Project 3 : Part 1

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1. About CIFAR-10

The CIFAR-10 dataset is a dataset of gathered from the 80 million tiny images dataset, containing a combination of images of animals and transportation objects. Within the dataset there are 6 animal & 4 transportation object classes:

- **Animals :** bird, cat, deer, dog, frog, horse
- **Transportation Objects :** airplane, automobile, ship, truck

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Dataset/s:

- CIFAR-10 (python version)
- CIFAR-10 (binary version)

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2. Data Preparation

2.1 Loading Data & Adjustments

In [1]:

```
import glob
import pickle
import numpy as np
import pandas as pd

from PIL import Image
from tkinter import Tcl
from sklearn import preprocessing

# Directory - Python dataset, Binary dataset, & file name of batch files
(python)
PY_DATA_PATH = './data/cifar-10-python/cifar-10-batches-py'
BIN_DATA_PATH = './data/cifar-10-binary/cifar-10-batches-bin/data_batch_1.bin'
BATCHES_PATH = ['/data_batch_1', '/data_batch_2', '/data_batch_3',
'/data_batch_4', '/data_batch_5', '/test_batch']

le = preprocessing.LabelEncoder()

# Load list of labels/classes (once dataset file has been extracted)
```

```
# -------- Method 1 ------------------------------------
#with open(BIN_DATA_PATH + '/batches.meta.txt', 'r') as f:
#    class_names = [line.rstrip() for line in f]

# -------- Method 2 ------------------------------------
with open(PY_DATA_PATH + '/batches.meta', 'rb') as fo:
    batches_meta = pickle.load(fo)
    class_names = batches_meta['label_names']

print("========== Classes ==========")
for i in range(len(class_names)): print(i,":", class_names[i])
print("\n# of Cases Per Batch:", batches_meta['num_cases_per_batch'])
print("# Channel Values (Size):", batches_meta['num_vis'])
```

```
========== Classes ==========
0 : airplane
1 : automobile
2 : bird
3 : cat
4 : deer
5 : dog
6 : frog
7 : horse
8 : ship
9 : truck

# of Cases Per Batch: 10000
# Channel Values (Size): 3072
```

In [2]:

```
from __future__ import print_function
from imageio import imsave
import os, sys, tarfile, errno, urllib

import matplotlib.pyplot as plt
%matplotlib inline

# Image shape - h : HEIGHT, w : WIDTH, d : DEPTH
h = 32
w = 32
d = 3

# Size of a single image in bytes
SIZE = h * w * d

def read_single_image(image_file):
    img = np.fromfile(image_file, dtype=np.uint8,
count=batches_meta['num_vis'])
```

```
    img = np.reshape(img, (d, h, w))
    img = np.transpose(img, (1, 2, 0))
    return img

def read_all_images(path_to_data):
    with open(path_to_data, 'rb') as f:
        all_data = np.fromfile(f, dtype=np.uint8)
        imgs = np.reshape(all_data, (-1, d, h, w))
        imgs = np.transpose(imgs, (1, 3, 2, 0))
        return imgs

def plot_image(img):
    plt.imshow(img)
    plt.show()

# unpickle : convert 'pickled' object into a dict
def unpickle(file):
    with open(file, 'rb') as fo:
        dict = pickle.load(fo, encoding='bytes')
    return dict

# cleanDict : Converts dict(bytes) --> dict(uint8)
def cleanDict(batch_dict):
    for i in list(batch_dict.keys()): batch_dict[i.decode()] =
batch_dict.pop(i)
    batch_dict['batch_label'] = batch_dict['batch_label'].decode()
    for i in range(len(list(batch_dict['filenames']))): batch_dict['filenames']
[i] = batch_dict['filenames'][i].decode()
    return batch_dict
```

In [3]:

```
print("================== BEFORE =================")
batch_ex = unpickle(PY_DATA_PATH + BATCHES_PATH[0])
batchKeys = list(batch_ex.keys())
print(batchKeys[0], "\t----> ", batch_ex[batchKeys[0]])
print(batchKeys[1], "\t----> ", batch_ex[batchKeys[1]][0])
print(batchKeys[2], "\t----> ", batch_ex[batchKeys[2]][0])
print(batchKeys[3], "\t----> ", batch_ex[batchKeys[3]][0])
```

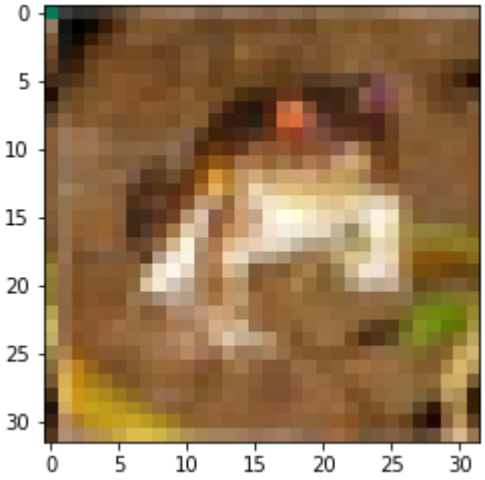
```
================== BEFORE =================
b'batch_label'  ----->  b'training batch 1 of 5'
b'labels'       ----->  6
b'data'         ----->  [ 59  43  50 ... 140  84  72]
b'filenames'    ----->  b'leptodactylus_pentadactylus_s_000004.png'
```

In [4]:

```
# Load each batch set into a dict w/ bytes type values,
# Convert: dict(bytes) --> dict(uint8)
```

```
batch_1 = cleanDict(unpickle(PY_DATA_PATH + BATCHES_PATH[0]))
batch_2 = cleanDict(unpickle(PY_DATA_PATH + BATCHES_PATH[1]))
batch_3 = cleanDict(unpickle(PY_DATA_PATH + BATCHES_PATH[2]))
batch_4 = cleanDict(unpickle(PY_DATA_PATH + BATCHES_PATH[3]))
batch_5 = cleanDict(unpickle(PY_DATA_PATH + BATCHES_PATH[4]))

print("================== AFTER ================")
print("-->", batch_1['batch_label'], "\n")

# Construct Image using vector
with open(BIN_DATA_PATH) as f:
    image = read_single_image(f)
    plot_image(image)

print("- Class:", class_names[batch_1['labels'][0]], "\n- Filename:",
batch_1['filenames'][0])
```

```
================== AFTER ================
--> training batch 1 of 5
```




```
- Class: frog
- Filename: leptodactylus_pentadactylus_s_000004.png
```

Alternatively, keras does have the cifar10 dataset included as a library that can be easily be imported in, rather than having to manually download the data.

In [5]:

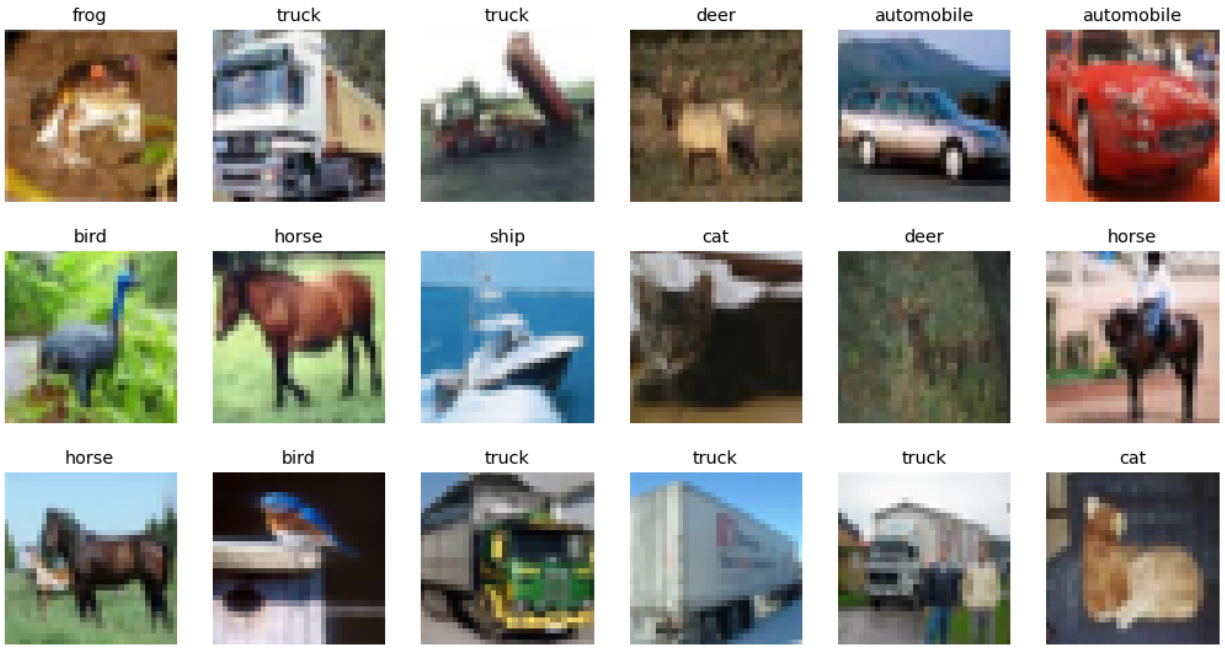
```
from tensorflow.keras.datasets import cifar10
(X_train, y_train), (X_test, y_test) = cifar10.load_data()

X_train = X_train / 255
X_test = X_test / 255

print("Training Set", "\n   - Data Shape:",X_train.shape,"\n   - Target
Shape:",y_train.shape)
```

```
print("\nTesting Set","\n   - Data Shape:",X_test.shape ,"\n   - Target
Shape:",y_test.shape)
```

```
2022-04-12 06:53:57.380385: I tensorflow/stream_executor/platform/default/dso_
loader.cc:49] Successfully opened dynamic library libcudart.so.10.1
Training Set
   - Data Shape: (50000, 32, 32, 3)
   - Target Shape: (50000, 1)

Testing Set
   - Data Shape: (10000, 32, 32, 3)
   - Target Shape: (10000, 1)
```

In [6]:

```
plt.style.use('ggplot')

def plot_gallery(images, titles):
    plt.figure(figsize=(14, 7))
    plt.subplots_adjust(bottom=0, left=.01, right=.99, top=1.0, hspace=.25)
    for i in range(18):
        plt.subplot(3, 6, i + 1)
        plt.imshow(images[i])
        plt.title(class_names[titles[i][0]])
        plt.xticks(());  plt.yticks(())

plot_gallery(X_train, y_train)
```



In [7]:

```
from sklearn.preprocessing import StandardScaler
from sklearn.linear_model import LogisticRegression

from sklearn.pipeline import Pipeline
```

```
clf = LogisticRegression()

clf = Pipeline([('scl', StandardScaler()),
                ('clf', LogisticRegression())])
```