

Vidyavardhini's College of Engineering & Technology
Department of Computer Engineering
Academic Year: 2023-24

Experiment No. 9
To create and train an Object Detector
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Date of Submission:
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Department of Computer Engineering Academic Year: 2023-24

Aim: To Creating and Training an Object Detector

Objective: Bag of Words BOW in computer version Detecting cars in a scene.

Theory:

Creating and Training an object detector:-

Using built-in features makes it easy to come up with a quick prototype for an application. and we're all very grateful to the OpenCV developers for making great features, such as face detection or people detection readily available (truly, we are). However, whether you are a hobbyist or a computer vision professional, it's unlikely that you will only deal with people and faces:

Bag-of -words:-

Bag-of-words (BOW) is a concept that was not mitially intended for computer vision, rather, we use an evolved version of this concept in the context of computer vision. So, let's first talk about its basic version, which-as you may have guessed-originally belongs to the field of language analysis and information retrieval. BOW is the technique by which we assign a count weight to each word in a series of documents; we then represent these documents with vectors that represent these

set of counts. Let's look at an example:

Document 1: like OpenCV and I like Python

Document 2: like C++ and Python

Document 3: don't like artichokes

BOW in Computer Vision :-

We are by now familiar with the concept of image features. We've used feature extractors, such as SIFT, and SURF, to extract features from images so that we could match these features in another image. We've also familiarized ourselves with the concept of codebook, and we know about SVM, a model that can be fed a set of features and utilizes complex algorithms to classify train data, and can predict the classification of new data. So, the implementation of a BOW approach will involve the following steps:

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- 1. Take a sample dataset.
- 2. For each image in the dataset, extract descriptors (with SIFT, SURF, and so on).
- 3. Add each descriptor to the BOW trainer.
- 4. Cluster the descriptors to k clusters (okay, this sounds obscure, but bear with me) whose centers (centroids) are our visual words.

Detecting ears

There is no virtual limit to the type of objects you can detect in your images and videos. However, to obtain an acceptable level of accuracy, you need a sufficiently large dataset containing train images that are identical in size. This would be a time-consuming operation if we were to do it all by ourselves.

Example – car detection in a scene

We are now ready to apply all the concepts we learned so far to a real-life example, and create a car detector application that scans an image and draws rectangles around cars.

Let's summarize the process before diving into the code:

- 1. Obtain a train dataset.
- 2. Create a BOW trainer and create a visual vocabulary.
- 3. Train an SVM with the vocabulary.
- 4. Attempt detection using sliding windows on an image pyramid of a test image.
- 5. Apply non-maximum suppression to overlapping boxes.
- 6. Output the result.

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```
Code:-
import cv2
import numpy as np
import os
if not os.path.isdir('CarData'):
      exit(1)
BOW NUM TRAINING SAMPLES PER CLASS = 10
SVM NUM TRAINING SAMPLES PER CLASS = 110
BOW NUM CLUSTERS = 40
sift = cv2.SIFT create()
FLANN INDEX KDTREE = 1
index params = dict(algorithm=FLANN INDEX KDTREE, trees=5)
search params = dict(checks=50)
flann = cv2.FlannBasedMatcher(index params, search params)
bow kmeans trainer = cv2.BOWKMeansTrainer(BOW NUM CLUSTERS)
bow extractor = cv2.BOWImgDescriptorExtractor(sift, flann)
def get pos_and_neg_paths(i):
      pos path = 'CarData/TrainImages/pos-%d.pgm' % (i+1)
      neg path = 'CarData/TrainImages/neg-%d.pgm' % (i+1)
      return pos path, neg path
def add sample(path):
      img = cv2.imread(path, cv2.IMREAD GRAYSCALE)
```

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keypoints, descriptors = sift.detectAndCompute(img, None)
      if descriptors is not None:
      bow kmeans trainer.add(descriptors)
for i in range(BOW NUM TRAINING SAMPLES PER CLASS):
      pos path, neg path = get pos and neg paths(i)
      add sample(pos path)
      add sample(neg path)
voc = bow kmeans trainer.cluster()
bow extractor.setVocabulary(voc)
def extract bow descriptors(img):
      features = sift.detect(img)
      return bow extractor.compute(img, features)
training data = []
training labels = []
for i in range(SVM_NUM_TRAINING_SAMPLES_PER_CLASS):
      pos path, neg path = get pos and neg paths(i)
      pos img = cv2.imread(pos path, cv2.IMREAD GRAYSCALE)
      pos descriptors = extract bow descriptors(pos img)
      if pos descriptors is not None:
      training data.extend(pos descriptors)
      training labels.append(1)
      neg img = cv2.imread(neg path, cv2.IMREAD GRAYSCALE)
      neg descriptors = extract bow descriptors(neg img)
```

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```
if neg descriptors is not None:
       training data.extend(neg descriptors)
       training labels.append(-1)
svm = cv2.ml.SVM create()
svm.train(np.array(training data), cv2.ml.ROW SAMPLE,
       np.array(training labels))
for test img path in ['CarData/TestImages/test-0.pgm',
              'CarData/TestImages/test-1.pgm','images/car.jpg','images/haying.jpg',]:
       img = cv2.imread(test img path)
       gray img = cv2.cvtColor(img, cv2.COLOR BGR2GRAY)
       descriptors = extract bow descriptors(gray img)
       prediction = svm.predict(descriptors)
       if prediction[1][0][0] == 1.0:
       text = 'car'
       color = (0, 255, 0)
       else:
       text = 'not car'
       color = (0, 0, 255)
       cv2.putText(img, text, (10, 30), cv2.FONT HERSHEY SIMPLEX, 1, color, 2,
cv2.LINE AA)
       cv2.imshow(test img path, img)
cv2.waitKey(0)
```



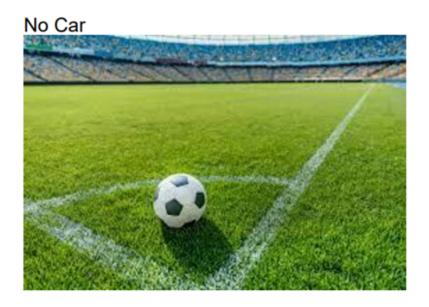
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OUTPUT:-

Input:-



Output:-





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Input:-



Output:-

Car



Conclusion:-

Object recognition is steps to collect the related data for identifying object in digital organization.

BOM model create a histogram of Bow model creates a visual wordy that return an image then this histogram is used to train.