In [ ]:

```python
import numpy
from keras.models import Sequential
from keras.layers import Dense,Dropout,Flatten,Conv2D,MaxPooling2D
from keras.constraints import maxnorm
from keras.optimizers import SGD
from keras.utils import np_utils
from keras import backend as K
```

```
Using TensorFlow backend.
```

In [2]:

```python
from keras.datasets import cifar10
# let's load data
(X_train, y_train), (X_test, y_test) = cifar10.load_data()
```

In [3]:

```python
#normalizing inputs from 0-255 to 0.0-1.0
X_train = X_train.astype('float32')
X_test = X_test.astype('float32')
X_train = X_train / 255.0
X_test = X_test / 255.0
```

In [4]:

```python
# one hot encode outputs
y_train = np_utils.to_categorical(y_train)
y_test = np_utils.to_categorical(y_test)
num_classes = y_test.shape[1]
```

In [6]:

```python
# Create the model
model = Sequential()
model.add(Conv2D(32, (3, 3), input_shape=(32,32,3), activation='relu', padding='same'))
model.add(Dropout(0.2))
model.add(Conv2D(32, (3, 3), activation='relu', padding='same'))
model.add(MaxPooling2D(pool_size=(2, 2)))
model.add(Conv2D(64, (3, 3), activation='relu', padding='same'))
model.add(Dropout(0.2))
model.add(Conv2D(64, (3, 3), activation='relu', padding='same'))
model.add(MaxPooling2D(pool_size=(2, 2)))
model.add(Conv2D(128, (3, 3), activation='relu', padding='same'))
model.add(Dropout(0.2))
model.add(Conv2D(128, (3, 3), activation='relu', padding='same'))
model.add(MaxPooling2D(pool_size=(2, 2)))
model.add(Flatten())
model.add(Dropout(0.2))
model.add(Dense(1024, activation='relu', kernel_constraint=maxnorm(3)))
model.add(Dropout(0.2))
model.add(Dense(512, activation='relu', kernel_constraint=maxnorm(3)))
model.add(Dropout(0.2))
model.add(Dense(num_classes, activation='softmax'))
print(model.summary())
```

```
Model: "sequential_2"
_________________________________________________________________
Layer (type)                 Output Shape              Param #   
=================================================================
conv2d_7 (Conv2D)            (None, 32, 32, 32)        896       
_________________________________________________________________
dropout_7 (Dropout)          (None, 32, 32, 32)        0         
_________________________________________________________________
conv2d_8 (Conv2D)            (None, 32, 32, 32)        9248      
_________________________________________________________________
max_pooling2d_4 (MaxPooling2 (None, 16, 16, 32)        0         
_________________________________________________________________
conv2d_9 (Conv2D)            (None, 16, 16, 64)        18496     
_________________________________________________________________
dropout_8 (Dropout)          (None, 16, 16, 64)        0         
_________________________________________________________________
conv2d_10 (Conv2D)           (None, 16, 16, 64)        36928     
_________________________________________________________________
max_pooling2d_5 (MaxPooling2 (None, 8, 8, 64)          0         
_________________________________________________________________
conv2d_11 (Conv2D)           (None, 8, 8, 128)         73856     
_________________________________________________________________
dropout_9 (Dropout)          (None, 8, 8, 128)         0         
_________________________________________________________________
conv2d_12 (Conv2D)           (None, 8, 8, 128)         147584    
_________________________________________________________________
max_pooling2d_6 (MaxPooling2 (None, 4, 4, 128)         0         
_________________________________________________________________
flatten_2 (Flatten)          (None, 2048)              0         
_________________________________________________________________
dropout_10 (Dropout)         (None, 2048)              0         
_________________________________________________________________
dense_4 (Dense)              (None, 1024)              2098176   
_________________________________________________________________
dropout_11 (Dropout)         (None, 1024)              0         
_________________________________________________________________
dense_5 (Dense)              (None, 512)               524800    
_________________________________________________________________
dropout_12 (Dropout)         (None, 512)               0         
_________________________________________________________________
dense_6 (Dense)              (None, 10)                5130      
=================================================================
Total params: 2,915,114
Trainable params: 2,915,114
Non-trainable params: 0
_________________________________________________________________
None
```

In [ ]:

```python
# Compile model
lrate = 0.01
epochs=15
decay = lrate/epochs
sgd = SGD(lr=lrate, momentum=0.9, decay=decay, nesterov=False)
model.compile(loss='categorical_crossentropy', optimizer=sgd, metrics=['accuracy'])
model.fit(X_train, y_train, validation_data=(X_test, y_test), epochs=15, batch_size=32)
# Final evaluation of the model
scores = model.evaluate(X_test, y_test, verbose=0)
print("Accuracy: %.2f%%" % (scores[1]*100))
```

In [ ]: