Pedestrian Detection - Visual Computing - Assignment 2

Brief Overview of Methods Used

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1 INTRODUCTION

For a literature survey of the given problem, I thoroughly went through many evaluation benchmarks mentioned here.[1]. Based on my study I came up with following techniques.

2 BACKGROUND SUBTRACTION BASED APPROACH

This method is based on Background subtraction and has following steps.

- Apply Canny Edge Detection
- Apply Background Subtraction
- Apply Opening (Morphological Image Processing Operations)
- Find Contours
- Fit an approximate rectangle to approximate the contour.
- Filter the rectangles based on aspect ratio and area of the rectangle. Since for pedestrian detection the aspect ratio (height:width) is around 2.0.

This is a simple technique but it is applicable for moving detection in videos in general because we are not using any person specific image features. I obtained the score of 0.0289.

3 MACHINE LEARNING BASED APPROACH

The next pipeline I used is a machine learning based pipeline. I used INRIA Person Dataset[2] to create dataset with equal positive and negative examples where the size of person in the image is 64*128. The pipeline has following steps:

- Creation of Positive and Negative datasets from INRIA Person dataset.
- Extract HOG Feature for both positive and negative datasets.
- Train SVM on these features
- For testing use a sliding window based scanning technique with multiple windows sizes, test the region for presence of human using SVM and then perform non maximum suppression to retain only few bounding boxes.

This method is computationally inefficient and takes around 6-7 hours to run.

4 MACHINE LEARNING BASED APPROACH 2

The other machine learning based approach that I tried was to combine background subtraction technique with machine learning. Following are the steps involved in the pipeline.

- Apply Background Subtraction Technique
- Create Training and Validation Dataset for Positive and Negative humans from the knowledge of groundtruth bounding.
- Extract the HOG Features from the dataset and train a SVM classifier on them.
- During the detection process, we find the human shaped contour using Background subtraction and further use SVM to get rid of false positives. Also in the next frame we search for the bounding box in local neighbourhood of the bounding box in the current frame.

The score achieved using this approach varies from 0.30 to 0.40.

5 TRACKING BASED APPROACH

Detect the Pedestrian in first image and use Kalman Filter to track it in the subsequent frames. Unfortunately I did not get time to implement this approach. But this approach offers a good trade off between execution time and accuracy.

REFERENCES

[1] [n. d.]. Caltech Pedestrian Dataset: Evaluated Algorithms. ([n. d.]). http://www.vision.caltech.edu/Image_Datasets/CaltechPedestrians/files/algorithms.pdf
[2] Navneet Dalal and Bill Triggs. 2005. INRIA person dataset. *Online: http://pascal.inrialpes. fr/data/human* (2005).