In [1]:
```
import tensorflow as tf
from tensorflow.keras import datasets, layers, models
import matplotlib.pyplot as plt
import numpy as np
```

In [2]:
```
(x_train, y_train), (x_test, y_test) = datasets.cifar10.load_data()
x_train.shape
```

Out[2]:
```
(50000, 32, 32, 3)
```

In [3]:
```
x_test.shape
```

Out[3]:
```
(10000, 32, 32, 3)
```

In [4]:
```
y_train[:5]
```

Out[4]:
```
array([[6],
       [9],
       [9],
       [4],
       [1]], dtype=uint8)
```

In [5]:
```
y_train = y_train.reshape(-1,)
y_train[:5]
```

Out[5]:
```
array([6, 9, 9, 4, 1], dtype=uint8)
```

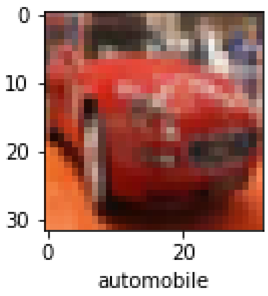
In [6]:
```
classes = ['airplane', 'automobile', 'bird', 'cat', 'deer',
               'dog', 'frog', 'horse', 'ship', 'truck']
```

In [7]:
```
classes[9]
```

Out[7]:
```
'truck'
```

In [8]:
```
def plot_sample(x,y, index):
    plt.figure(figsize = (15,2))
    plt.imshow(x[index])
    plt.xlabel(classes[y[index]])
```

In [9]:
```
plot_sample(x_train, y_train, 5)
```



In [10]:
```
x_train[0]/ 255
x_test = x_test/ 255
```

In [11]:
```
ann = models.Sequential([
    layers.Flatten(input_shape=(32,32,3)),
    layers.Dense(3000, activation='relu'),
    layers.Dense(1000, activation='relu'),
    layers.Dense(10, activation='sigmoid')
])

ann.compile(optimizer='SGD',
           loss='sparse_categorical_crossentropy',
           metrics=['accuracy'])

ann.fit(x_train, y_train, epochs=1)
```

```
1563/1563 [==============================] - 70s 45ms/step - loss: nan - accuracy:
0.1001
```

Out[11]:

```
<keras.callbacks.History at 0x1e95b1cce50>
```

In [12]:

```
ann.evaluate(x_test, y_test)
```

```
313/313 [==============================] - 5s 15ms/step - loss: nan - accuracy: 0.
1000
```

Out[12]:

```
[nan, 0.10000000149011612]
```

In [13]:

```
from sklearn.metrics import confusion_matrix, classification_report
import numpy as np
y_pred = ann.predict(x_test)
y_pred_classes = [np.argmax(element) for element in y_pred]

print("classification Report: \n", classification_report(y_test, y_pred_classes))
```

```
313/313 [==============================] - 4s 13ms/step
classification Report:
               precision    recall  f1-score   support

           0       0.10      1.00      0.18      1000
           1       0.00      0.00      0.00      1000
           2       0.00      0.00      0.00      1000
           3       0.00      0.00      0.00      1000
           4       0.00      0.00      0.00      1000
           5       0.00      0.00      0.00      1000
           6       0.00      0.00      0.00      1000
           7       0.00      0.00      0.00      1000
           8       0.00      0.00      0.00      1000
           9       0.00      0.00      0.00      1000

    accuracy                           0.10     10000
   macro avg       0.01      0.10      0.02     10000
weighted avg       0.01      0.10      0.02     10000
```

```
C:\Users\lenovo\Anaconda\envs\tf\lib\site-packages\sklearn\metrics\_classificatio
n.py:1327: UndefinedMetricWarning: Precision and F-score are ill-defined and being
set to 0.0 in labels with no predicted samples. Use `zero_division` parameter to c
ontrol this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
C:\Users\lenovo\Anaconda\envs\tf\lib\site-packages\sklearn\metrics\_classificatio
n.py:1327: UndefinedMetricWarning: Precision and F-score are ill-defined and being
set to 0.0 in labels with no predicted samples. Use `zero_division` parameter to c
ontrol this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
C:\Users\lenovo\Anaconda\envs\tf\lib\site-packages\sklearn\metrics\_classificatio
n.py:1327: UndefinedMetricWarning: Precision and F-score are ill-defined and being
set to 0.0 in labels with no predicted samples. Use `zero_division` parameter to c
ontrol this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
```

In [70]:

```
cnn = models.Sequential([
    #cnn
    layers.Conv2D(filters=33, kernel_size=(3,3), activation='relu', input_shape=(3
    layers.MaxPooling2D(pool_size=(2, 2), padding='same'),

    layers.Conv2D(filters=33, kernel_size=(3,3), activation='relu', padding="same"
    layers.MaxPooling2D(pool_size=(2, 2), padding='same'),

    #dense
    layers.Flatten(),
    layers.Dense(64, activation='relu'),
    layers.Dense(10, activation='softmax')
])
```

In [71]:
```
cnn.compile(optimizer='adam',
             loss='sparse_categorical_crossentropy',
             metrics=['accuracy'])
```

In [72]:
```
cnn.fit(x_train, y_train, epochs=10)
```

```
Epoch 1/10
1563/1563 [==============================] - 41s 26ms/step - loss: 1.9648 - accura
cy: 0.3793
Epoch 2/10
1563/1563 [==============================] - 43s 28ms/step - loss: 1.3475 - accura
cy: 0.5183
Epoch 3/10
1563/1563 [==============================] - 45s 29ms/step - loss: 1.2062 - accura
cy: 0.5749
Epoch 4/10
1563/1563 [==============================] - 46s 29ms/step - loss: 1.0918 - accura
cy: 0.6189
Epoch 5/10
1563/1563 [==============================] - 47s 30ms/step - loss: 1.0051 - accura
cy: 0.6485
Epoch 6/10
1563/1563 [==============================] - 47s 30ms/step - loss: 0.9380 - accura
cy: 0.6715
Epoch 7/10
1563/1563 [==============================] - 47s 30ms/step - loss: 0.8793 - accura
cy: 0.6947
Epoch 8/10
1563/1563 [==============================] - 51s 33ms/step - loss: 0.8218 - accura
cy: 0.7120
Epoch 9/10
1563/1563 [==============================] - 49s 31ms/step - loss: 0.7868 - accura
cy: 0.7255
Epoch 10/10
1563/1563 [==============================] - 48s 31ms/step - loss: 0.7535 - accura
cy: 0.7394
```

Out[72]:
```
<keras.callbacks.History at 0x1e906c6fca0>
```

In [73]:
```
cnn.evaluate(x_test, y_test)
```

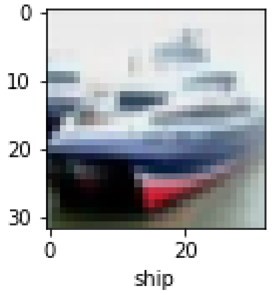
```
313/313 [==============================] - 2s 7ms/step - loss: 2.6217 - accuracy:
0.1286
```

Out[73]:
```
[2.6217451095581055, 0.12860000133514404]
```

In [76]:
```
y_test= y_test.reshape(-1,)
y_test[:5]
```

Out[76]:
```
array([3, 8, 8, 0, 6], dtype=uint8)
```

In [77]:
```
plot_sample(x_test, y_test, 1)
```



In [78]:
```
y_pred = cnn.predict(x_test)
y_pred[:5]
```

Out[78]:
```
313/313 [==============================] - 2s 6ms/step
array([[0.04259494, 0.04461665, 0.12741426, 0.12681948, 0.24777812,
         0.05803224, 0.25018483, 0.03692523, 0.03269459, 0.03293962],
        [0.0439445 , 0.04397541, 0.12093395, 0.13586678, 0.25963914,
         0.06045731, 0.22385524, 0.03674   , 0.03719375, 0.03739383],
        [0.04092592, 0.04068265, 0.1267711 , 0.12975575, 0.26308733,
         0.05746062, 0.23852389, 0.0365388 , 0.03222532, 0.03402865],
        [0.0374856 , 0.03883978, 0.124599  , 0.12944104, 0.26557034,
         0.05503376, 0.24879704, 0.03519782, 0.03101401, 0.03402162],
        [0.03687756, 0.03917681, 0.13384984, 0.12432764, 0.25580096,
         0.05324021, 0.26060188, 0.03487547, 0.03041456, 0.03083508]],
      dtype=float32)
```

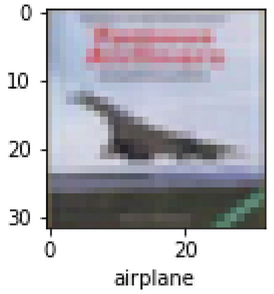
In [81]:
```
y_classes = [np.argmax(element) for element in y_pred]
y_classes[:5]
```

Out[81]:
```
[6, 4, 4, 4, 6]
```

In [82]:
```
y_test[:5]
```

Out[82]:
```
array([3, 8, 8, 0, 6], dtype=uint8)
```

In [89]:
```
plot_sample(x_test, y_test, 3)
```



In [90]:
```
classes[y_classes[3]]
```

Out[90]:
```
'deer'
```

In [ ]: