that architecture since i found out about it too late. Here we have an accuracy of about 52% and a loss of 0.07

In [ ]:
```
1
```

In [ ]:
```
1
```

In [ ]:
```
1
```

In [ ]:
```
1
```