In [2]:

```
import numpy as np
import matplotlib.pyplot as plt
import tensorflow as tf
from tensorflow import keras
from tensorflow.keras.datasets import cifar10
from tensorflow.keras import layers
from tensorflow.keras.layers import Embedding,SimpleRNN,LSTM,GRU,Dense
from tensorflow.keras.models import Sequential
from tensorflow.keras.utils import to_categorical
```

In [3]:

```
(train_images,train_labels),(test_images,test_labels)=cifar10.load_data()
train_images,test_images=train_images/255.0,test_images/255.0
train_labels,test_labels=to_categorical(train_labels),to_categorical(test_labels)
```

```
Downloading data from https://www.cs.toronto.edu/~kriz/cifar-10-python.tar.gz (https://www.cs.toronto.edu/~kriz/cifa
r-10-python.tar.gz)
170498071/170498071 [==============================] - 54s 0us/step
```

In [11]:

```
model=Sequential([
    layers.Flatten(input_shape=(32,32,3)),
    layers.Dense(256,activation='relu'),
    layers.Dense(128,activation='relu'),
    layers.Dense(64,activation='relu'),
    layers.Dense(10,activation='softmax')
])
model.compile(optimizer='adam',metrics=['accuracy'],loss='categorical_crossentropy')
```

In [12]:
```
model.summary()
```

```
Model: "sequential_2"
_________________________________________________________________
 Layer (type)                Output Shape              Param #   
=================================================================
 flatten_2 (Flatten)         (None, 3072)              0         
                                                                 
 dense_8 (Dense)             (None, 256)               786688    
                                                                 
 dense_9 (Dense)             (None, 128)               32896     
                                                                 
 dense_10 (Dense)            (None, 64)                8256      
                                                                 
 dense_11 (Dense)            (None, 10)                650       
                                                                 
=================================================================
Total params: 828490 (3.16 MB)
Trainable params: 828490 (3.16 MB)
Non-trainable params: 0 (0.00 Byte)
_________________________________________________________________
```

In [13]:
```
model.fit(train_images,train_labels,epochs=1,validation_data=(test_images,test_labels))
```

```
WARNING:tensorflow:From C:\Users\user\anaconda3\Lib\site-packages\keras\src\utils\tf_utils.py:492: The name tf.ragge
d.RaggedTensorValue is deprecated. Please use tf.compat.v1.ragged.RaggedTensorValue instead.

WARNING:tensorflow:From C:\Users\user\anaconda3\Lib\site-packages\keras\src\engine\base_layer_utils.py:384: The name
tf.executing_eagerly_outside_functions is deprecated. Please use tf.compat.v1.executing_eagerly_outside_functions in
stead.

1563/1563 [==============================] - 26s 15ms/step - loss: 1.8712 - accuracy: 0.3210 - val_loss: 1.7423 - va
l_accuracy: 0.3699
```

Out[13]:
```
<keras.src.callbacks.History at 0x2594ace51d0>
```

In [15]:

```
loss,accuracy=model.evaluate(test_images,test_labels)
print(f'accuracy:{accuracy}')
print(f'loss:{loss}')
```

```
313/313 [==============================] - 2s 6ms/step - loss: 1.7423 - accuracy: 0.3699
accuracy:0.3698999881744385
loss:1.7423150539398193
```

In [53]:

```
number=5
actual_labels=np.argmax(test_labels[:number],axis=1)
predicted=model.predict(test_images[:number])
predicted_labels=np.argmax(predicted,axis=1)
classes=['airplane','automobile','bird','cat','deer','dog','frog','horse','ship','truck']
```

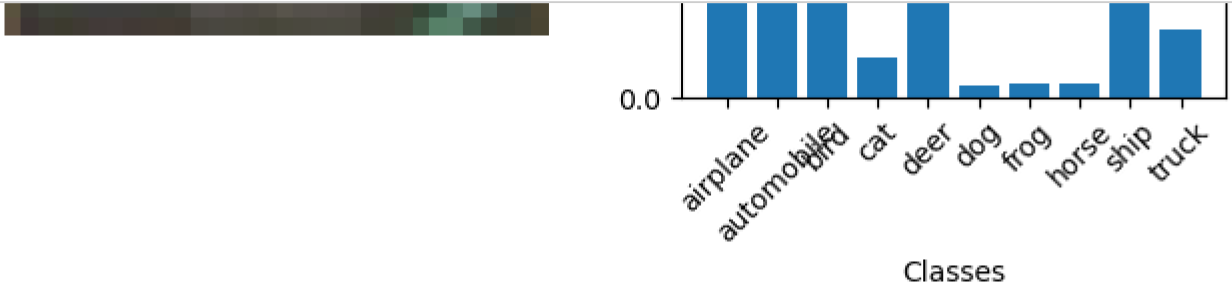
```
1/1 [==============================] - 0s 63ms/step
```

In [59]:

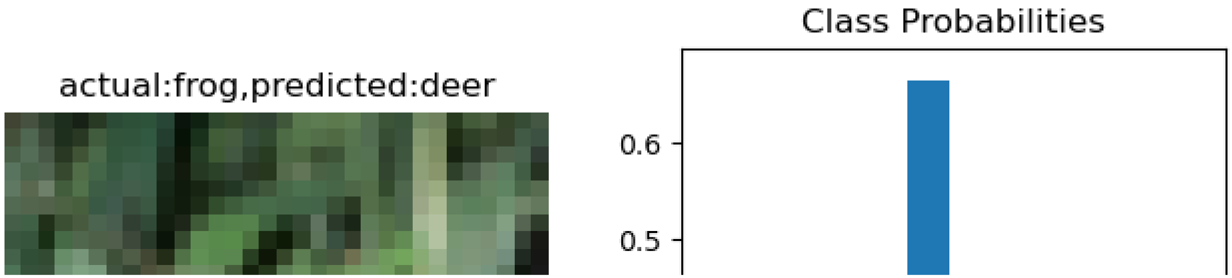
```python
for i in range(number):
    plt.subplot(1,2,1)
    plt.title(f'actual:{classes[actual_labels[i]]},predicted:{classes[predicted_labels[i]]}')
    plt.imshow(test_images[i])
    plt.axis("off")
    test_image = np.expand_dims(test_images[i], axis=0)
    probabilities = model.predict(test_image)[0]

    plt.subplot(1, 2, 2)
    plt.bar(classes, probabilities)
    plt.title('Class Probabilities')
    plt.xlabel('Classes')
    plt.ylabel('Probability')
    plt.xticks(rotation=45)
    plt.tight_layout()


    plt.show()
```



```
1/1 [==============================] - 0s 47ms/step
```

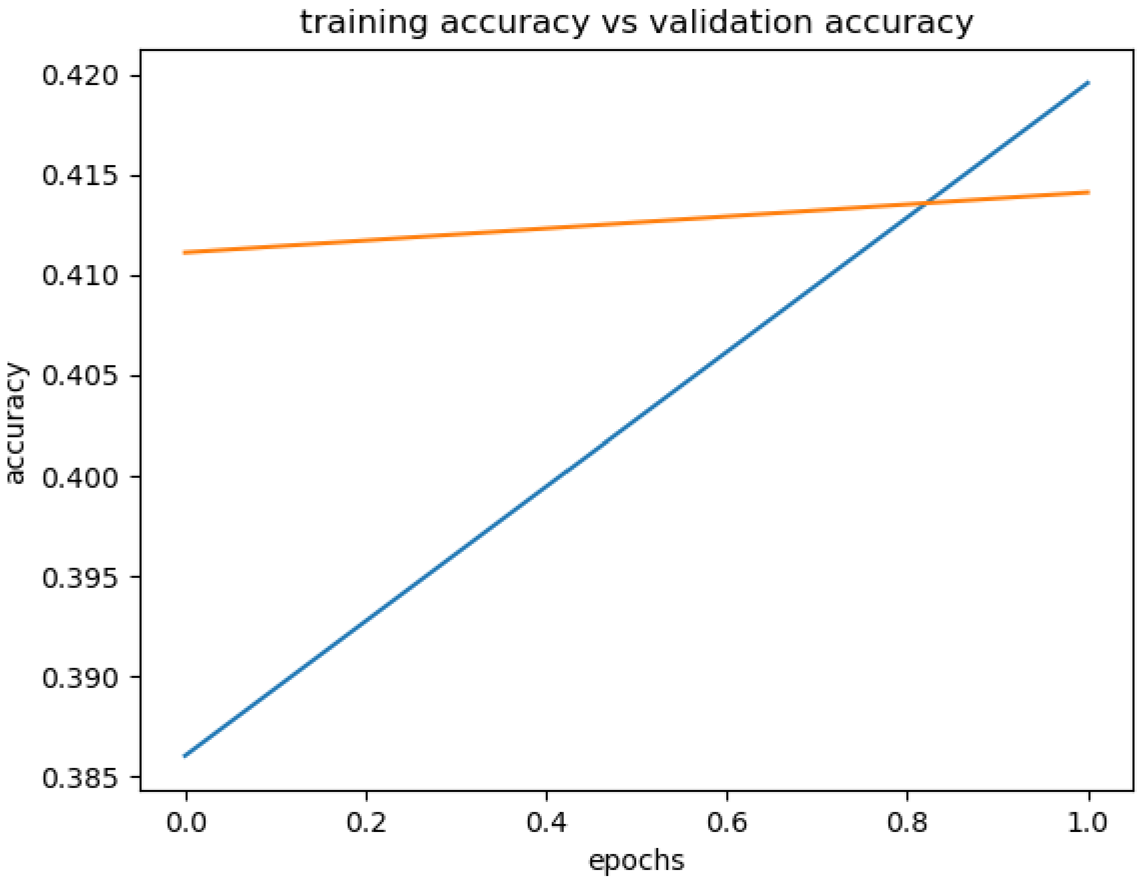


In [32]:

```
history=model.fit(train_images,train_labels,epochs=5,validation_data=(test_images,test_labels))
```

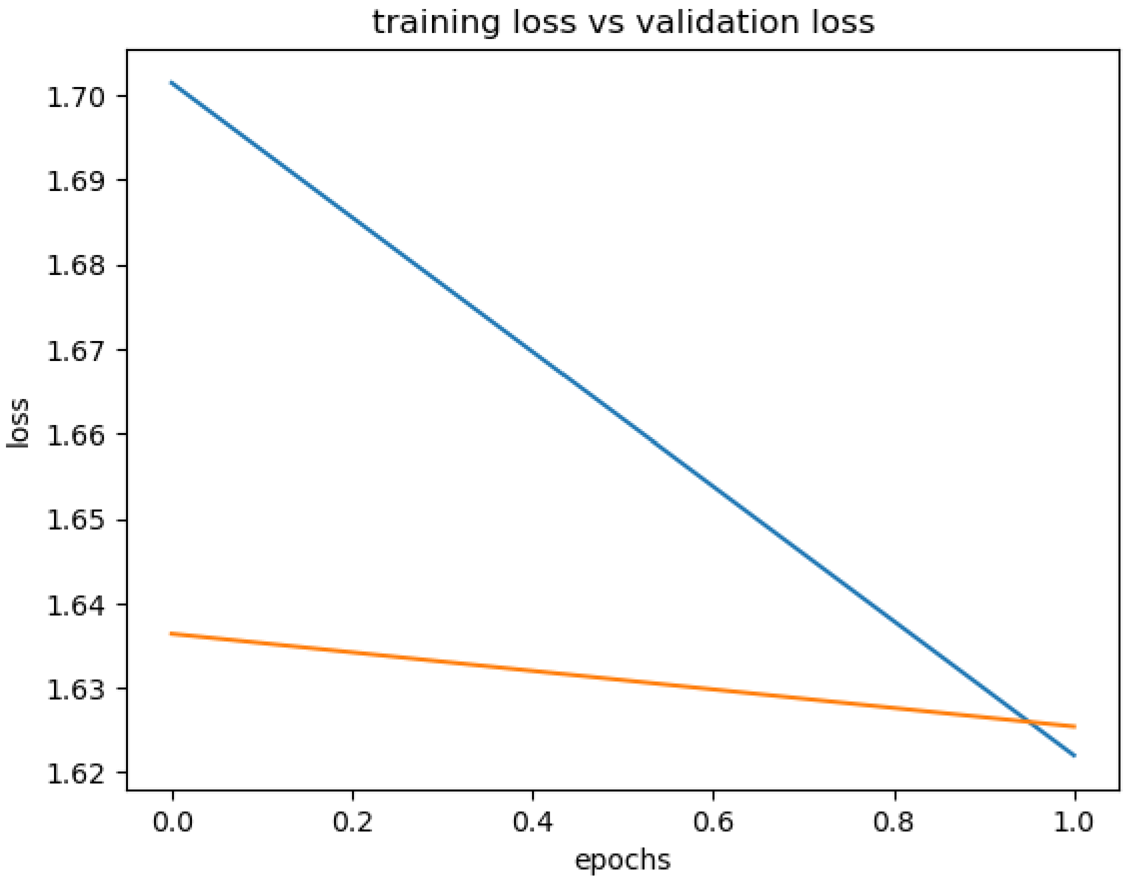
```
Epoch 1/5
1563/1563 [==============================] - 22s 14ms/step - loss: 1.5661 - accuracy: 0.4383 - val_loss: 1.5506 - va
l_accuracy: 0.4491
Epoch 2/5
1563/1563 [==============================] - 22s 14ms/step - loss: 1.5290 - accuracy: 0.4555 - val_loss: 1.5364 - va
l_accuracy: 0.4480
Epoch 3/5
1563/1563 [==============================] - 22s 14ms/step - loss: 1.4974 - accuracy: 0.4629 - val_loss: 1.5144 - va
l_accuracy: 0.4625
Epoch 4/5
1563/1563 [==============================] - 22s 14ms/step - loss: 1.4709 - accuracy: 0.4741 - val_loss: 1.5311 - va
l_accuracy: 0.4558
Epoch 5/5
1563/1563 [==============================] - 22s 14ms/step - loss: 1.4487 - accuracy: 0.4831 - val_loss: 1.5010 - va
l_accuracy: 0.4650
```

```
In [30]: plt.plot(history.history['accuracy'],label='training accuracy')
         plt.plot(history.history['val_accuracy'],label='training accuracy')
         plt.title(f'training accuracy vs validation accuracy')
         plt.xlabel('epochs')
         plt.ylabel('accuracy')
         plt.show()
```



In [31]:

```
plt.plot(history.history['loss'],label='training loss')
plt.plot(history.history['val_loss'],label='training loss')
plt.title(f'training loss vs validation loss')
plt.xlabel('epochs')
plt.ylabel('loss')
plt.show()
```



In [ ]:

```
```

In [ ]:

In [ ]: