About Student

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About Assignment

Class: Computer Vision Lab.
Subject: Image Retrieval Basics
Programming Language: Python 3.7

1. INTRODOCTİON

In this assignment, we studied on basic image representation and retrieval methods. Firstly we experiment with simple image represantations and used k-NN classification method to obtain categories of the query images. We compared the results in terms of the classification accuracy. We used a subset of Caltech dataset

1.1 What is k-NN classifier?

K nearest neighbors is a simple algorithm that stores all available cases and classifies new cases based on a similarity measure (e.g., distance functions). KNN has been used in statistical estimation and pattern recognition already in the beginning of 1970's as a non-parametric technique. Algorithm.

1.2 What is Gabor Filter?

Gabor filter, named after Dennis Gabor, is a linear filter used for texture analysis, which means that it basically analyzes whether there are any specific frequency content in the image in specific directions in a localized region around the point or region of analysis.

1.3 What is SIFT?

The scale-invariant feature transform (SIFT) is a feature detection algorithm in computer vision to detect and describe local features in images.

2.Implementation Details

def read_images(): Read images from folder to array as gray color

2.1 Gabor Filters

def build_filters(): creating filters for gabor filter bank

cv2.getGaborKernel(ksize, sigma, theta, lambda, gamma, psi, ktype)

ksize is the size of the Gabor kernel. If ksize = (a, b), we then have a Gabor kernel of size a x b pixels. As with many other convolution kernels, ksize is preferably odd and the kernel is a square (just for the sake of uniformity).
sigma is the standard deviation of the Gaussian function used in the Gabor filter.
theta is the orientation of the normal to the parallel stripes of the Gabor function.
lambda is the wavelength of the sinusoidal factor in the above equation.
gamma is the spatial aspect ratio.
psi is the phase offset.
ktype indicates the type and range of values that each pixel in the Gabor kernel can hold.

def process(img): apply created filters to image

def gabor(): call process method for each image

def gabor_knn(): calculate k nearest neighbour and predict test images

KNeighborsClassifier(n_neighbors)

2.2 Avarage SIFT

def feature_vectors(images): calculate the descriptors and key points

cv2.xfeatures2d.SIFT_create()
sift.detectAndCompute(img,None)

def sift_knn(lst): calculate k nearest neighbour and predict test images

KNeighborsClassifier(n_neighbors)

3.Experimental Results

3.1 Gabor Filter Banks

I keep number of filters in the bank as constant. I changed some paremeters in getGaborFilter function to observe different results.

a. Change on ksize

Sigma:1.0, theta:theta/2, lambd:5, gamma:0.02, ktype: cv2.CV_32F

Ksize	Accuracy
15	0.12
31	0.14
63	0.12

The best value for ksize is 31 as i observed.

b. Change on sigma

Ksize:31, theta:theta/2, lambd:5, gamma:0.02, ktype: cv2.CV_32F

Sigma	Accuracy
1	0.14
2	0.12
4	0.08

While sigma increasing, the accuracy decreasing.

c. Change on theta

Ksize:31, Sigma:1.0, lambd:5, gamma:0.02, ktype: cv2.CV_32F

Theta	Accuracy
Theta/2	0.14
Theta	0.14
2*Theta	0.14

Change of theta makes no affect on accuracy.

d. Change on lambd

Sigma:1.0, theta:theta/2, theta:theta, gamma:0.02, ktype: cv2.CV_32F

Lambd	Accuracy
2.5	0.14
5.0	0.14
10.0	0.12

The best value for lambd is 5.0.

3.2 Avarege SIFT(Scale-Invariant Feature Transform)

Neighbours	Accuracy
10	0.16
20	0.22
50	0.18

Best suitable neighbour numbers is 20.

4. Conclusion

We learned different image representation techniques and we learned how we implement them in Python. We observed these techniques to get best accuracy ratio by changing different parameters.