In [1]:

```
# Use GPU for Theano, comment to use CPU instead of GPU
# Tensorflow uses GPU by default
import os
os.environ["THEANO_FLAGS"] = "mode=FAST_RUN,device=gpu,floatX=float32"
```

In [2]:

```
# If using tensorflow, set image dimensions order
from keras import backend as K
if K.backend()=='tensorflow':
    K.set_image_dim_ordering("th")
```

```
Using TensorFlow backend.
```

In [3]:

```
import time
import matplotlib.pyplot as plt
import numpy as np
np.random.seed(2017)
from keras.models import Sequential
from keras.layers.convolutional import Convolution2D, MaxPooling2D
from keras.layers import Activation, Flatten, Dense, Dropout
from keras.layers.normalization import BatchNormalization
from keras.utils import np_utils
```

In [4]:

```
from keras.datasets import cifar10
(train_features, train_labels), (test_features, test_labels) = cifar10.load_data()
num_train, img_channels, img_rows, img_cols =  train_features.shape
num_test, _, _, _ =  test_features.shape
num_classes = len(np.unique(train_labels))
```

In [5]:

```
class_names = ['airplane','automobile','bird','cat','deer',
               'dog','frog','horse','ship','truck']
fig = plt.figure(figsize=(8,3))
for i in range(num_classes):
    ax = fig.add_subplot(2, 5, 1 + i, xticks=[], yticks=[])
    idx = np.where(train_labels[:]==i)[0]
    features_idx = train_features[idx,::]
    img_num = np.random.randint(features_idx.shape[0])
    im = np.transpose(features_idx[img_num,::], (1, 2, 0))
    ax.set_title(class_names[i])
    plt.imshow(im)
plt.show()
```

In [6]:

```
train_features = train_features.astype('float32')/255
test_features = test_features.astype('float32')/255
# convert class labels to binary class labels
# convert class labels to binary class labels
train_labels = np_utils.to_categorical(train_labels, num_classes)
test_labels = np_utils.to_categorical(test_labels, num_classes)
```

In [7]:

```
def accuracy(test_x, test_y, model):
    result = model.predict(test_x)
    predicted_class = np.argmax(result, axis=1)
    true_class = np.argmax(test_y, axis=1)
    num_correct = np.sum(predicted_class == true_class)
    accuracy = float(num_correct)/result.shape[0]
    return (accuracy * 100)
```

In [8]:

```
# Define the model
model = Sequential()
model.add(Convolution2D(48, 3, 3, border_mode='same', input_shape=(3, 32, 32)))
model.add(Activation('relu'))
model.add(Convolution2D(48, 3, 3))
model.add(Activation('relu'))
model.add(MaxPooling2D(pool_size=(2, 2)))
model.add(Dropout(0.25))
model.add(Convolution2D(96, 3, 3, border_mode='same'))
model.add(Activation('relu'))
model.add(Convolution2D(96, 3, 3))
model.add(Activation('relu'))
model.add(MaxPooling2D(pool_size=(2, 2)))
model.add(Dropout(0.25))
model.add(Convolution2D(192, 3, 3, border_mode='same'))
model.add(Activation('relu'))
model.add(Convolution2D(192, 3, 3))
model.add(Activation('relu'))
model.add(MaxPooling2D(pool_size=(2, 2)))
model.add(Dropout(0.25))
model.add(Flatten())
model.add(Dense(512))
model.add(Activation('relu'))
model.add(Dropout(0.5))
model.add(Dense(256))
model.add(Activation('relu'))
model.add(Dropout(0.5))
model.add(Dense(num_classes, activation='softmax'))
# Compile the model
model.compile(optimizer='adam', loss='categorical_crossentropy', metrics=['accuracy'])
# Train the model
start = time.time()
model_info = model.fit(train_features, train_labels,
                       batch_size=128, nb_epoch=3,
                       validation_data = (test_features, test_labels),
                       verbose=0)
end = time.time()
```

```
WARNING: Logging before flag parsing goes to stderr.
W0704 20:57:34.634667 21012 deprecation_wrapper.py:119] From C:\Users\Abhay\Anaconda3\lib\site-pac
kages\keras\backend\tensorflow_backend.py:74: The name tf.get_default_graph is deprecated. Please
use tf.compat.v1.get_default_graph instead.

C:\Users\Abhay\Anaconda3\lib\site-packages\ipykernel_launcher.py:3: UserWarning: Update your
`Conv2D` call to the Keras 2 API: `Conv2D(48, (3, 3), input_shape=(3, 32, 32..., padding="same")`
  This is separate from the ipykernel package so we can avoid doing imports until
W0704 20:57:34.669144 21012 deprecation_wrapper.py:119] From C:\Users\Abhay\Anaconda3\lib\site-pac
kages\keras\backend\tensorflow_backend.py:517: The name tf.placeholder is deprecated. Please use t
f.compat.v1.placeholder instead.

W0704 20:57:34.669144 21012 deprecation_wrapper.py:119] From C:\Users\Abhay\Anaconda3\lib\site-pac
kages\keras\backend\tensorflow_backend.py:4138: The name tf.random_uniform is deprecated. Please u
se tf.random.uniform instead.

W0704 20:57:34.684824 21012 deprecation_wrapper.py:119] From C:\Users\Abhay\Anaconda3\lib\site-pac
kages\keras\backend\tensorflow_backend.py:174: The name tf.get_default_session is deprecated. Plea
se use tf.compat.v1.get_default_session instead.

W0704 20:57:34.684824 21012 deprecation_wrapper.py:119] From C:\Users\Abhay\Anaconda3\lib\site-pac
```

```
kages\keras\backend\tensorflow_backend.py:181: The name tf.ConfigProto is deprecated. Please use t
f.compat.v1.ConfigProto instead.

C:\Users\Abhay\Anaconda3\lib\site-packages\ipykernel_launcher.py:5: UserWarning: Update your
`Conv2D` call to the Keras 2 API: `Conv2D(48, (3, 3))`
  """
W0704 20:57:34.777247 21012 deprecation_wrapper.py:119] From C:\Users\Abhay\Anaconda3\lib\site-pac
kages\keras\backend\tensorflow_backend.py:3976: The name tf.nn.max_pool is deprecated. Please use
tf.nn.max_pool2d instead.

W0704 20:57:34.793559 21012 deprecation.py:506] From C:\Users\Abhay\Anaconda3\lib\site-
packages\keras\backend\tensorflow_backend.py:3445: calling dropout (from
tensorflow.python.ops.nn_ops) with keep_prob is deprecated and will be removed in a future
version.
Instructions for updating:
Please use `rate` instead of `keep_prob`. Rate should be set to `rate = 1 - keep_prob`.
C:\Users\Abhay\Anaconda3\lib\site-packages\ipykernel_launcher.py:9: UserWarning: Update your
`Conv2D` call to the Keras 2 API: `Conv2D(96, (3, 3), padding="same")`
  if __name__ == '__main__':
C:\Users\Abhay\Anaconda3\lib\site-packages\ipykernel_launcher.py:11: UserWarning: Update your
`Conv2D` call to the Keras 2 API: `Conv2D(96, (3, 3))`
  # This is added back by InteractiveShellApp.init_path()
C:\Users\Abhay\Anaconda3\lib\site-packages\ipykernel_launcher.py:15: UserWarning: Update your
`Conv2D` call to the Keras 2 API: `Conv2D(192, (3, 3), padding="same")`
  from ipykernel import kernelapp as app
C:\Users\Abhay\Anaconda3\lib\site-packages\ipykernel_launcher.py:17: UserWarning: Update your
`Conv2D` call to the Keras 2 API: `Conv2D(192, (3, 3))`
W0704 20:57:35.172510 21012 deprecation_wrapper.py:119] From C:\Users\Abhay\Anaconda3\lib\site-pac
kages\keras\optimizers.py:790: The name tf.train.Optimizer is deprecated. Please use
tf.compat.v1.train.Optimizer instead.

C:\Users\Abhay\Anaconda3\lib\site-packages\ipykernel_launcher.py:36: UserWarning: The `nb_epoch` a
rgument in `fit` has been renamed `epochs`.
W0704 20:57:35.375360 21012 deprecation.py:323] From C:\Users\Abhay\Anaconda3\lib\site-
packages\tensorflow\python\ops\math_grad.py:1250: add_dispatch_support.<locals>.wrapper (from
tensorflow.python.ops.array_ops) is deprecated and will be removed in a future version.
Instructions for updating:
Use tf.where in 2.0, which has the same broadcast rule as np.where
```

In [9]:

```
print ("Model took %0.2f seconds to train"%(end - start))
# compute test accuracy
print ("Accuracy on test data is: %0.2f"%accuracy(test_features, test_labels, model))
```

```
Model took 1073.71 seconds to train
Accuracy on test data is: 65.85
```

In [10]:

```
#The code for this I have referred through a github source but I made sure that I understand each
line of code
```