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# PERSON DETECTION IN SURVEILLANCE VIDEOS – A SURVEY

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## ABSTRACT

The main goal of this paper is to compare various person detection approaches used in video surveillance applications. Over the last decade, person detection has made remarkable progress. The paper gives an overview of some of the successful techniques for people detection. In this paper we discuss about the current methods involved in human detection in fixed cameras used for surveillance purposes.

Sliding window approach scans the image at all relevant positions and scales to detect a person. There are two stages in part based methods. First uses low level classifiers to identify the parts and second connects based on specified topology.

**KEYWORDS:** Video Surveillance, Haar Wavelets, Histogram Oriented Gradients, Partial Least Square Analysis, Part Based Model

## INTRODUCTION

Visual surveillance is playing an important role in any security system and also has opened new avenues for research in detecting, tracking humans and interpreting their behavior. Detecting humans in surveillance videos is a challenging task due to their different appearances and variety of poses they can adopt [3]. Biometric features such as face and gait [1] or non-biometric features such as appearance can be used for person recognition in video sequences. Biometric features can provide information of high discriminability about the individual.

At the same time they impose many restrictions on the data acquisition such as high and frontal images for face recognition or full body profile image for gait recognition. Non biometric features have less restriction on data and it lacks the uniqueness provided by the biometric features. Color and texture details from an image can be extracted and can be used for object recognition [2]. Two different approaches for object detection in surveillance videos are studied in this paper. The Sliding window based approach and part based approach.

## HAAR WAVELETS

Papageorgiouand Poggio [5] has proposed a method of person detection using Haar wavelets. This method proposes a dense over complete representation using wavelets at scale of 16 and 32 pixel with an overlap of 75% is considered. The low frequency changes contrast are encoded using three different types such as vertical, horizontal, diagonal wavelets.

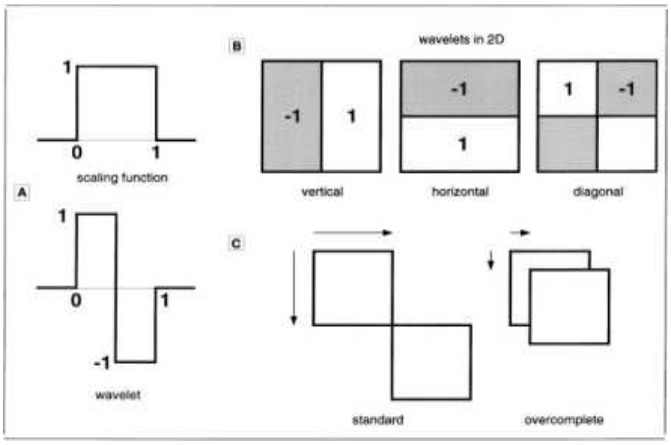


**Figure 1: The Haar Wavelet Framework; (a) The Haar Scaling Function and Wavelet, (b) The Three Types of 2-Dimensional Non-Standard Haar Wavelets, Papageorgiou and Poggio [5]**

## HISTOGRAMS OF ORIENTED GRADIENTS

Dalal and Triggs [3] have proposed an appearance based person detection method based on Histograms of Oriented Gradients. This involves evaluating well-normalized local histograms of image gradient orientations in a dense grid. Their basic idea is to use distribution of local intensity of gradients to characterize local object appearance and shape. The image window is divided into small spatial regions called cells. Each cells will accumulate a local 1-D histogram of gradient directions of the pixels in the cell. The representation is formed using the combined histogram entries. Contrast normalizing the local responses can be used for adjusting to illumination and shadowing invariance. The normalized descriptor blocks are referred as Histogram of Gradients (HOG) descriptors. The HOG descriptors along with SVM are used for detecting humans. HOG descriptor method has shown good results in different datasets.

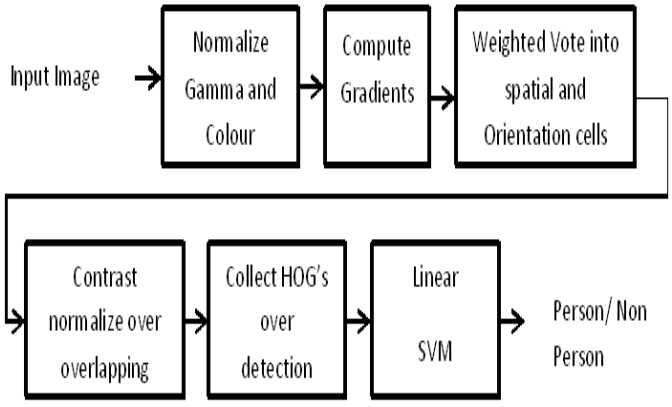


**Figure 2: Histogram Oriented Gradients Method Dalal and Triggs[3]**

## PARTIAL LEAST SQUARES ANALYSIS

Partial Least Squares Analysis method is used in [4] for person detection. The information such as the homogeneity of regions such as human clothing, color, skin color, textures on clothes and background are used to complement HOG features. This reduces the number of training samples required. The neighboring blocks of the detection window are also used for feature extraction to increase multi collinearity of the feature set. A statistical technique known as Partial Least Squares (PLS) regression is used to detect humans in this approach.

## PART BASED APPROACH

An elegant framework is provided as pictorial structures using deformable part models [6][12][13]. Sliding Window-based approach has representational complexity and part-based involves more searching effort. This method helps to deal with partial occlusion and requires fewer training samples. The methodology to divide the human body different parts such head, legs, left arm, right arm and so on. Each part detector is trained using a polynomial SVM where outputs are fed into a final classifier after checking geometric plausibility. Mikolajczyk [9] proposes a method in which humans are modeled as assemblies of parts that are represented by SIFT-like orientation features. Deformable part-based model human detector can outperform many of existing current single-template-based detectors [10] Bar-Hillel in their paper [11] suggested a new method for learning part-based human detection through feature synthesis. Pedestrian detection algorithms have an obvious extension to automotive applications due to the potential for improving safety systems.

## CONCLUSIONS

In this paper we have discussed about the person recognition methods used for visual surveillance. We can observe that the tradeoff between complexity and number of training samples required in both sliding window based approach and part based approach.

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