In [1]:
```
from keras.datasets import cifar10
from keras.models import Sequential
from keras.layers import Dense, Dropout, Conv2D, MaxPool2D, Flatten
from keras.utils import np_utils
```

In [2]:
```
(X_train, y_train), (X_test, y_test) = cifar10.load_data()
```

In [3]:
```
X_train = X_train.reshape(X_train.shape[0], 32, 32, 3)
X_test = X_test.reshape(X_test.shape[0], 32, 32, 3)
X_train = X_train.astype('float32')
X_test = X_test.astype('float32')
```

In [4]:
```
X_train /= 255
X_test /= 255
```

In [5]:
```
n_classes = 10
print("Shape before one-hot encoding: ", y_train.shape)
Y_train = np_utils.to_categorical(y_train, n_classes)
Y_test = np_utils.to_categorical(y_test, n_classes)
print("Shape after one-hot encoding: ", Y_train.shape)
```

```
Shape before one-hot encoding:  (50000, 1)
Shape after one-hot encoding:  (50000, 10)
```

In [6]:
```
model = Sequential()
```

In [7]:
```
model.add(Conv2D(50, kernel_size=(3,3), strides=(1,1), padding='same', activation=

# convolutional layer
model.add(Conv2D(75, kernel_size=(3,3), strides=(1,1), padding='same', activation=
model.add(MaxPool2D(pool_size=(2,2)))
model.add(Dropout(0.25))

model.add(Conv2D(125, kernel_size=(3,3), strides=(1,1), padding='same', activation=
model.add(MaxPool2D(pool_size=(2,2)))
model.add(Dropout(0.25))

model.add(Flatten())

# hidden layer
model.add(Dense(500, activation='relu'))
model.add(Dropout(0.4))
model.add(Dense(250, activation='relu'))
model.add(Dropout(0.3))
# output layer
model.add(Dense(10, activation='softmax'))

# compiling the sequential model
model.compile(loss='categorical_crossentropy', metrics=['accuracy'], optimizer='ada

# training the model for 10 epochs
model_log = model.fit(X_train, Y_train, batch_size=128, epochs=10, validation_data=
```

```
Epoch 1/10
391/391 [==============================] - 322s 822ms/step - loss: 1.6371 - accura
cy: 0.3970 - val_loss: 1.2306 - val_accuracy: 0.5586
Epoch 2/10
391/391 [==============================] - 315s 805ms/step - loss: 1.1571 - accura
cy: 0.5897 - val_loss: 0.9781 - val_accuracy: 0.6559
Epoch 3/10
391/391 [==============================] - 318s 814ms/step - loss: 0.9635 - accura
cy: 0.6636 - val_loss: 0.8423 - val_accuracy: 0.7099
Epoch 4/10
391/391 [==============================] - 328s 839ms/step - loss: 0.8479 - accura
cy: 0.7008 - val_loss: 0.7697 - val_accuracy: 0.7370
Epoch 5/10
391/391 [==============================] - 315s 806ms/step - loss: 0.7660 - accura
cy: 0.7335 - val_loss: 0.7346 - val_accuracy: 0.7455
Epoch 6/10
391/391 [==============================] - 322s 824ms/step - loss: 0.6909 - accura
cy: 0.7595 - val_loss: 0.7063 - val_accuracy: 0.7579
Epoch 7/10
391/391 [==============================] - 330s 845ms/step - loss: 0.6470 - accura
cy: 0.7732 - val_loss: 0.6965 - val_accuracy: 0.7611
Epoch 8/10
391/391 [==============================] - 317s 811ms/step - loss: 0.5905 - accura
cy: 0.7922 - val_loss: 0.6738 - val_accuracy: 0.7715
Epoch 9/10
391/391 [==============================] - 323s 827ms/step - loss: 0.5491 - accura
cy: 0.8068 - val_loss: 0.6707 - val_accuracy: 0.7734
Epoch 10/10
391/391 [==============================] - 327s 836ms/step - loss: 0.5079 - accura
cy: 0.8217 - val_loss: 0.6650 - val_accuracy: 0.7761
```

In [8]:

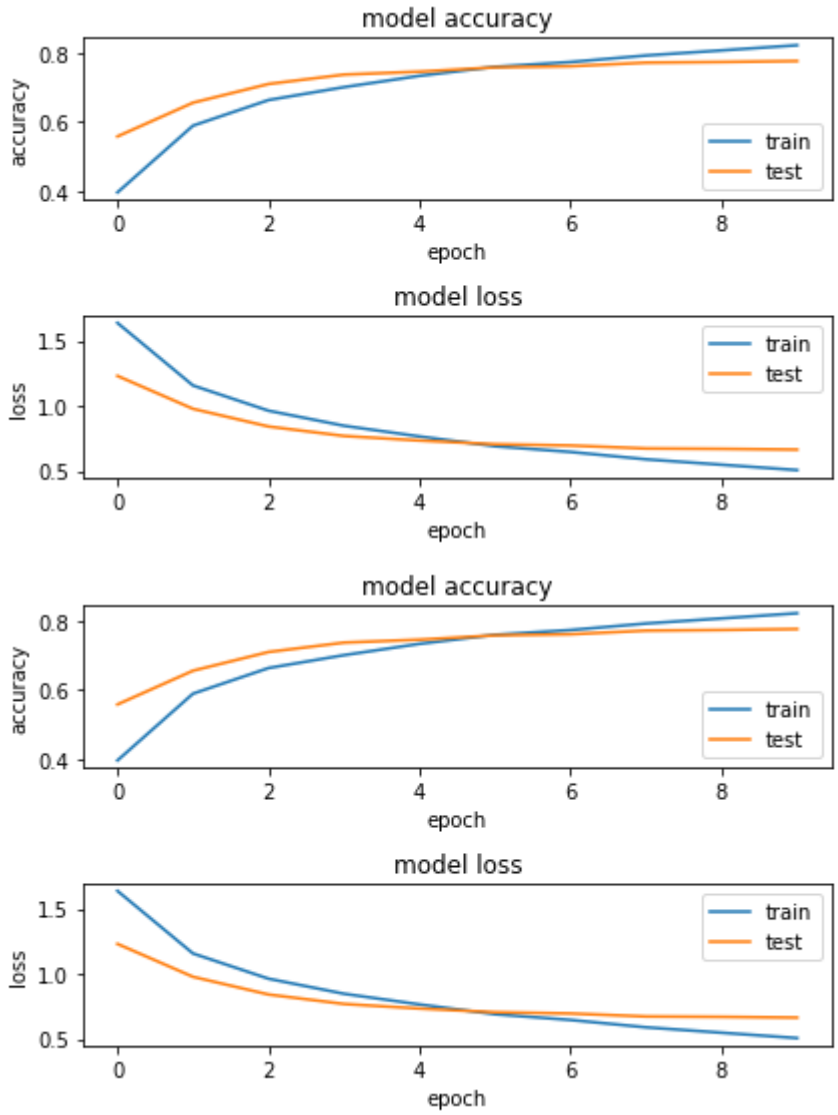
```
loss, accuracy = model.evaluate(X_test, Y_test, verbose=0)

print(f"Test Loss: {loss:.4f}")
print(f"Test Accuracy: {accuracy * 100:.2f}%")
```

```
Test Loss: 0.6650
Test Accuracy: 77.61%
```

In [9]:

```
import os
import matplotlib.pyplot as plt
# plotting the metrics
fig = plt.figure()
plt.subplot(2,1,1)
plt.plot(model_log.history['accuracy'])
plt.plot(model_log.history['val_accuracy'])
plt.title('model accuracy')
plt.ylabel('accuracy')
plt.xlabel('epoch')
plt.legend(['train', 'test'], loc='lower right')
plt.subplot(2,1,2)
plt.plot(model_log.history['loss'])
plt.plot(model_log.history['val_loss'])
plt.title('model loss')
plt.ylabel('loss')
plt.xlabel('epoch')
plt.legend(['train', 'test'], loc='upper right')
plt.tight_layout()
fig
```

Out[9]:


model accuracy
accuracy
epoch
train
test
model loss
loss
epoch
train
test
model accuracy
accuracy
epoch
train
test
model loss
loss
epoch
train
test