In [19]:
```
!pip install keras
```

```
Requirement already satisfied: keras in c:\users\praja\anaconda3\lib\site-packages (2.10.0)
```

In [20]:
```
from tensorflow.keras.datasets import cifar10
from matplotlib import pyplot
```

In [27]:
```
(x_train,y_train),(x_test,y_test)=cifar10.load_data()
```

In [33]:
```
import numpy
from keras.datasets import cifar10
from keras.models import Sequential
from keras.layers import Dense
from keras.layers import Dropout
from keras.layers import Flatten
from keras.constraints import maxnorm
from keras.optimizers import SGD
from keras.layers.convolutional import Convolution2D
from keras.layers.convolutional import MaxPooling2D
from keras.utils import np_utils
from keras import backend as K
```

In [34]:
```
seed=7
numpy.random.seed(seed)
```

In [36]:
```
(x_train,y_train),(x_test,y_test)=cifar10.load_data()
```

In [37]:
```
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 [38]:
```
y_train=np_utils.to_categorical(y_train)
y_test=np_utils.to_categorical(y_test)
num_classes=y_test.shape[1]
```

In [47]:
```
model=Sequential()
model.add(Convolution2D(32,(3,3),input_shape=(32,32,3),activation='relu'))
model.add(Dropout(0.2))
model.add(Convolution2D(32,3,3,activation='relu',))
model.add(MaxPooling2D(pool_size=(2,2)))
model.add(Flatten())
model.add(Dense(512,activation='relu',))
model.add(Dropout(0.5))
model.add(Dense(num_classes,activation='softmax'))
```

In [53]:
```
epochs=25
lrate=0.01
decay=lrate/epochs
sgd=SGD(lr=lrate,momentum=0.9,decay=decay,nesterov=False)
model.compile(loss='categorical_crossentropy',optimizer=sgd,metrics=['accuracy'])
```

```
C:\Users\praja\anaconda3\lib\site-packages\keras\optimizers\optimizer_v2\gradient_descent.py:111: UserWarning: The `lr
` argument is deprecated, use `learning_rate` instead.
  super().__init__(name, **kwargs)
```

In [54]:
```
print(model.summary())
```

```
Model: "sequential_8"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 conv2d_11 (Conv2D)          (None, 30, 30, 32)        896

 dropout_5 (Dropout)         (None, 30, 30, 32)        0

 conv2d_12 (Conv2D)          (None, 10, 10, 32)        9248

 max_pooling2d_4 (MaxPooling  (None, 5, 5, 32)         0
 2D)

 flatten_3 (Flatten)         (None, 800)               0

 dense_2 (Dense)             (None, 512)               410112

 dropout_6 (Dropout)         (None, 512)               0

 dense_3 (Dense)             (None, 10)                5130

=================================================================
Total params: 425,386
Trainable params: 425,386
Non-trainable params: 0
_________________________________________________________________
None
```

In [56]:
```
model.fit(x_train,y_train,validation_data=(x_test,y_test),epochs=epochs,batch_size=10,verbose=1)
```

```
Epoch 1/25
5000/5000 [==============================] - 33s 6ms/step - loss: 1.7478 - accuracy: 0.3608 - val_loss: 1.3984 - val_a
ccuracy: 0.4993
Epoch 2/25
5000/5000 [==============================] - 33s 7ms/step - loss: 1.4132 - accuracy: 0.4919 - val_loss: 1.2683 - val_a
ccuracy: 0.5458
Epoch 3/25
5000/5000 [==============================] - 31s 6ms/step - loss: 1.3039 - accuracy: 0.5331 - val_loss: 1.2134 - val_a
ccuracy: 0.5721
Epoch 4/25
5000/5000 [==============================] - 32s 6ms/step - loss: 1.2284 - accuracy: 0.5638 - val_loss: 1.1504 - val_a
ccuracy: 0.5901
Epoch 5/25
5000/5000 [==============================] - 32s 6ms/step - loss: 1.1709 - accuracy: 0.5827 - val_loss: 1.1183 - val_a
ccuracy: 0.6036
Epoch 6/25
5000/5000 [==============================] - 32s 6ms/step - loss: 1.1266 - accuracy: 0.5997 - val_loss: 1.0988 - val_a
ccuracy: 0.6081
Epoch 7/25
5000/5000 [==============================] - 33s 7ms/step - loss: 1.0903 - accuracy: 0.6142 - val_loss: 1.0851 - val_a
ccuracy: 0.6200
Epoch 8/25
5000/5000 [==============================] - 33s 7ms/step - loss: 1.0650 - accuracy: 0.6224 - val_loss: 1.0640 - val_a
ccuracy: 0.6239
Epoch 9/25
5000/5000 [==============================] - 33s 7ms/step - loss: 1.0320 - accuracy: 0.6317 - val_loss: 1.0411 - val_a
ccuracy: 0.6358
Epoch 10/25
5000/5000 [==============================] - 32s 6ms/step - loss: 1.0101 - accuracy: 0.6422 - val_loss: 1.0604 - val_a
ccuracy: 0.6283
Epoch 11/25
5000/5000 [==============================] - 33s 7ms/step - loss: 0.9883 - accuracy: 0.6505 - val_loss: 1.0333 - val_a
ccuracy: 0.6371
Epoch 12/25
5000/5000 [==============================] - 35s 7ms/step - loss: 0.9711 - accuracy: 0.6540 - val_loss: 1.0140 - val_a
ccuracy: 0.6454
Epoch 13/25
5000/5000 [==============================] - 34s 7ms/step - loss: 0.9539 - accuracy: 0.6612 - val_loss: 0.9996 - val_a
ccuracy: 0.6514
Epoch 14/25
5000/5000 [==============================] - 33s 7ms/step - loss: 0.9426 - accuracy: 0.6663 - val_loss: 1.0028 - val_a
ccuracy: 0.6514
Epoch 15/25
5000/5000 [==============================] - 33s 7ms/step - loss: 0.9233 - accuracy: 0.6708 - val_loss: 0.9975 - val_a
ccuracy: 0.6550
Epoch 16/25
5000/5000 [==============================] - 33s 7ms/step - loss: 0.9110 - accuracy: 0.6797 - val_loss: 0.9905 - val_a
ccuracy: 0.6563
Epoch 17/25
5000/5000 [==============================] - 33s 7ms/step - loss: 0.8960 - accuracy: 0.6802 - val_loss: 0.9834 - val_a
ccuracy: 0.6597
Epoch 18/25
5000/5000 [==============================] - 33s 7ms/step - loss: 0.8833 - accuracy: 0.6878 - val_loss: 0.9799 - val_a
ccuracy: 0.6604
Epoch 19/25
5000/5000 [==============================] - 33s 7ms/step - loss: 0.8765 - accuracy: 0.6891 - val_loss: 0.9769 - val_a
ccuracy: 0.6624
Epoch 20/25
5000/5000 [==============================] - 32s 6ms/step - loss: 0.8678 - accuracy: 0.6941 - val_loss: 0.9787 - val_a
ccuracy: 0.6628
Epoch 21/25
5000/5000 [==============================] - 32s 6ms/step - loss: 0.8548 - accuracy: 0.6993 - val_loss: 0.9719 - val_a
ccuracy: 0.6668
Epoch 22/25
5000/5000 [==============================] - 32s 6ms/step - loss: 0.8518 - accuracy: 0.6976 - val_loss: 0.9799 - val_a
ccuracy: 0.6657
Epoch 23/25
5000/5000 [==============================] - 35s 7ms/step - loss: 0.8357 - accuracy: 0.7028 - val_loss: 0.9680 - val_a
ccuracy: 0.6685
Epoch 24/25
5000/5000 [==============================] - 32s 6ms/step - loss: 0.8306 - accuracy: 0.7042 - val_loss: 0.9632 - val_a
ccuracy: 0.6672
Epoch 25/25
5000/5000 [==============================] - 33s 7ms/step - loss: 0.8234 - accuracy: 0.7105 - val_loss: 0.9668 - val_a
ccuracy: 0.6710
```

Out[56]:
```
<keras.callbacks.History at 0x2cf81396100>
```