Import the necessary packages

In [ ]:

```
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```

In [ ]:

```
import numpy as np
import matplotlib.pyplot as plt
from keras.datasets import cifar10
from keras.models import Sequential
from keras.layers import Dense, Conv2D, MaxPool2D, Flatten, Dropout
```

In [ ]:

```
(x_train, y_train),(x_test, y_test) = cifar10.load_data()
```

```
Downloading data from https://www.cs.toronto.edu/~kriz/cifar-10-python.tar.gz
(https://www.cs.toronto.edu/~kriz/cifar-10-python.tar.gz)
170498071/170498071 [==============================] - 89s 1us/step
```

In [ ]:

```
x_train.shape
```

Out[3]:

```
(50000, 32, 32, 3)
```

In [ ]:

```
x_test.shape
```

Out[4]:

```
(10000, 32, 32, 3)
```

Explore the image data

In [ ]:

```
labels = ['airplane','automobile','bird','cat','deer','dog','frog','horse','shi
```

In [ ]:

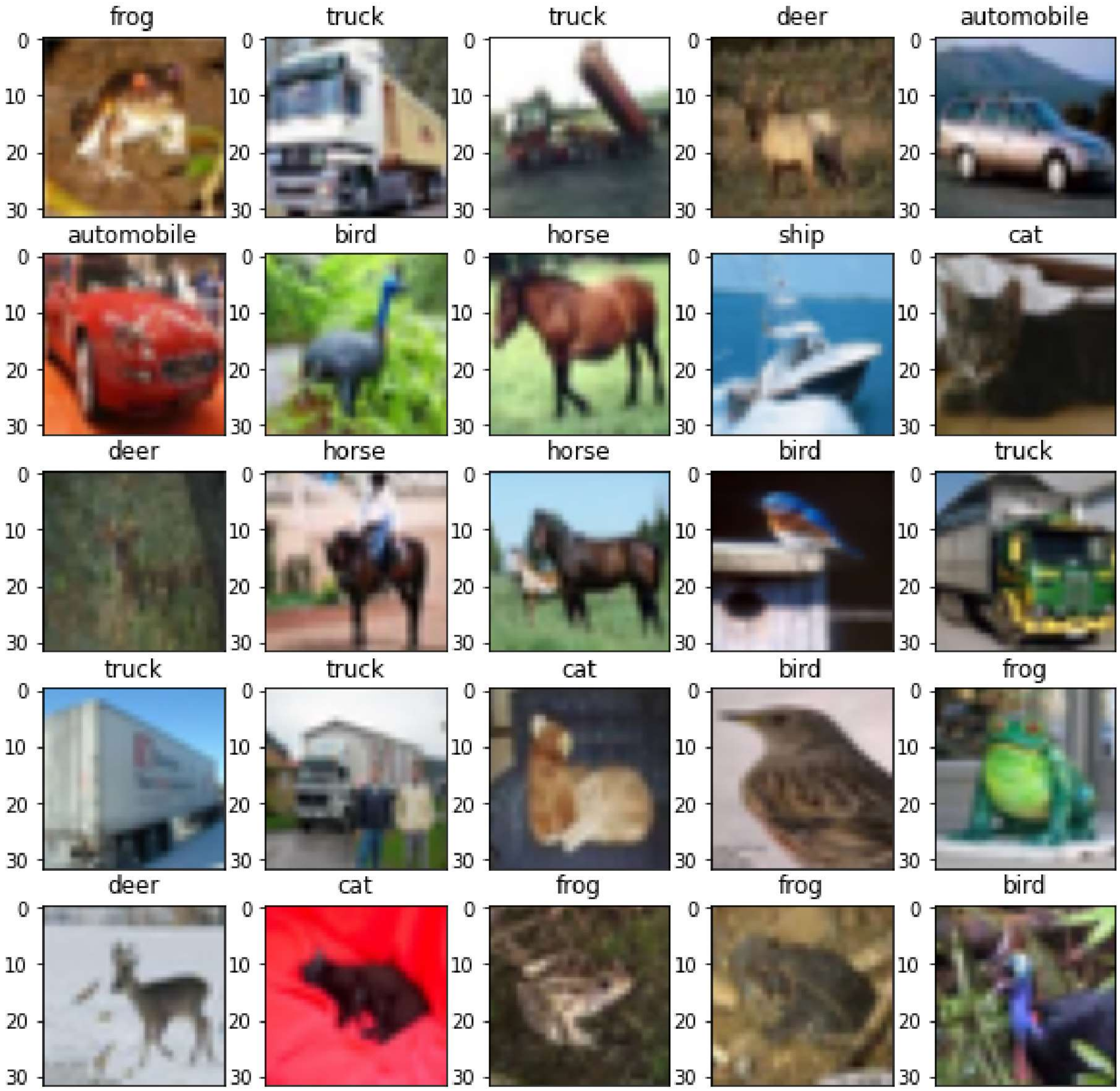
```
labels
```

Out[8]:

```
['airplane',
 'automobile',
 'bird',
 'cat',
 'deer',
 'dog',
 'frog',
 'horse',
 'ship',
 'truck']
```

In [ ]:

```
plt.figure(figsize=(10,10))
for i in range(25):
  plt.subplot(5,5,i+1)
  plt.xticks([])
  plt.title(labels[y_train[i][0]])
  plt.imshow(x_train[i])
```



Normalization

In [ ]:

```
x_train = x_train / 255
x_test = x_test / 255
```

One hot encoding

In [ ]:

```
from keras.utils import to_categorical
```

In [ ]:

```
y_train_new = to_categorical(y_train)
y_test_new = to_categorical(y_test)
```

In [ ]:

```
y_train_new.shape
```

Out[14]:

```
(50000, 10)
```

Build the model

In [ ]:

```
model = Sequential()

model.add(Conv2D(filters=32, input_shape=(32,32,3), kernel_size=(3,3),
                 activation='relu'))
model.add(MaxPool2D(pool_size=(2,2)))
model.add(Dropout(0.2))

model.add(Conv2D(filters=64, kernel_size=(3,3), activation='relu'))
model.add(MaxPool2D(pool_size=(2,2)))

model.add(Conv2D(filters=32, kernel_size=(3,3), activation='relu'))
model.add(MaxPool2D(pool_size=(2,2)))

model.add(Flatten())

model.add(Dense(512, activation='relu'))
model.add(Dense(10, activation='softmax'))
```

In [ ]:

```
model.summary()
```

```
Model: "sequential_1"
_________________________________________________________________
 Layer (type)                Output Shape              Param #   
=================================================================
 conv2d_1 (Conv2D)           (None, 30, 30, 32)        896       
                                                                 
 max_pooling2d (MaxPooling2D  (None, 15, 15, 32)       0         
 )                                                               
                                                                 
 dropout (Dropout)           (None, 15, 15, 32)        0         
                                                                 
 conv2d_2 (Conv2D)           (None, 13, 13, 64)        18496     
                                                                 
 max_pooling2d_1 (MaxPooling  (None, 6, 6, 64)         0         
 2D)                                                             
                                                                 
 conv2d_3 (Conv2D)           (None, 4, 4, 32)          18464     
                                                                 
 max_pooling2d_2 (MaxPooling  (None, 2, 2, 32)         0         
 2D)                                                             
                                                                 
 flatten (Flatten)           (None, 128)               0         
                                                                 
 dense (Dense)               (None, 512)               66048     
                                                                 
 dense_1 (Dense)             (None, 10)                5130      
                                                                 
=================================================================
Total params: 109,034
Trainable params: 109,034
Non-trainable params: 0
_________________________________________________________________
```

Compile the model

In [ ]:

```
model.compile(loss='categorical_crossentropy', optimizer='adam', metrics=['accu
```

Train the model

In [ ]:
```
model.fit(x_train, y_train_new, epochs=10, batch_size=20)
```

```
Epoch 1/10
2500/2500 [==============================] - 14s 5ms/step - loss: 1.5565 - ac
curacy: 0.4258
Epoch 2/10
2500/2500 [==============================] - 12s 5ms/step - loss: 1.2107 - ac
curacy: 0.5673
Epoch 3/10
2500/2500 [==============================] - 12s 5ms/step - loss: 1.0747 - ac
curacy: 0.6196
Epoch 4/10
2500/2500 [==============================] - 12s 5ms/step - loss: 0.9833 - ac
curacy: 0.6514
Epoch 5/10
2500/2500 [==============================] - 12s 5ms/step - loss: 0.9251 - ac
curacy: 0.6726
Epoch 6/10
2500/2500 [==============================] - 12s 5ms/step - loss: 0.8712 - ac
curacy: 0.6927
Epoch 7/10
2500/2500 [==============================] - 12s 5ms/step - loss: 0.8291 - ac
curacy: 0.7060
Epoch 8/10
2500/2500 [==============================] - 12s 5ms/step - loss: 0.7930 - ac
curacy: 0.7188
Epoch 9/10
2500/2500 [==============================] - 12s 5ms/step - loss: 0.7656 - ac
curacy: 0.7278
Epoch 10/10
2500/2500 [==============================] - 12s 5ms/step - loss: 0.7382 - ac
curacy: 0.7386
```

Out[26]:
```
<keras.callbacks.History at 0x7f8fe4b69c10>
```

Evaluate the model

In [ ]:
```
model.evaluate(x_test, y_test_new, batch_size=1)
```

```
10000/10000 [==============================] - 28s 3ms/step - loss: 0.8799 -
accuracy: 0.7009
```

Out[27]:
```
[0.8798902630805969, 0.7009000182151794]
```

In [ ]:
```
plt.figure(figsize=(1,1))
plt.imshow(x_train[120])
```

Out[28]:
```
<matplotlib.image.AxesImage at 0x7f8fe4a31820>
```

In [ ]:

```
new = x_train[120]
new = new.reshape(1,32,32,3)
labels[np.argmax(model.predict(new, verbose=0))]
```

Out[32]:

```
'bird'
```

In [ ]:

```
```