Image retrieval by example query image

Experiment with 10 query image for each class label

In [84]:
```python
%reset
```

Once deleted, variables cannot be recovered. Proceed (y/[n])? y

In [85]:
```python
from PIL import Image
import matplotlib.pyplot as plt
import numpy as np
import os
import sys
from time import time
import pickle

experimentPath = r'D:\1_Code\FOE\ECE3086\lab1_cbir_student'
os.chdir(experimentPath)
# lab related module
#from ai_pytorch_module import *
import cbir_module
from cbir_module import *
import importlib
importlib.reload(cbir_module)
%matplotlib inline
```

In [86]:
```python
#%% Set Path
imgpath = r'.\images'
os.chdir(experimentPath)
sys.path.append(os.getcwd())
sys.path.insert(0, experimentPath)
```

In [87]:
```python
%pwd
```

Out[87]: 'D:\\1_Code\\FOE\\ECE3086\\lab1_cbir_student'

In [88]:
```python
#%% load database
# Need this since pickle store a list of Database objects
# Pickle need to refer to this class
class Database :
    def __init__(self) :
        self.imageName =  None
        self.featCNN = None

with open("CBIR_database.pickle","rb") as f:
    dataDict = pickle.load(f)
database = dataDict['database']
```

Question 7

Write and implement the functions and complete the scripts to compute the average precision for ten queries. Use the following image index for class 1 (Africa) as queries, 0,1,2,3,4,5,6,7,8,9 . Use CNN feature.

In [ ]:
```python
# Implement your code for the function in cbir_module.py
# Implement def doRetrieval(featQuery , k, database, imgpath, showImage=True):
# Implement def getPrecisionRank_K(k, queryLabel, retrievedID, database):
```

In [89]:
```python
#%% Test your code with the script in this cell. It should produce the following out
# from cbir_module import doRetrieval, getPrecisionRank_K
# Do retrieval by nearest neighbour search
# Use query by example
from cbir_module import getPrecisionRank_K , doRetrieval

k =10
i=0
Precision_K = np.zeros(k)
queryID_list = [0,1,2,3,4,5,6,7,8,9]
for queryID in queryID_list :
    featQuery = database[queryID].featCNN
    # your code
    print("Query image label :" , queryLabel)
    print("Precision for query ID {} when retrieving {} images = {:02.3f}".format(qu
    i=i+1

average_precision = np.mean(Precision_K)

print("\n\n Average precision = {:02.3f} ".format( average_precision ) )
```

```
 Class label of retrieved img
1  1  1  9  1  1  1  3  3  1  Query image label : 1
Precision for query ID 0 when retrieving 10 images = 0.700

 Class label of retrieved img
1  1  1  1  1  1  1  1  1  1  Query image label : 1
Precision for query ID 1 when retrieving 10 images = 1.000

 Class label of retrieved img
1  1  1  9  3  1  1  1  1  1  Query image label : 1
Precision for query ID 2 when retrieving 10 images = 0.800

 Class label of retrieved img
1  1  1  1  2  1  2  1  1  1  Query image label : 1
Precision for query ID 3 when retrieving 10 images = 0.800

 Class label of retrieved img
1  2  1  2  2  2  1  2  3  2  Query image label : 1
Precision for query ID 4 when retrieving 10 images = 0.300

 Class label of retrieved img
1  1  1  1  1  1  2  1  1  1  Query image label : 1
Precision for query ID 5 when retrieving 10 images = 0.900

 Class label of retrieved img
1  1  1  1  1  1  1  1  2  1  Query image label : 1
Precision for query ID 6 when retrieving 10 images = 0.900

 Class label of retrieved img
1  1  1  1  1  1  1  1  1  1  Query image label : 1
Precision for query ID 7 when retrieving 10 images = 1.000

 Class label of retrieved img
1  1  1  1  1  1  1  1  1  1  Query image label : 1
Precision for query ID 8 when retrieving 10 images = 1.000

 Class label of retrieved img
1  1  1  1  1  1  1  1  1  1  Query image label : 1
Precision for query ID 9 when retrieving 10 images = 1.000
```

```
Average precision = 0.840
```

Question 8

Repeat the task in question 7 by completing the short script in the cell to compute the average precision for 100 queries. Use the first 10 images for each class as query image. All the 10 classes must be included. Use CNN feature

In [90]:
```python
# Sample code to generate the query list for 100 images (cover 10 classes)
#class 1 [0,1,2,3,4,5,6,7,8,9]
#class 2 [100,101,102,103,104,105,106,107,108,109]

qlist=[]
c=1 ; num=0
for i in range(1000):
    if database[i].classLabel == c :
        qlist.append(database[i].id)
        num +=1
        if num>=10 :
            c=c+1 ; num=0
# qList = [0,1,2,..9,100,101,.....900,901..909]
print("total image in query list = ", len(qlist))
qlist = np.array(qlist, dtype=np.int32)
print(qlist)
```

```
total image in query list =  100
[  0   1   2   3   4   5   6   7   8   9 100 101 102 103 104 105 106 107
 108 109 200 201 202 203 204 205 206 207 208 209 300 301 302 303 304 305
 306 307 308 309 400 401 402 403 404 405 406 407 408 409 500 501 502 503
 504 505 506 507 508 509 600 601 602 603 604 605 606 607 608 609 700 701
 702 703 704 705 706 707 708 709 800 801 802 803 804 805 806 807 808 809
 900 901 902 903 904 905 906 907 908 909]
```

In [91]:
```python
print("\n Performing CBIR experiment with 100 queries with CNN feature")

k=10 # select the top K image to be retrieved
# Your code


average_precision = np.mean(Precision_K)

print("\n\n Average precision for all 10 classes = {:02.3f} ".format( average_precis
```

```
 Performing CBIR experiment with 100 queries with CNN feature

 Class label of retrieved img
1  1  1  9  1  1  1  3  3  1  Query image label : 1
Precision for query ID 0 when retrieving 10 images = 0.700

 Class label of retrieved img
1  1  1  1  1  1  1  1  1  1  Query image label : 1
Precision for query ID 1 when retrieving 10 images = 1.000

 Class label of retrieved img
1  1  1  9  3  1  1  1  1  1  Query image label : 1
Precision for query ID 2 when retrieving 10 images = 0.800

 Class label of retrieved img
1  1  1  1  2  1  2  1  1  1  Query image label : 1
Precision for query ID 3 when retrieving 10 images = 0.800

 Class label of retrieved img
1  2  1  2  2  2  1  2  3  2  Query image label : 1
```

```
          Precision for query ID 4 when retrieving 10 images = 0.300

           Class label of retrieved img
          1  1  1  1  1  1  2  1  1  1  Query image label : 1
          Precision for query ID 5 when retrieving 10 images = 0.900

           Class label of retrieved img
          1  1  1  1  1  1  1  1  2  1  Query image label : 1
          Precision for query ID 6 when retrieving 10 images = 0.900

           Class label of retrieved img
          1  1  1  1  1  1  1  1  1  1  Query image label : 1
          Precision for query ID 7 when retrieving 10 images = 1.000

           Class label of retrieved img
          1  1  1  1  1  1  1  1  1  1  Query image label : 1
          Precision for query ID 8 when retrieving 10 images = 1.000

           Class label of retrieved img
          1  1  1  1  1  1  1  1  1  1  Query image label : 1
          Precision for query ID 9 when retrieving 10 images = 1.000

           Class label of retrieved img
          1  4  3  4  2  2  4  4  4  9  Query image label : 2
          Precision for query ID 100 when retrieving 10 images = 0.200

           Class label of retrieved img
          2  2  2  2  2  2  2  2  2  2  Query image label : 2
          Precision for query ID 101 when retrieving 10 images = 1.000

           Class label of retrieved img
          2  2  2  2  2  2  2  2  2  2  Query image label : 2
          Precision for query ID 102 when retrieving 10 images = 1.000

           Class label of retrieved img
          2  2  2  2  2  2  2  2  2  2  Query image label : 2
          Precision for query ID 103 when retrieving 10 images = 1.000

           Class label of retrieved img
          2  2  2  2  2  2  2  2  2  2  Query image label : 2
          Precision for query ID 104 when retrieving 10 images = 1.000

           Class label of retrieved img
          2  1  7  7  2  1  1  7  1  1  Query image label : 2
          Precision for query ID 105 when retrieving 10 images = 0.200

           Class label of retrieved img
          2  2  2  2  2  2  2  2  2  2  Query image label : 2
          Precision for query ID 106 when retrieving 10 images = 1.000

           Class label of retrieved img
          2  2  2  2  2  2  2  2  2  2  Query image label : 2
          Precision for query ID 107 when retrieving 10 images = 1.000

           Class label of retrieved img
          1  2  1  2  1  1  2  1  2  2  Query image label : 2
          Precision for query ID 108 when retrieving 10 images = 0.500

           Class label of retrieved img
          2  9  2  9  2  9  9  2  2  9  Query image label : 2
          Precision for query ID 109 when retrieving 10 images = 0.500

           Class label of retrieved img
          3  3  3  3  3  3  3  3  3  3  Query image label : 3
          Precision for query ID 200 when retrieving 10 images = 1.000

           Class label of retrieved img
          3  3  3  3  3  3  3  3  3  3  Query image label : 3
          Precision for query ID 201 when retrieving 10 images = 1.000
```

```
 Class label of retrieved img
3  3  3  3  3  3  2  3  3  2  Query image label : 3
Precision for query ID 202 when retrieving 10 images = 0.800

 Class label of retrieved img
3  3  3  3  3  3  3  3  3  3  Query image label : 3
Precision for query ID 203 when retrieving 10 images = 1.000

 Class label of retrieved img
3  3  3  3  3  3  3  3  3  3  Query image label : 3
Precision for query ID 204 when retrieving 10 images = 1.000

 Class label of retrieved img
3  3  3  3  3  3  3  3  3  3  Query image label : 3
Precision for query ID 205 when retrieving 10 images = 1.000

 Class label of retrieved img
3  3  3  3  3  3  3  3  3  3  Query image label : 3
Precision for query ID 206 when retrieving 10 images = 1.000

 Class label of retrieved img
3  3  3  3  3  3  3  3  3  3  Query image label : 3
Precision for query ID 207 when retrieving 10 images = 1.000

 Class label of retrieved img
3  3  3  3  3  3  3  3  3  3  Query image label : 3
Precision for query ID 208 when retrieving 10 images = 1.000

 Class label of retrieved img
3  3  3  3  3  9  3  3  2  2  Query image label : 3
Precision for query ID 209 when retrieving 10 images = 0.700

 Class label of retrieved img
4  4  4  4  4  4  4  4  4  4  Query image label : 4
Precision for query ID 300 when retrieving 10 images = 1.000

 Class label of retrieved img
4  4  4  4  4  4  4  4  4  4  Query image label : 4
Precision for query ID 301 when retrieving 10 images = 1.000

 Class label of retrieved img
4  4  4  4  4  4  4  4  4  4  Query image label : 4
Precision for query ID 302 when retrieving 10 images = 1.000

 Class label of retrieved img
4  4  4  4  4  4  4  4  4  4  Query image label : 4
Precision for query ID 303 when retrieving 10 images = 1.000

 Class label of retrieved img
4  4  4  4  4  4  4  4  4  4  Query image label : 4
Precision for query ID 304 when retrieving 10 images = 1.000

 Class label of retrieved img
4  4  4  4  4  4  4  4  4  4  Query image label : 4
Precision for query ID 305 when retrieving 10 images = 1.000

 Class label of retrieved img
4  4  4  4  4  4  4  4  4  4  Query image label : 4
Precision for query ID 306 when retrieving 10 images = 1.000

 Class label of retrieved img
4  4  4  4  4  4  4  4  4  4  Query image label : 4
Precision for query ID 307 when retrieving 10 images = 1.000

 Class label of retrieved img
4  4  4  4  4  4  4  4  4  4  Query image label : 4
Precision for query ID 308 when retrieving 10 images = 1.000
```

```
 Class label of retrieved img
4  4  4  4  4  4  4  4  4  4  Query image label : 4
Precision for query ID 309 when retrieving 10 images = 1.000

 Class label of retrieved img
5  5  5  5  5  5  5  5  5  5  Query image label : 5
Precision for query ID 400 when retrieving 10 images = 1.000

 Class label of retrieved img
5  5  5  5  5  5  5  5  5  5  Query image label : 5
Precision for query ID 401 when retrieving 10 images = 1.000

 Class label of retrieved img
5  5  5  5  5  5  5  5  5  5  Query image label : 5
Precision for query ID 402 when retrieving 10 images = 1.000

 Class label of retrieved img
5  5  5  5  5  5  5  5  5  5  Query image label : 5
Precision for query ID 403 when retrieving 10 images = 1.000

 Class label of retrieved img
5  5  5  5  5  5  5  5  5  5  Query image label : 5
Precision for query ID 404 when retrieving 10 images = 1.000

 Class label of retrieved img
5  5  5  5  5  5  5  5  5  5  Query image label : 5
Precision for query ID 405 when retrieving 10 images = 1.000

 Class label of retrieved img
5  5  5  5  5  5  5  5  5  5  Query image label : 5
Precision for query ID 406 when retrieving 10 images = 1.000

 Class label of retrieved img
5  5  5  5  5  5  5  5  5  5  Query image label : 5
Precision for query ID 407 when retrieving 10 images = 1.000

 Class label of retrieved img
5  5  5  5  5  5  5  5  5  5  Query image label : 5
Precision for query ID 408 when retrieving 10 images = 1.000

 Class label of retrieved img
5  5  5  5  5  5  5  5  5  5  Query image label : 5
Precision for query ID 409 when retrieving 10 images = 1.000

 Class label of retrieved img
6  6  6  6  6  6  6  6  6  6  Query image label : 6
Precision for query ID 500 when retrieving 10 images = 1.000

 Class label of retrieved img
6  6  6  6  6  6  6  6  6  6  Query image label : 6
Precision for query ID 501 when retrieving 10 images = 1.000

 Class label of retrieved img
6  6  6  6  6  6  6  6  6  6  Query image label : 6
Precision for query ID 502 when retrieving 10 images = 1.000

 Class label of retrieved img
6  6  6  6  6  6  6  6  6  6  Query image label : 6
Precision for query ID 503 when retrieving 10 images = 1.000

 Class label of retrieved img
6  6  6  6  6  6  6  6  6  6  Query image label : 6
Precision for query ID 504 when retrieving 10 images = 1.000

 Class label of retrieved img
6  6  6  6  6  6  6  6  6  6  Query image label : 6
Precision for query ID 505 when retrieving 10 images = 1.000

 Class label of retrieved img
```

```
6  6  6  6  6  6  6  6  6  6  Query image label : 6
Precision for query ID 506 when retrieving 10 images = 1.000

 Class label of retrieved img
6  6  6  6  6  6  6  6  6  6  Query image label : 6
Precision for query ID 507 when retrieving 10 images = 1.000

 Class label of retrieved img
6  6  6  6  6  6  6  6  6  6  Query image label : 6
Precision for query ID 508 when retrieving 10 images = 1.000

 Class label of retrieved img
6  6  6  6  6  6  6  6  6  6  Query image label : 6
Precision for query ID 509 when retrieving 10 images = 1.000

 Class label of retrieved img
7  7  7  7  7  7  7  7  7  7  Query image label : 7
Precision for query ID 600 when retrieving 10 images = 1.000

 Class label of retrieved img
7  7  7  7  7  7  7  7  7  7  Query image label : 7
Precision for query ID 601 when retrieving 10 images = 1.000

 Class label of retrieved img
7  7  7  7  7  7  7  7  7  7  Query image label : 7
Precision for query ID 602 when retrieving 10 images = 1.000

 Class label of retrieved img
7  7  7  7  7  7  7  7  7  7  Query image label : 7
Precision for query ID 603 when retrieving 10 images = 1.000

 Class label of retrieved img
7  7  7  7  7  7  7  7  7  7  Query image label : 7
Precision for query ID 604 when retrieving 10 images = 1.000

 Class label of retrieved img
7  7  7  7  7  7  7  7  7  7  Query image label : 7
Precision for query ID 605 when retrieving 10 images = 1.000

 Class label of retrieved img
7  7  7  7  7  7  7  7  7  7  Query image label : 7
Precision for query ID 606 when retrieving 10 images = 1.000

 Class label of retrieved img
7  7  7  7  7  7  7  7  7  7  Query image label : 7
Precision for query ID 607 when retrieving 10 images = 1.000

 Class label of retrieved img
7  7  7  7  7  7  7  7  7  7  Query image label : 7
Precision for query ID 608 when retrieving 10 images = 1.000

 Class label of retrieved img
7  7  7  7  7  7  7  7  7  7  Query image label : 7
Precision for query ID 609 when retrieving 10 images = 1.000

 Class label of retrieved img
8  8  8  8  8  8  8  8  8  8  Query image label : 8
Precision for query ID 700 when retrieving 10 images = 1.000

 Class label of retrieved img
8  8  8  8  8  8  8  8  8  8  Query image label : 8
Precision for query ID 701 when retrieving 10 images = 1.000

 Class label of retrieved img
8  8  8  8  8  8  8  8  8  8  Query image label : 8
Precision for query ID 702 when retrieving 10 images = 1.000

 Class label of retrieved img
8  8  8  8  8  8  8  8  8  8  Query image label : 8
```

```
          Precision for query ID 703 when retrieving 10 images = 1.000

           Class label of retrieved img
          8  8  8  8  8  8  8  8  8  8  Query image label : 8
          Precision for query ID 704 when retrieving 10 images = 1.000

           Class label of retrieved img
          8  8  8  8  8  8  8  8  8  8  Query image label : 8
          Precision for query ID 705 when retrieving 10 images = 1.000

           Class label of retrieved img
          8  8  8  8  8  8  8  8  8  1  Query image label : 8
          Precision for query ID 706 when retrieving 10 images = 0.900

           Class label of retrieved img
          8  8  8  8  8  8  8  8  8  8  Query image label : 8
          Precision for query ID 707 when retrieving 10 images = 1.000

           Class label of retrieved img
          8  8  8  8  8  8  8  8  8  8  Query image label : 8
          Precision for query ID 708 when retrieving 10 images = 1.000

           Class label of retrieved img
          8  8  8  8  8  8  8  8  8  1  Query image label : 8
          Precision for query ID 709 when retrieving 10 images = 0.900

           Class label of retrieved img
          9  9  9  9  9  9  9  9  9  9  Query image label : 9
          Precision for query ID 800 when retrieving 10 images = 1.000

           Class label of retrieved img
          9  9  9  9  9  9  9  9  9  9  Query image label : 9
          Precision for query ID 801 when retrieving 10 images = 1.000

           Class label of retrieved img
          9  9  9  9  9  9  9  9  9  9  Query image label : 9
          Precision for query ID 802 when retrieving 10 images = 1.000

           Class label of retrieved img
          9  9  9  9  9  9  9  9  9  9  Query image label : 9
          Precision for query ID 803 when retrieving 10 images = 1.000

           Class label of retrieved img
          9  9  9  9  9  9  9  9  9  9  Query image label : 9
          Precision for query ID 804 when retrieving 10 images = 1.000

           Class label of retrieved img
          9  9  9  9  9  9  9  9  9  9  Query image label : 9
          Precision for query ID 805 when retrieving 10 images = 1.000

           Class label of retrieved img
          9  9  9  9  9  9  9  9  9  9  Query image label : 9
          Precision for query ID 806 when retrieving 10 images = 1.000

           Class label of retrieved img
          9  9  9  9  9  9  9  9  9  9  Query image label : 9
          Precision for query ID 807 when retrieving 10 images = 1.000

           Class label of retrieved img
          9  9  9  9  9  9  2  9  2  9  Query image label : 9
          Precision for query ID 808 when retrieving 10 images = 0.800

           Class label of retrieved img
          9  9  9  9  9  9  9  9  9  9  Query image label : 9
          Precision for query ID 809 when retrieving 10 images = 1.000

           Class label of retrieved img
          10  10  10  10  10  10  10  10  10  10  Query image label : 10
          Precision for query ID 900 when retrieving 10 images = 1.000
```

```
 Class label of retrieved img
9  2  2  2  2  2  2  2  2  2  Query image label : 10
Precision for query ID 901 when retrieving 10 images = 0.000

 Class label of retrieved img
10  1  10  2  2  2  7  10  7  2  Query image label : 10
Precision for query ID 902 when retrieving 10 images = 0.300

 Class label of retrieved img
10  10  10  10  10  10  10  1  10  10  Query image label : 10
Precision for query ID 903 when retrieving 10 images = 0.900

 Class label of retrieved img
2  2  2  3  9  2  2  2  2  2  Query image label : 10
Precision for query ID 904 when retrieving 10 images = 0.000

 Class label of retrieved img
10  10  10  10  3  10  1  10  10  2  Query image label : 10
Precision for query ID 905 when retrieving 10 images = 0.700

 Class label of retrieved img
10  10  10  10  10  10  10  10  10  10  Query image label : 10
Precision for query ID 906 when retrieving 10 images = 1.000

 Class label of retrieved img
7  7  10  7  10  7  7  7  7  7  Query image label : 10
Precision for query ID 907 when retrieving 10 images = 0.200

 Class label of retrieved img
10  10  10  10  7  7  10  7  7  10  Query image label : 10
Precision for query ID 908 when retrieving 10 images = 0.600

 Class label of retrieved img
10  10  10  10  10  10  7  10  7  10  Query image label : 10
Precision for query ID 909 when retrieving 10 images = 0.800


 Average precision for all 10 classes = 0.904
```

Question 9

Repeat the experiment in question 8 with the use of colour histogram image feature.

In [92]:
```python
print("\n Performing CBIR experiment with 100 queries with Color histogram feature")
# Your code

average_precision = np.mean(Precision_K)

print("\n\n Average precision for all 10 classes = {:02.3f} ".format( average_precis
```

```
 Performing CBIR experiment with 100 queries with Color histogram feature

 Class label of retrieved img
1  1  1  1  1  1  1  1  3  8  Query image label : 1
Precision for query ID 0 when retrieving 10 images = 0.800

 Class label of retrieved img
1  1  1  1  1  1  1  1  1  1  Query image label : 1
Precision for query ID 1 when retrieving 10 images = 1.000

 Class label of retrieved img
1  1  1  1  1  1  1  1  1  1  Query image label : 1
Precision for query ID 2 when retrieving 10 images = 1.000

 Class label of retrieved img
6  3  1  6  1  1  1  1  6  1  Query image label : 1
```

```
        Precision for query ID 3 when retrieving 10 images = 0.600

         Class label of retrieved img
        1  1  1  1  1  1  1  3  1  1   Query image label : 1
        Precision for query ID 4 when retrieving 10 images = 0.900

         Class label of retrieved img
        1  1  1  1  1  1  6  1  1  1   Query image label : 1
        Precision for query ID 5 when retrieving 10 images = 0.900

         Class label of retrieved img
        1  1  1  1  1  1  1  1  1  1   Query image label : 1
        Precision for query ID 6 when retrieving 10 images = 1.000

         Class label of retrieved img
        1  1  3  1  1  1  1  1  1  1   Query image label : 1
        Precision for query ID 7 when retrieving 10 images = 0.900

         Class label of retrieved img
        1  1  1  1  1  3  1  1  1  8   Query image label : 1
        Precision for query ID 8 when retrieving 10 images = 0.800

         Class label of retrieved img
        1  1  1  1  1  1  1  1  1  1   Query image label : 1
        Precision for query ID 9 when retrieving 10 images = 1.000

         Class label of retrieved img
        1  1  1  1  1  1  3  1  1  6   Query image label : 2
        Precision for query ID 100 when retrieving 10 images = 0.000

         Class label of retrieved img
        9  9  9  10  9  6  2  6  9  6   Query image label : 2
        Precision for query ID 101 when retrieving 10 images = 0.100

         Class label of retrieved img
        2  6  2  2  2  6  2  9  6  2   Query image label : 2
        Precision for query ID 102 when retrieving 10 images = 0.600

         Class label of retrieved img
        2  2  3  2  3  6  1  3  3  6   Query image label : 2
        Precision for query ID 103 when retrieving 10 images = 0.300

         Class label of retrieved img
        2  9  9  6  6  3  6  3  9  3   Query image label : 2
        Precision for query ID 104 when retrieving 10 images = 0.100

         Class label of retrieved img
        1  1  10  1  1  1  10  1  1  3   Query image label : 2
        Precision for query ID 105 when retrieving 10 images = 0.000

         Class label of retrieved img
        2  9  3  6  3  6  2  6  6  2   Query image label : 2
        Precision for query ID 106 when retrieving 10 images = 0.300

         Class label of retrieved img
        2  3  3  9  6  9  3  6  3  2   Query image label : 2
        Precision for query ID 107 when retrieving 10 images = 0.200

         Class label of retrieved img
        6  6  8  8  8  6  3  8  3  6   Query image label : 2
        Precision for query ID 108 when retrieving 10 images = 0.000

         Class label of retrieved img
        4  4  10  4  9  4  4  4  4  10   Query image label : 2
        Precision for query ID 109 when retrieving 10 images = 0.000

         Class label of retrieved img
        3  3  4  4  4  3  2  2  4  9   Query image label : 3
        Precision for query ID 200 when retrieving 10 images = 0.300
```

```
 Class label of retrieved img
10  3  4  4  4  3  3  4  3  7  Query image label : 3
Precision for query ID 201 when retrieving 10 images = 0.400

 Class label of retrieved img
3  3  3  9  3  3  3  3  3  3  Query image label : 3
Precision for query ID 202 when retrieving 10 images = 0.900

 Class label of retrieved img
3  3  3  3  3  10  10  10  9  3  Query image label : 3
Precision for query ID 203 when retrieving 10 images = 0.600

 Class label of retrieved img
3  3  3  6  3  3  2  6  3  9  Query image label : 3
Precision for query ID 204 when retrieving 10 images = 0.600

 Class label of retrieved img
3  3  2  3  9  3  2  2  3  3  Query image label : 3
Precision for query ID 205 when retrieving 10 images = 0.600

 Class label of retrieved img
4  10  4  3  4  3  3  4  3  4  Query image label : 3
Precision for query ID 206 when retrieving 10 images = 0.400

 Class label of retrieved img
10  3  3  4  3  4  3  3  7  3  Query image label : 3
Precision for query ID 207 when retrieving 10 images = 0.600

 Class label of retrieved img
1  1  3  3  1  1  4  1  7  1  Query image label : 3
Precision for query ID 208 when retrieving 10 images = 0.200

 Class label of retrieved img
3  1  1  9  9  1  1  1  3  1  Query image label : 3
Precision for query ID 209 when retrieving 10 images = 0.200

 Class label of retrieved img
4  4  4  4  4  4  4  7  4  4  Query image label : 4
Precision for query ID 300 when retrieving 10 images = 0.900

 Class label of retrieved img
4  4  4  4  4  4  4  4  4  4  Query image label : 4
Precision for query ID 301 when retrieving 10 images = 1.000

 Class label of retrieved img
4  4  4  4  4  4  4  4  4  10  Query image label : 4
Precision for query ID 302 when retrieving 10 images = 0.900

 Class label of retrieved img
4  4  4  4  4  4  4  4  4  2  Query image label : 4
Precision for query ID 303 when retrieving 10 images = 0.900

 Class label of retrieved img
4  4  4  4  2  4  10  4  4  9  Query image label : 4
Precision for query ID 304 when retrieving 10 images = 0.700

 Class label of retrieved img
4  4  9  4  4  1  3  1  1  1  Query image label : 4
Precision for query ID 305 when retrieving 10 images = 0.400

 Class label of retrieved img
4  4  4  4  4  4  4  4  4  4  Query image label : 4
Precision for query ID 306 when retrieving 10 images = 1.000

 Class label of retrieved img
4  4  4  4  4  4  4  4  4  10  Query image label : 4
Precision for query ID 307 when retrieving 10 images = 0.900
```

```
 Class label of retrieved img
4  4  4  4  4  10  4  4  9  3   Query image label : 4
Precision for query ID 308 when retrieving 10 images = 0.700

 Class label of retrieved img
4  4  9  1  4  10  9  9  1  1   Query image label : 4
Precision for query ID 309 when retrieving 10 images = 0.300

 Class label of retrieved img
5  5  5  5  5  5  5  5  5  5   Query image label : 5
Precision for query ID 400 when retrieving 10 images = 1.000

 Class label of retrieved img
5  5  5  5  5  5  5  5  5  5   Query image label : 5
Precision for query ID 401 when retrieving 10 images = 1.000

 Class label of retrieved img
5  5  5  5  5  5  5  5  5  5   Query image label : 5
Precision for query ID 402 when retrieving 10 images = 1.000

 Class label of retrieved img
5  5  5  5  5  5  5  5  5  5   Query image label : 5
Precision for query ID 403 when retrieving 10 images = 1.000

 Class label of retrieved img
5  5  5  5  5  5  5  5  5  5   Query image label : 5
Precision for query ID 404 when retrieving 10 images = 1.000

 Class label of retrieved img
5  5  5  5  5  5  5  5  5  5   Query image label : 5
Precision for query ID 405 when retrieving 10 images = 1.000

 Class label of retrieved img
5  5  5  5  5  5  5  5  5  5   Query image label : 5
Precision for query ID 406 when retrieving 10 images = 1.000

 Class label of retrieved img
5  5  5  5  5  5  5  5  5  5   Query image label : 5
Precision for query ID 407 when retrieving 10 images = 1.000

 Class label of retrieved img
5  5  5  5  5  5  5  5  5  5   Query image label : 5
Precision for query ID 408 when retrieving 10 images = 1.000

 Class label of retrieved img
5  5  5  5  5  5  5  5  5  5   Query image label : 5
Precision for query ID 409 when retrieving 10 images = 1.000

 Class label of retrieved img
6  6  6  6  6  6  1  6  1  3   Query image label : 6
Precision for query ID 500 when retrieving 10 images = 0.700

 Class label of retrieved img
1  1  6  6  6  6  10  10  10  10   Query image label : 6
Precision for query ID 501 when retrieving 10 images = 0.400

 Class label of retrieved img
9  9  3  9  6  9  3  9  9  4   Query image label : 6
Precision for query ID 502 when retrieving 10 images = 0.100

 Class label of retrieved img
6  6  6  8  10  1  8  1  1  1   Query image label : 6
Precision for query ID 503 when retrieving 10 images = 0.300

 Class label of retrieved img
6  6  1  6  1  4  6  6  6  9   Query image label : 6
Precision for query ID 504 when retrieving 10 images = 0.600

 Class label of retrieved img
```

6 3 10 3 6 6 6 4 6 6 Query image label : 6
Precision for query ID 505 when retrieving 10 images = 0.600

 Class label of retrieved img
6 6 6 6 6 6 6 6 6 6 Query image label : 6
Precision for query ID 506 when retrieving 10 images = 1.000

 Class label of retrieved img
6 6 6 6 6 6 6 6 6 6 Query image label : 6
Precision for query ID 507 when retrieving 10 images = 1.000

 Class label of retrieved img
6 6 10 6 6 6 6 1 6 6 Query image label : 6
Precision for query ID 508 when retrieving 10 images = 0.800

 Class label of retrieved img
6 8 8 6 6 8 8 8 1 8 Query image label : 6
Precision for query ID 509 when retrieving 10 images = 0.300

 Class label of retrieved img
7 7 7 7 7 7 7 7 7 7 Query image label : 7
Precision for query ID 600 when retrieving 10 images = 1.000

 Class label of retrieved img
7 7 10 7 7 10 4 1 10 4 Query image label : 7
Precision for query ID 601 when retrieving 10 images = 0.400

 Class label of retrieved img
7 7 7 7 7 7 7 4 7 4 Query image label : 7
Precision for query ID 602 when retrieving 10 images = 0.800

 Class label of retrieved img
7 7 7 7 7 7 7 7 7 7 Query image label : 7
Precision for query ID 603 when retrieving 10 images = 1.000

 Class label of retrieved img
7 7 7 7 7 7 7 7 7 7 Query image label : 7
Precision for query ID 604 when retrieving 10 images = 1.000

 Class label of retrieved img
1 8 8 1 3 8 1 8 1 1 Query image label : 7
Precision for query ID 605 when retrieving 10 images = 0.000

 Class label of retrieved img
7 7 7 7 7 10 7 7 7 7 Query image label : 7
Precision for query ID 606 when retrieving 10 images = 0.900

 Class label of retrieved img
3 1 1 1 1 7 4 1 1 4 Query image label : 7
Precision for query ID 607 when retrieving 10 images = 0.100

 Class label of retrieved img
7 7 7 7 7 4 7 4 4 7 Query image label : 7
Precision for query ID 608 when retrieving 10 images = 0.700

 Class label of retrieved img
7 7 7 7 7 7 7 7 7 7 Query image label : 7
Precision for query ID 609 when retrieving 10 images = 1.000

 Class label of retrieved img
8 8 8 8 8 8 8 8 8 8 Query image label : 8
Precision for query ID 700 when retrieving 10 images = 1.000

 Class label of retrieved img
8 8 8 8 8 8 1 3 8 8 Query image label : 8
Precision for query ID 701 when retrieving 10 images = 0.800

 Class label of retrieved img
8 6 8 8 8 8 8 6 1 1 Query image label : 8

```
Precision for query ID 702 when retrieving 10 images = 0.600

 Class label of retrieved img
8  6  1  8  6  8  6  3  6  1  Query image label : 8
Precision for query ID 703 when retrieving 10 images = 0.300

 Class label of retrieved img
8  6  8  8  8  8  8  6  8  8  Query image label : 8
Precision for query ID 704 when retrieving 10 images = 0.800

 Class label of retrieved img
8  8  8  8  1  6  8  8  8  6  Query image label : 8
Precision for query ID 705 when retrieving 10 images = 0.700

 Class label of retrieved img
8  8  8  8  1  8  8  8  8  8  Query image label : 8
Precision for query ID 706 when retrieving 10 images = 0.900

 Class label of retrieved img
8  8  8  8  8  8  8  8  6  8  Query image label : 8
Precision for query ID 707 when retrieving 10 images = 0.900

 Class label of retrieved img
6  8  8  1  6  9  6  8  1  6  Query image label : 8
Precision for query ID 708 when retrieving 10 images = 0.300

 Class label of retrieved img
8  8  8  1  8  8  7  3  1  7  Query image label : 8
Precision for query ID 709 when retrieving 10 images = 0.500

 Class label of retrieved img
3  3  9  2  2  4  3  3  3  4  Query image label : 9
Precision for query ID 800 when retrieving 10 images = 0.100

 Class label of retrieved img
4  3  4  4  1  9  9  10  3  4  Query image label : 9
Precision for query ID 801 when retrieving 10 images = 0.200

 Class label of retrieved img
4  9  10  4  2  4  4  4  4  6  Query image label : 9
Precision for query ID 802 when retrieving 10 images = 0.100

 Class label of retrieved img
2  2  2  8  1  9  1  2  9  4  Query image label : 9
Precision for query ID 803 when retrieving 10 images = 0.200

 Class label of retrieved img
2  2  9  2  2  9  2  9  2  3  Query image label : 9
Precision for query ID 804 when retrieving 10 images = 0.300

 Class label of retrieved img
9  2  2  9  2  9  9  3  2  9  Query image label : 9
Precision for query ID 805 when retrieving 10 images = 0.500

 Class label of retrieved img
9  9  9  6  9  9  6  6  1  1  Query image label : 9
Precision for query ID 806 when retrieving 10 images = 0.500

 Class label of retrieved img
3  3  2  2  2  2  3  3  3  2  Query image label : 9
Precision for query ID 807 when retrieving 10 images = 0.000

 Class label of retrieved img
9  4  2  4  4  4  4  4  4  4  Query image label : 9
Precision for query ID 808 when retrieving 10 images = 0.100

 Class label of retrieved img
9  2  9  2  2  2  2  7  2  4  Query image label : 9
Precision for query ID 809 when retrieving 10 images = 0.200
```

```
 Class label of retrieved img
10  10  10  10   1   1  10   1   6  10   Query image label : 10
Precision for query ID 900 when retrieving 10 images = 0.600

 Class label of retrieved img
 3   3   3   3   3   3   3   3  10   3  Query image label : 10
Precision for query ID 901 when retrieving 10 images = 0.100

 Class label of retrieved img
10  10  10   7  10   4   4   7   1   3  Query image label : 10
Precision for query ID 902 when retrieving 10 images = 0.400

 Class label of retrieved img
 4   4   4   4   4   4  10   4   4  10   Query image label : 10
Precision for query ID 903 when retrieving 10 images = 0.200

 Class label of retrieved img
 1   1   1   1   3   1   9   1   3   1  Query image label : 10
Precision for query ID 904 when retrieving 10 images = 0.000

 Class label of retrieved img
10  10  10  10  10  10  10  10  10  10   Query image label : 10
Precision for query ID 905 when retrieving 10 images = 1.000

 Class label of retrieved img
10  10  10  10  10  10  10  10  10  10   Query image label : 10
Precision for query ID 906 when retrieving 10 images = 1.000

 Class label of retrieved img
10  10   1  10   1  10  10   1  10   1   Query image label : 10
Precision for query ID 907 when retrieving 10 images = 0.600

 Class label of retrieved img
10  10  10  10  10   4  10   1  10  10   Query image label : 10
Precision for query ID 908 when retrieving 10 images = 0.800

 Class label of retrieved img
 9  10  10  10  10   3  10  10  10   3   Query image label : 10
Precision for query ID 909 when retrieving 10 images = 0.700


 Average precision for all 10 classes = 0.601
```

Question 10

Write a conclusion based on the result of the image retrieval experiment. Which feature gives better accuracy for image retrieval?

In [93]:
```
# Type your answer here
```