Experiment No: 8

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Aim: To Detecting and Recognizing Objects

Objective: Object Detection and recognition techniques HOG descriptor The Scale issues The location

issue Non-maximum (or non-maxima) suppression vector machine people detection

Theory:

Object detection and recognition Techniques

Object detection and recognition are essential tasks in computer vision and image processing. They involve identifying and localizing objects of interest within images or videos. Several techniques and algorithms have been developed to achieve these objectives. In this experiment, we will explore some of these techniques:

1. HOG Descriptors (Histogram of Oriented Gradients):

- HOG descriptors are a widely used feature extraction method for object detection. They capture the local gradient information of an image by dividing it into small cells and computing gradient histograms for each cell. These histograms represent the intensity and orientation of edges in the image.
- HOG descriptors are particularly useful for detecting objects with distinctive texture or shape patterns, such as pedestrians and vehicles.

2. The Scale Issue:

- Object detection often involves handling objects at different scales. Objects can appear larger or smaller in images depending on their distance from the camera or variations in perspective. Dealing with scale variations is a critical challenge in object detection.

3. The Location Issue:

- Accurately determining the location of objects within an image is another key challenge. Objects can be partially occluded, rotated, or in complex backgrounds. Detecting their precise position is crucial for various applications, including tracking and augmented reality.

4. Non-maximum (or Non-maxima) Suppression:

- After detecting potential object candidates in an image, there may be multiple detections for the same object or region. Non-maximum suppression is a post-processing step that eliminates redundant or overlapping detections, retaining only the most confident ones.

5. Support Vector Machines (SVM):

- SVM is a machine learning algorithm used for classification and regression tasks. In object detection, SVM can be employed to classify object candidates as either objects of interest or background. It helps in making decisions about whether a given region contains an object or not.

Code:

Now, let's discuss the code for implementing object detection and recognition using HOG descriptors and SVM. This code will focus on detecting people in images.

```python import

cv2 import numpy

as np

# Load the pre-trained SVM model for pedestrian detection

svm = cv2.ml.SVM_load('pedestrian_svm_model.xml')

# Load the image for object detection

image = cv2.imread('test_image.jpg')
```

```
# Create a HOG descriptor object
hog = cv2.HOGDescriptor()
hog.setSVMDetector(cv2.HOGDescr
iptor_getDefaultPeopleDetector())

# Detect people in the image using HOG and SVM
rectangles, weights = hog.detectMultiScale(image)

# Draw rectangles around detected pedestrians
for (x, y, w, h) in rectangles:
        cv2.rectangle(image, (x, y), (x + w, y + h), (0, 255, 0), 2)

# Display the image with detections
cv2.imshow('Pedestrian Detection',
image) cv2.waitKey(0)
cv2.destroyAllWindows()
```

In this code, we first load a pre-trained SVM model for pedestrian detection and an image in which we want to detect pedestrians. We then create a HOG

descriptor and set the SVM detector for people detection. Using the `detectMultiScale` function, we detect pedestrians in the image and draw rectangles around them.

This code provides a basic implementation of object detection using HOG descriptors and SVM, but it can be extended and customized for various object recognition tasks.

Please make sure to replace 'pedestrian_svm_model.xml' with the actual path to your SVM model file and 'test_image.jpg' with the image you want to test the detection on.

Output:

Original Image:

Processed Image:

Conclusion:

Basic tasks in computer vision, object detection and recognition have many practical applications. This experiment addressed issues of scale and location and introduced methods such as HOG descriptors. These methods allow us to efficiently identify and detect objects in images.