IJIREEICE

ISSN (Online) 2321-2004
ISSN (Print) 2321- 5526

International Journal of Innovative Research in
Electrical, Electronics, Instrumentation and Control Engineering
ISO 3297:2007 Certified
Vol. 6, Issue 7, July 2018

Occlusion Handling in Pedestrian Detection

Poonam B. Yewale[1], Shridevi S. Vasekar[2]

PG Student, E & TC, Smt. Kashibai Navale College of Engineering, Vadgaon, Pune, India[1]

Prof. E &TC, Smt. Kashibai Navale College of Engineering, Vadgaon, Pune, India[2]

Abstract: Object detection plays very important role in image processing. In which detection of pedestrian gains lot of interest due to it's direct application in security system, visual surveillance etc. Occlusion means hiding of an object by another object during multiple human tracking. Different methods are implemented for pedestrian detection but that methods suffer from performance degradation due to occlusions, deformations and illuminations. In this paper problem of occlusion is addressed and this system uses two-stage classifier with circulant structure with kernel, named Integrated Circulant Structure Kernels (ICSK). The first stage is applied for transition estimation and the second is used for scale estimation. The circulant structure makes our algorithm realize fast learning and detection. Then, the ICSK is used to detect the target without occlusion and build a classifier pool to save these classifiers with noisy updates. When the target is in heavy occlusion or after long-term occlusion, redetect it using an optimal classifier selected from the classifier-pool according to an entropy minimization criterion.

Keywords: Pedestrian Detection; Visual Surveillance; Occlusion; ICSK

I. INTRODUCTION

Today's world is full of mechanised and of automatic systems. In addition to these systems, visual tracking is an important task for many other industrial applications such as human machine interfaces, remote sensing, defense systems and security system. Object detection and object tracking are important aspects in visual tracking systems. Object detection is first low -level important task for any video surveillance application. Tracking is required in higher level applications. Out of different types of object detection, Pedestrian detection is a necessary and noticeable task in any video surveillance system as it gives information for semantic understanding of video footages. Due to current improved techniques with more intelligent pedestrian models, effective features and detection strategies, pedestrian detection has acquired impressive growth in recent years [1]. Numerous approaches have been proposed for pedestrian detection that is holistic detection, part based detection, patch based detection, motion based detection and multiple camera based detection. The main problem faced during pedestrian detection is occlusion. The problem of occlusion is occurs while tracking single or multiple objects and it is major cause of loss of information. Occlusion is the one which blocks our view. It is means that there is something we want to see, but can't due to some events. If we are tracking some objects such as people, cars etc. then occlusion occurs if an object we are tracking is hidden by other object. To handle occlusions, general way used is to train set of specific detector and combine the results of detector directly and relationship among detector is not considered so it is not much effective approach. Another approaches based on classification and features are used for detection that are boosting classifier, probabilistic model and different types of SVM. The important requirement in pedestrian detection is that the occlusion handling model must be capable of handling full occlusion as well as partial occlusions. This paper discusses pedestrian detection related work in section II, The proposed system block diagram, system flow and software required given in section III. Results are given in section IV. Finally the work is concluded in section V.

II. RELATED WORK

Different methods to detect pedestrians are presented below.

Adaptive color attributes for real-time visual tracking [2]. Visual tracking is a challenging problem in computer vision. Most state-of-the-art visual trackers either rely on luminance information or use simple color representations for image description. Contrary to visual tracking, for object recognition and detection, sophisticated color features when combined with luminance have shown to provide excellent performance. Due to the complexity of the tracking problem, the desired color feature should be computationally efficient, and possess a certain amount of photometric invariance while maintaining high discriminative power. This paper investigates the contribution of color in a tracking-by-detection framework. Results suggest that color attributes provides superior performance for visual tracking. System further proposes an adaptive low-dimensional variant of color attributes. Both quantitative and attribute based evaluations are performed on 41 challenging benchmark color sequences.

IJIREEICE

ISSN (Online) 2321-2004
ISSN (Print) 2321- 5526

International Journal of Innovative Research in
Electrical, Electronics, Instrumentation and Control Engineering
ISO 3297:2007 Certified
Vol. 6, Issue 7, July 2018

Struck: Structured Output Tracking with Kernels represented in [3] Adaptive tracking-by-detection methods are widely used in computer vision for tracking arbitrary objects. Current approaches treat the tracking problem as a classification task and use online learning techniques to update the object model. However, for these updates to happen one needs to convert the estimated object position into a set of labelled training examples, and it is not clear how best to perform this intermediate step. Furthermore, the objective for the classifier (label prediction) is not explicitly coupled to the objective for the tracker (estimation of object position). In this paper, a framework for adaptive visual object tracking based on structured output prediction is presented. By explicitly allowing the output space to express the needs of the tracker, avoid the need for an intermediate classification step. This method uses a kernelised structured output Support Vector Machine (SVM), which is learned online to provide adaptive tracking. Experimentally, proposed algorithm is able to outperform state-of-the-art trackers on various benchmark videos. Additionally, system can easily incorporate additional features and kernels into framework, which results in increased tracking performance.

High-Speed Tracking with Kernelized Correlation Filters described in [4]. The core component of most modern trackers is a discriminative classifier, tasked with distinguishing between the target and the surrounding environment. To cope with natural image changes, this classifier is typically trained with translated and scaled sample patches. Such sets of samples are riddled with redundancies any overlapping pixels are constrained to be the same. Based on this simple observation, this paper proposes an analytic model for datasets of thousands of translated patches. By showing that the resulting data matrix is circulant, system can diagonalize it with the discrete Fourier transform, reducing both storage and computation by several orders of magnitude. Interestingly, for linear regression, proposed formulation is equivalent to a correlation filter, used by some of the fastest competitive trackers. For kernel regression, a new Kernelized Correlation Filter (KCF) is derived, that unlike other kernel algorithms has the exact same complexity as its linear counterpart. Building on it, a fast multi-channel extension of linear correlation filters, via a linear kernel is also proposed, which is called as Dual Correlation Filter (DCF). Both KCF and DCF outperform top-ranking trackers such as Struck or TLD on a 50 videos benchmark.

Object Tracking with Occlusion Handling Using Mean Shift, Kalman Filter and Edge Histogram is described in [5]. This paper proposes an algorithm that uses Mean Shift and Kalman Filter for object tracking. Also this method uses Edge Histogram for occlusion handling. Firstly, use Mean Shift algorithm to obtain center of desired object. But the robust of tracking is not very well, so use Kalman Filter to improve the effect of tracking. Bhattacharyya coefficient and Edge Histogram are used for finding out both partial and full occlusions. With this approach tracking of the object is more accurate. The results prove that the robust of tracking is very well.

Visual Tracking via Probability Continuous Outlier Model explained in [6], in this paper method is based on linear representation. First, present a novel Probability Continuous Outlier Model (PCOM) to depict the continuous outliers that occur in the linear representation model. In the proposed model, the element of the noisy observation sample can be either represented by a PCA subspace with small Gaussian noise or treated as an arbitrary value with a uniform prior, in which the spatial consistency prior is exploited by using a binary Markov random field model. Then, derive the objective function of the PCOM method, the solution of which can be iteratively obtained by the outlier-free least squares and standard maxflow/min-cut steps. Finally, based on the proposed PCOM method, design an effective observation likelihood function and a simple update scheme for visual tracking. Both qualitative and quantitative evaluations demonstrate that proposed tracker achieves very favorable performance in terms of both accuracy and speed. Overall system architecture of proposed system used for pedestrian detection with partial occlusion handling is as shown in Fig.1.

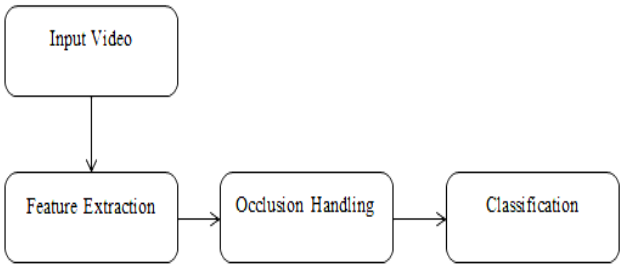


Fig.1. Overview of system

For software requirement MATLAB R2018a with operating system windows used for system implementation

A. Input video

Input video with ground truth values for each frame is used. Video is used for further processing.

IJIREEICE

ISSN (Online) 2321-2004
ISSN (Print) 2321- 5526

International Journal of Innovative Research in
Electrical, Electronics, Instrumentation and Control Engineering
ISO 3297:2007 Certified
Vol. 6, Issue 7, July 2018

B. Feature Extraction

The Feature Extraction is the technique used for the detection and classification of images. In the feature extraction, appropriate features of images are collected in a set because when the data is large then all the information in that data is not required. This feature set is nothing but the description of image in small dimensionality space. In this paper, features are extracted from each frame which are helpful for pedestrian detection. In this paper, HOG feature is used as it preserves edge information of object.

C. Occlusion handling

Difficulty during and after occlusion is to determine visibility of tracked object. Each frame in the video is divided into one of the three situations: without occlusion, partial occlusion and full occlusion.

i. Tracking without occlusion

Tracking of object is easy when there is no occlusion present. In proposed method firstly employ the Circulant Structure Kernels with Color Names and the Discriminative Scale Space Correlation Filter (DSSCF) to construct a new Integrated Circulant Structure Kernels (ICSK) to process the frames without occlusion. The ICSK is a two-stage discriminative classifier including transition estimate and scale estimate.

ii. Tracking with occlusion

The proposed ICSK may fail to track the object with heavy Occlusion. That is because the updating strategy may add some incorrect information into the classifier when the target is occluded. Some incorrect samples (predicted target patches) caused by occlusion are used to update the classifier. With the time of occlusion increasing, the classifier will contain more noisy information and lose discriminability gradually. To solve this problem, we propose a novel updating strategy to track targets with occlusion. The proposed ICSK first tracks the target without occlusion.

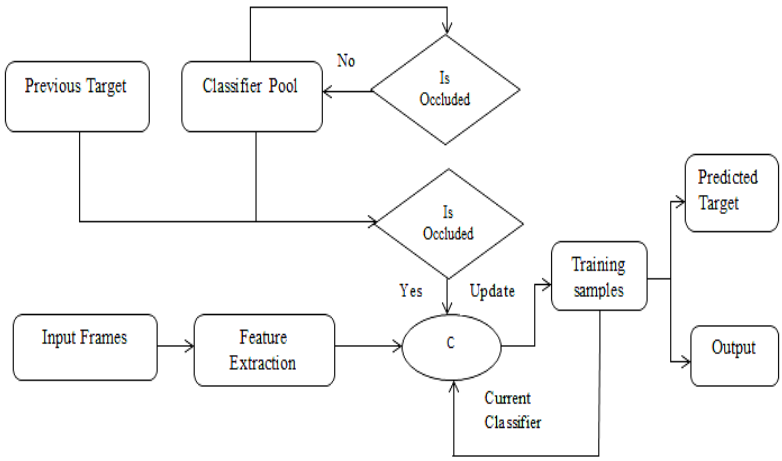


Fig.2. Framework of proposed system

There are following steps for handling occlusion.

1. Pre-update
2. Prediction
3. Update

As per shown in fig.3, input includes the current frame and a predicted target in previous frame. The previous target is used to discriminate the occlusion. The patch feature extraction shows the color maps of a gray feature. Ellipses represent the proposed ICSK classifiers, which contain transition and scale estimations. First, the current classifier will be pre-updated if the target in previous frame is completely occluded. Second, the updated classifier is applied to predict the target in current frame. Third, update the current classifier by using the training samples. If the predicted target is not occluded, the classifier-pool will be updated.

D. Classification

Many tracking-by-detection algorithms are based on the classifiers, such as Support Vector Machines (SVM), Random Forest classifiers or boosting variants, and they are adapted for online learning. In proposed method, only the reliable classifiers in the no-occlusion frames are used to build the classifier-pool.

IJIREEICE

ISSN (Online) 2321-2004
ISSN (Print) 2321- 5526

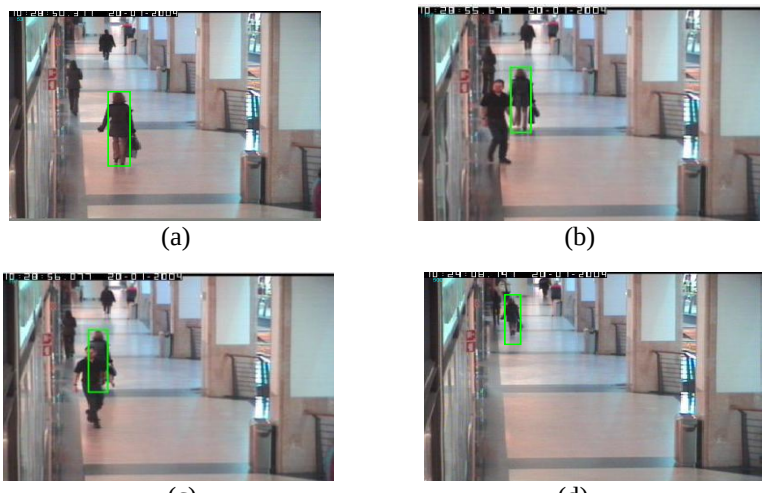
International Journal of Innovative Research in
Electrical, Electronics, Instrumentation and Control Engineering
ISO 3297:2007 Certified
Vol. 6, Issue 7, July 2018

Algorithm

1. Compute the minimal distance as target distance using target patch feature and patch pool.
2. If the target distance > Occlusion threshold (complete occlusion) then select the classifier from classifier pool. Update the classifier pool and patch pool. Compute target position and maximal response using ICSK model and scale.
3. If target distance< occlusion threshold then compute estimated target position, maximal reponse, and scale using ICSK model.
4. Extract the appearance model and target patch feature using target position and scale.
5. Train the updated ICSK model with appearance model.
6. Set the value of adaptive parameter to adjust threshold of occlusion.
7. Compute the minimum distance without occlusion and then update the classifier pool and patch pool. Extract patches surrounding to the estimated target position.
8. Update occlusion threshold value.

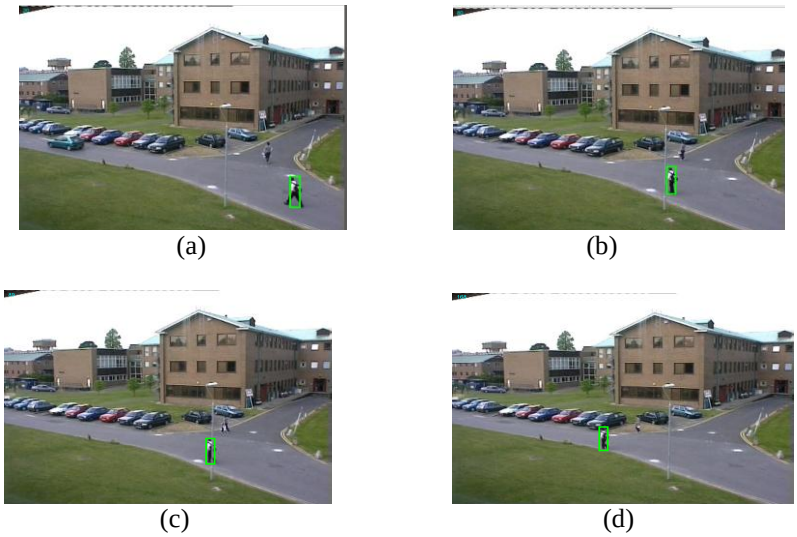
III. RESULTS AND DISCUSSIONS

The proposed system is implemented using MATLAB 2018 a. Experimental results are shown in figure 3,4, 5 and 6. Proposed method is tested on various sequences. The result shows tracking of object when occlusion is not present and tracking with occlusion. The detection of pedestrian is carried out in two steps: Detection and Tracking.



(a) (b) (c) (d)

Fig.3. Qualitative Results for sequence 1. (a) Tracking without occlusion, (b)&(c) Tracking with occlusion, (d) Tracking after occlusion.



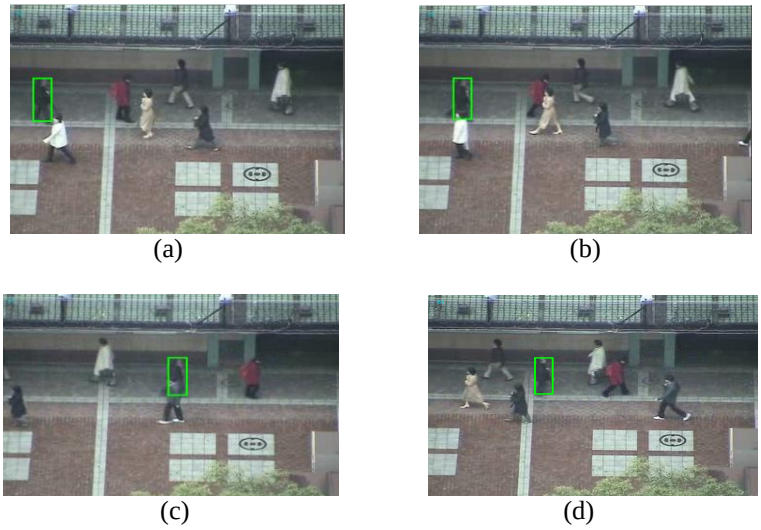
(a) (b) (c) (d)

Fig.4. Qualitative Results for sequence 2. (a) Tracking without occlusion, (b)&(c) Tracking with occlusion, (d) Tracking after occlusion

IJIREEICE

ISSN (Online) 2321-2004
ISSN (Print) 2321- 5526

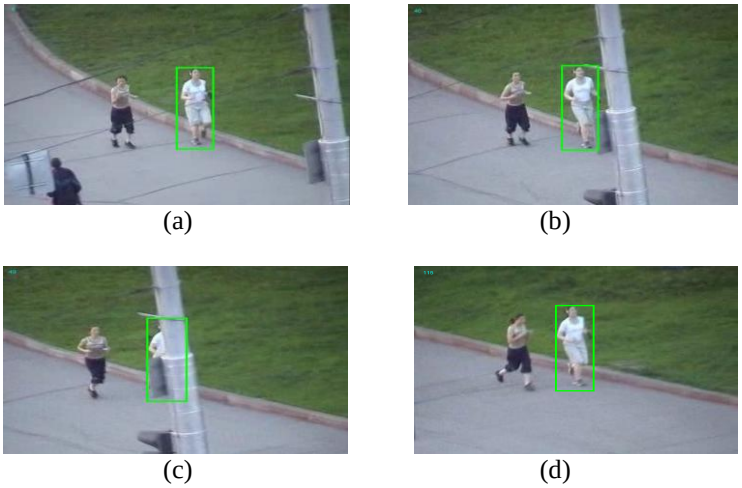
International Journal of Innovative Research in
Electrical, Electronics, Instrumentation and Control Engineering
ISO 3297:2007 Certified
Vol. 6, Issue 7, July 2018



(a) (b)

(c) (d)

Fig.5. Qualitative Results for sequence 3. (a) Tracking without occlusion, (b)&(c) Tracking with occlusion, (d) Tracking after occlusion



(a) (b)

(c) (d)

Fig.6. Qualitative Results for sequence 4. (a) Tracking without occlusion, (b)&(c) Tracking with occlusion, (d) Tracking after occlusion

Some qualitative detection results of the proposed method on the different sequences are shown in Fig.3, 4, 5 and 6. As shown in above figures the pedestrian is continuously tracked even if occlusion is present. The pedestrian is redetected using optimal classifier.

Table I: Comparison between different methods and proposed method based on various performance parameters.

Parameters / Method	Struck	PCOM	KCF	CSKCN	Proposed Method
CLE	46.5	86.8	36	58.8	2.8
Precision(%)	68.8	45.7	72.4	66.1	100
Success Rate(%)	58.8	39.7	61.7	55.3	97.1
Speed(fps)	12.8	7.3	252	180.2	44.7

IJIREEICE

ISSN (Online) 2321-2004
ISSN (Print) 2321- 5526

International Journal of Innovative Research in
Electrical, Electronics, Instrumentation and Control Engineering
ISO 3297:2007 Certified
Vol. 6, Issue 7, July 2018

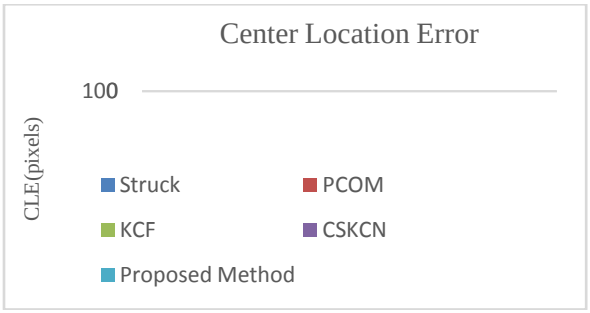


Fig.7 Graphical presentation shows CLE for different methods

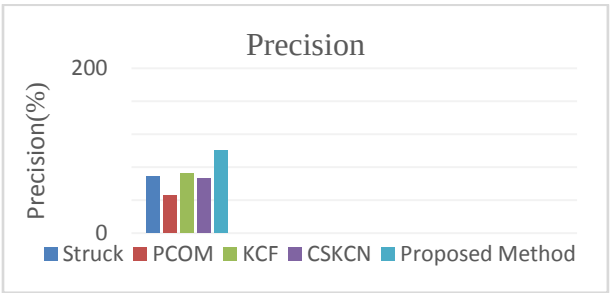


Fig.8 Graphical presentation shows Precision for different methods

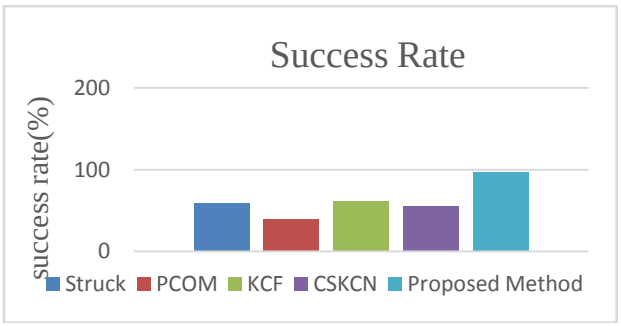


Fig.9 Graphical presentation shows Success rate for different method

IV. CONCLUSION

This paper proposes effective occlusion handling method with improved speed. The videos with heavy occlusion and partial occlusion also handled by this method System learn discriminative classifiers for assessing the translation and scale varieties of target efficiently. The translation is assessed by demonstrating a classifier with kernelized circulant structure. The scale is evaluated by building a correlation filter with multi scale samples to get robust tracking results.The whole system is implemented using MATLAB R 2018a software. System is tested using various video sequences and performance parameters also evaluated.

REFERENCES

[1]. P. Doll´ar, C. Wojek, B. Schiele, and P. Perona, “Pedestrian detection: An evaluation of the state of the art,” IEEE Trans.Pattern Anal. Mach. Intell., vol. 34, no. 4, pp. 743–761, 2012.
[2]. Martin Danelljan, Fahad Shahbaz Khan, Michael Felsberg. “Adaptive Color Attributes for Real- Time Visual Tracking.” IEEE Conference on Computer Vision and Pattern Recognition, 2014.
[3]. Sam Hare, Stuart Golodetz, Amir Saffari. “Struck: Structured Output Tracking with Kernels” IEEE transactions on pattern analysis and machine intelligence 2015.
[4]. Joao F. Henriques, Rui Caseiro, Pedro Martins, “High-Speed Tracking with Kernelized Correlation Filters” IEEE Transactions on pattern analysis and machine intelligence, vol. 37, no. 3, March 2015
[5]. Iman Iraei, Karim Faez, “Object Tracking with Occlusion Handling Using Mean Shift, Kalman Filter and Edge Histogram”, 2nd International Conference on Pattern Recognition and Image Analysis (IPRIA 2015) March 11-12, 2015
[6]. Dong Wang Huchuan Lu,“Visual Tracking via Probability Continuous Outlier Model”, IEEE Conference on Computer Vision and Pattern Recognition 2014.
[7]. X.Wang, M. Wang, and W. Li. Scene-specific pedestrian detection for static video surveillance. Pattern Analysis and Machine Intelligence,IEEE Transactions on, 36(2):361–374, 2014
[8]. P. Viola, M. J. Jones, and D. Snow. Detecting pedestrians using patterns of motion and appearance. IJCV, 63(2):153–161, 2005