Experiment No. 8
To perform Detecting & Recognizing Objects
Date of Performance: 7/9/23
Date of Submission: 14/9/23
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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.

code:

```python
import cv2

from google.colab.patches import cv2_imshow

from imutils.object_detection import non_max_suppression

from imutils import resize

import numpy as np


hog = cv2.HOGDescriptor()

hog.setSVMDetector(cv2.HOGDescriptor_getDefaultPeopleDetector())


img = cv2.imread('/content/test4.jpg')

img = resize(img,height=500)


rects,weights = hog.detectMultiScale(img,winStride=(4,4),padding=(8,8),scale=1.05)


copy = img.copy()

for x,y,w,h in rects:

    cv2.rectangle(copy,(x,y),(x+w,y+h),(0,0,255),2)


cv2_imshow(copy)

cv2.waitKey(0)
```

```
r = np.array([[x,y,x+w,y+h] for x,y,w,h in rects])

pick = non_max_suppression(r,probs=None,overlapThresh=0.65)


for xa,ya,xb,yb in pick:

    cv2.rectangle(img,(xa,ya),(xb,yb),(0,255,0),2)


cv2_imshow(img)

cv2.waitKey(0)


cv2.destroyAllWindows()
```
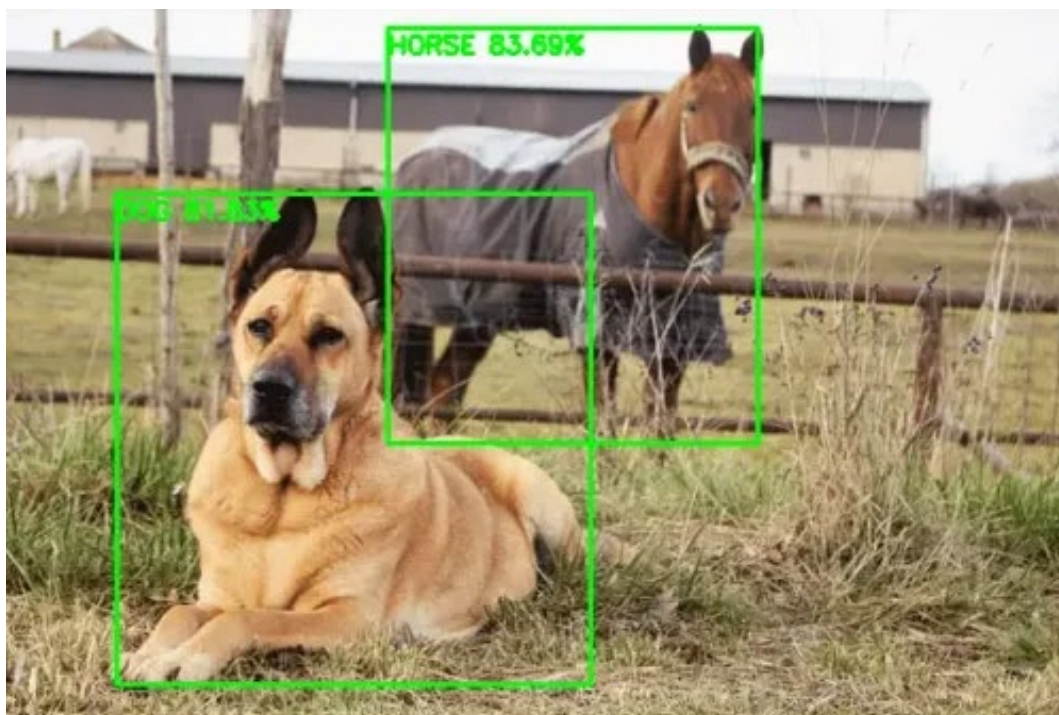
Output:

Conclusion:

Support vector machines (SVM) combined with the HOG descriptor is a powerful method for object recognition and detection.

It is very good at capturing the texture and contour of objects, but it has trouble with different scales and accurate placement.

Image pyramids are employed to manage scale changes, while non-maximum suppression (NMS) helps to reduce the number of redundant detections.

SVMs offer a useful tool for object classification. To obtain precise and dependable object detection, this technique must be implemented carefully, fine-tuning the parameters and training the SVM classifier with annotated data.