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Multi-Target Tracking in Non-Overlapping Cameras Using AdaBoost

Pooja Magdum[1], S. B. Jadhav[2]
P.G. Student, Department of E&TC Engineering, Bharati Vidyapeeth's College Of Engineering, Kolhapur, India[1]
Assistant Professor, Department of E &TC Engineering, Bharati Vidyapeeth's College Of Engineering, Kolhapur, India[2]
[1]pooja.magdum.372@gmail.com [2]sachin30_2k6@redifmail.com

Abstract: Multi-target tracking is an important task within the field of computer vision and it's still challenging research topic. Nowadays, the demand of surveillance camera is increasing rapidly. It is useful for developing surveillance as well as monitoring purpose [1] [2]. Some previous methods are used for multi-target tracking that are colour histogram, brightness transfer function (BTF) [9]. Many times it is not possible to cover complete area of interest by using single camera, such a cases there is need to use multi-target tracking system with non-overlapping field f views. In this paper we use two comparative methods of feature extractions that are AdaBoost [15]. The paper proposes the reference set based tracking in non-overlapping FOV's due to overlapping FOV's are having high cost. In this work widely used features HSV colour histograms, LBP, HOG are used to extract colour, texture, shape of target.

Keywords: multi-target tracking, predefined reference set, AdaBoost, Gentleboost.

I. Introduction

Multi-target tracking is the research approach which is used to find the locations and sizes of multiple targets. Nowadays CCTV cameras are used for many purposes such as in public places, schools, airports, colleges etc [18]. For security purpose the rate of use of CCTV cameras are increases. The paper proposes to track the object robustly using multi-target tracking concept in non-overlapping field of views [11]. There are two types of field of views that are overlapping FOV's and non-overlapping FOV's. The paper focused on non-overlapping FOV's. The main goal of this project to find the appearance of same object across the multiple cameras output tracks. In computer vision automatic tracking of multiple targets is the recent topic which is used for industrial applications such as security purpose or monitoring purpose. The idea of multi-target tracking which is done by comparing both outputs that are output obtained from different cameras is compared with multi-cam dataset output. Using techniques for human detection, multi-target tracking system can play important role to capture location of people at public areas such as stores and travel sites and then produce congestion analysis to assist in the management of the people. In such a way tracking system can monitor express ways and junctions of the road network. In some cases it is necessary to analyse the behaviour of people and vehicles also and check whether these behaviours are normal or abnormal. For example multi-target tracking system set in parking lots and supermarkets could track abnormal behaviour of theft which is useful to identify any criminals quickly and then contact the police immediately [17].

II. RELATED WORK

In this paper we propose the novel approach of multi-target tracking in non-overlapping cameras. With the help of tracking system we get the exact location and size of the object which are captured by the surveillance camera. Due to variation in illumination conditions, and camera imaging characteristics, there might be significant appearance change of target across camera views [18]. In multi-target tracking system there is need to track same object across multiple camera output tracks provided cameras are consist of non-overlapping regions. Consequently the same target may appear in very different in two cameras which causes to error. Hence in most previous methods the appearance similarity is captured either using color histogram or based on brightness transfer function (BTF) [9]. BTF is used to find color difference between different cameras output. In computer vision automatic tracking of multiple targets is the recent research topic which is used for industrial applications. This project proposes reference set based appearance of the target to determine the similarity of multiple targets in different camera. The goal of multi-tracking across camera is to associate tracks in different cameras which contain the same object [18]. The idea of multi-target tracking which is done by comparing both outputs that are output

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obtained from different camera is compared with the reference set output.

Tracking of multiple targets in multiple cameras is classified into two categories that are first one is overlapping Field Of Views (FOVs) and second one is non-overlapping FOVs. Our main goal is to implement the algorithm for multi-target tracking in non-overlapping cameras using predefined reference set.

III. IMPLEMENTATION

The basic aim of multi-target tracking across non-overlapping cameras is to automatically recover the trajectories of all targets and keep their identities consistent while they travel from one camera to another camera.

A] AdaBoost Method:

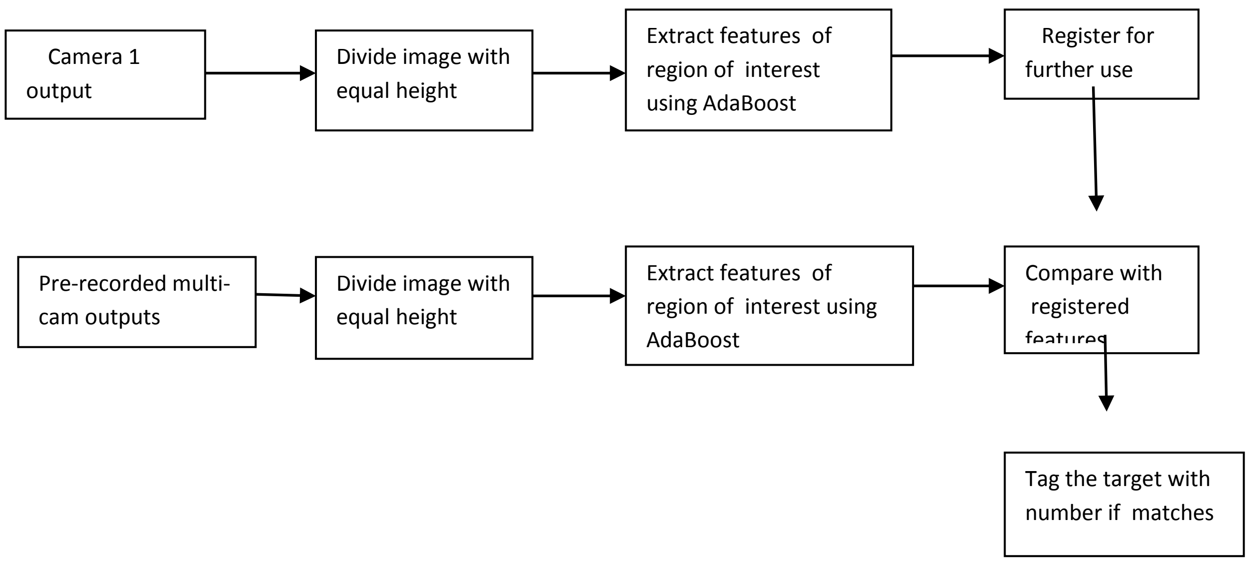

Figure 1. Block diagram using AdaBoost method

- **Camera 1 output:**

In this block here first track moving object and take it as a camera 1 output. After this take its features and store it as a reference set.

- **Divide image with equal height:**

After tracking object the whole body is dividing into two parts that are torso and legs. Torso is upper part of detection and legs are lower part of detection. Here whole body is divided into upper and lower part with equal height. Register for further use. All above obtained information is stored as a reference set which is used for comparison purpose. This is our register set which is use to comparison with different cameras outputs dataset.

- **Compare with register features:**

In this block compare pre-recorded multiple cameras outputs dataset with the registered features to identify appearance of similar object. For comparison purpose here uses two methods that are as follows.

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IV. EXPERIMENTAL RESULTS

Feature Extraction:

The features obtained from first block the features are extracted with using AdaBoost feature extraction method. AdaBoost is stands for 'Adaptive Boosting'. AdaBoost is the method of feature extraction. The role of AdaBoost algorithm is used for selection purpose. It can be used in conjunction with many other types of learning algorithms to improve performance of the system [15]. It is referred as the best classifier. Here we take three kinds of appearance features that are HSV color histograms, Local binary pattern (LPB) and histogram of gradient (HOG). These appearance features are used to capture color, texture, and shape information of object. Here we are partitioning body image into torso and legs for each detection with equal height. For this total nine features are extracted that are Torso HSV, Torso LBP, Torso HOG, Body HSV, Body LBP, Body HOG, Legs HSV, Legs LBP, Legs HOG. For distance measurement the Bhattacharya coefficient is used [18]. To measure the similarity of two discrete or continuous probability distributions the Bhattacharya distance is proposed.

A] HISTOGRAM OF GRADIENT:

HOG is a feature descriptor in computer vision and image processing which is used for object detection. It is used to count occurrence of gradient orientation localize portions of an image. The image is divided into small connected regions called cells. A HOG direction is compiled. HOG has advantage over other descriptor, it operates on local cells and it is invariant to geometric and photometric. Here we obtain the HOG features of nine different tracked images as shown in table 1.

B] HSV COLOR HISTOGRAM:

Histogram is a graphical representation of number of pixel in an image. X-axis represents tonal scale i.e. black at the left and white at the right. Y-axis represents number of pixel in an image in a certain area of tonal scale. A color histogram of an image represents the distribution of the composition of colors in the image. It shows different types of colors appeared and number of pixel in each type of the color appeared. HSV stands for the angle around the central axis corresponds to "hue". The distance from the axis corresponds to "saturation". The distance along the axis corresponds to "value". Hue deals with the purity of the color. Saturation determines the amount of white light mixed with the original value. Value gives the intensity of color. . Here we obtain the HSV Color histogram features of nine different tracked images as shown in table 1.

C] LOCAL BINARY PATTERN (LBP):

LBP is a type of visual descriptor used for classification in computer vision. LBP is a particular case of texture spectrum model. It has been found a powerful feature for texture classification. When LBP is combined with HOG it improves the detection performance. Here we obtain the Lbp features of nine different tracked images as shown in table 1.

AdaBoost train:

Fig.3 shows that the graphical representation of complete window output after AdaBoost training. Here the graph shows that iteration verses test error. When number of iterations more the result in minimum error is occurred. Here we take 50 iterations which reduce the maximum error present in model. The fig.3 indicates only HOG AdaBoost train model results. Here we done boosting process

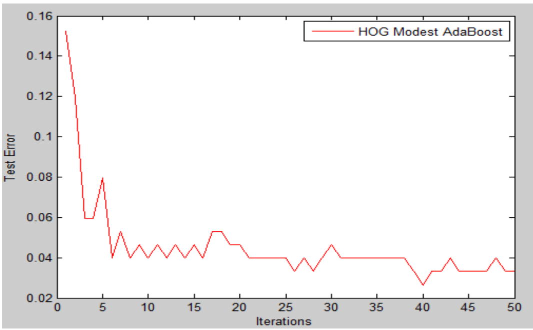

Fig. 2 Complete window output after AdaBoost training

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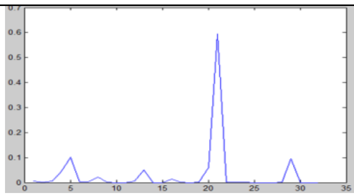
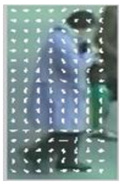
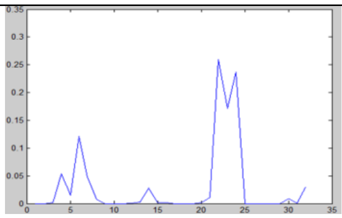
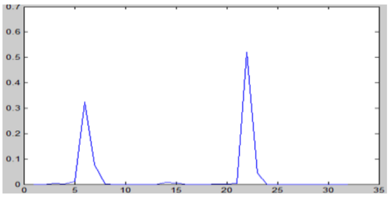
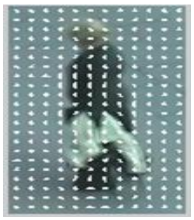
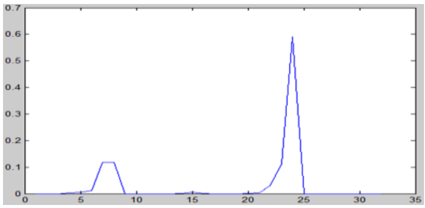
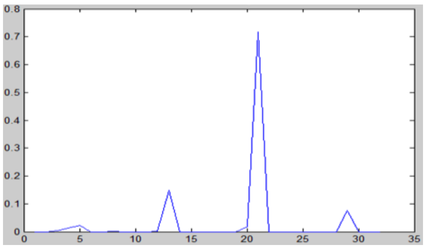
Results :

Input image	HOG features	HSV color histogram	LBP features
			
			
			
			
			

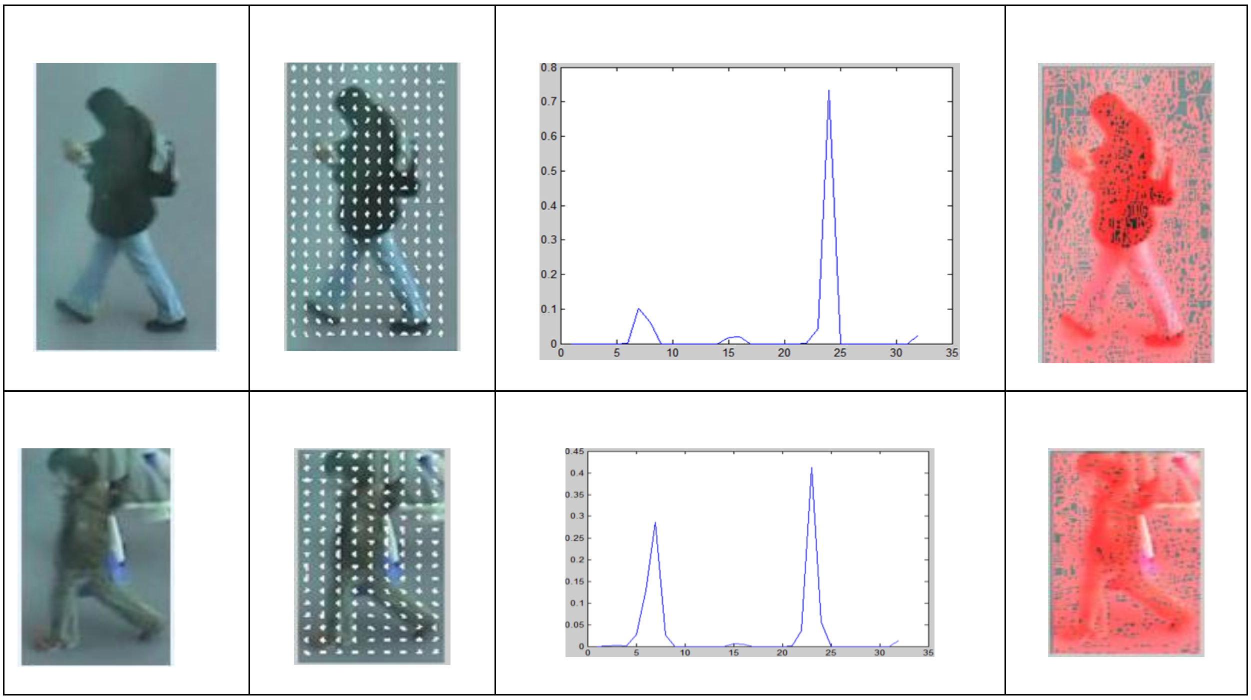


Fig. 3 Feature extraction

Table no.1 shows that the values of extracted features of result images

Sr. No.	HOG	HSV Color histogram	LBP
1	0.5051	0.00024	0.09803
2	0.5054	0.00275	0.32941
3	0.5108	0.09694	0.23137
4	0.5000	0.01362	0.39607
5	0.5052	0.00097	0.38823
6	0.4954	0.00105	0.35686
7	0.4955	0.00121	0.42352
8	0.4915	0.01241	0.41960
9	0.5108	0.01411	0.14901

V. Conclusion

By considering above discussion we conclude that feature extraction is completed and obtained its results such as HOG features, HSV color histogram and LBP features. We also have done the AdaBoost train model results for HOG features. From the experimental result we have found that multi-target tracking using AdaBoost has been implemented along with this various features such as HOG, HSV Color histograms, LBP are extracted. Hence we implement AdaBoost method to identify tracked target in multi-target tracking in non-overlapping camera system.

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