Detection and Crowd Counting System Based on Fuzzy Color Histogram Features

Geeta L. Makhija Dr. R. D. Raut Dr. V. M. Thakare

Abstract - **This paper proposes an efficient motion detection and crowd counting system based on background subtraction using dynamic threshold and fuzzy logic. Here two methods are used effectively for object detection followed by people counting. In dynamic threshold based object counting, morphological process and filtering are used effectively for unwanted pixel removal from the background. Along with this dynamic threshold, a background subtraction algorithm is introduced for temporally dynamic texture scenes using a clustering-based feature, called fuzzy color histogram (FCH), which has an ability of greatly attenuating color variations generated by background motions while still highlighting moving objects for efficient people counting.**

Index Terms: **Device Free passive, Dynamic Threshold Optimization, fuzzy color histogram, RGB histogram.**

I. INTRODUCTION

Ambient Intelligence envisions that future smart environments will be sensitive and responsive to the presence of people, thereby enhancing everyday life. Potential applications include elder-care, rescue operations, security enforcement, building occupancy statistics, etc... Automatic detecting and tracking people in video surveillance system is a very challenging problem.

With various important practical applications, such as human surveillance and security at restricted places, traffic surveillance and security, these are commonly observed. Video cameras are relatively inexpensive surveillance tool. In today's world manually reviewing and verifying large amount of data sounds often impractical. Therefore, introduction of an advanced image acquisition system with motion detection, target count, edge detection, and filtration and color histogram analysis combined into one, which requires no human input, is undoubtedly an excellent solution for us [1, 2].

In this paper an efficient motion detection and crowd counting system based on background subtraction using dynamic threshold and fuzzy logic is presented. Here two methods are used effectively for object detection followed by people counting. The performances are compared based on accurate estimation. In dynamic threshold based object counting, morphological process and filtering are used effectively for unwanted pixel removal from the background. Along with this dynamic threshold, a background subtraction algorithm is introduced for temporally dynamic texture scenes using a clustering-based feature, called fuzzy color histogram (FCH), which has an ability of greatly attenuating color variations generated by background motions while still highlighting moving objects for efficient people counting.

II. RELATED THEORY

A. *Background*

Chenren [1] proposed device-free passive localization as an emerging technique for localizing people, without requiring them to carry any devices. Radio frequency(RF)-based techniques have the advantages of long-range, low-cost, and the ability to work through non-conducting walls and obstacles. In 2007,Youssef et al. first proposed the idea of RF-based device-free passive localization through finger printing approach- first collect a radio map with the subject present in a few predetermined locations, and then map the test location to one of these trained locations based upon observed radio signals. All the methods mentioned above might lose their localization accuracy in cluttered indoor environments because the rich multipath will cause deep fading and further make it a challenging problem to compute people's relative location to the radio link based on the link's RSS measurements. Dutta et al.[2] proposed a system which is developed to track and count dynamic objects efficiently with color histogram analysis. Previous techniques such as combination of moving camera and lack of calibration makes the concept of speed estimation a challenging job. The RGB histogram analysis enhances the quality of traced footage or video in real time. In addition with this the edge detected traced image is filtered in order to get more advanced image processed system. Intelligent visual surveillance for people movement and people flow count are the key components for developing autonomous intelligent image acquisition systems. The system backend coding does not require any prior knowledge of target place feature extraction on static images. A system for detecting and tracking people is presented in surveillance video which uses a simple motion model to determine salient movements in a sequence of multiple image frames. Similar movements are associated between frames and grouped to form the backend. The entire process is automatic and uses computation time that scales according to the size of the input image sequence. Image segmentation is considered with initial backend tracing, target object (people) tracking in real time and people flow counting in the domain of people monitoring over an intersection. Daniel et al. [3] proposed mean shift algorithm for pedestrian tracking. The main challenges for visual tracking algorithms are real time capability, accuracy and robustness to changes in the object appearance, due to motion or illumination. Especially the mean shift algorithm, also commonly known as kernel based tracking, fulfills these criteria adequately. MS was first introduced by Fukunaga for data analysis in the field of pattern recognition, as gradient ascent local mode search algorithm for probability density distributions. Later different

Journal Impact Factor-2.02
Indexed by- ProQuest, DOAJ and many International Bodies.

approaches were introduced to handle the scale estimation problem, like mean shift based blob tracking or multi kernel tracker, which divide the target into several blocks, track each block separately and have the advantage of additional spatial information of the separated object blocks. In the field of face tracking, CAMSHIFT and EM-shift have been introduced since 1998, to estimate the scale and orientation changes adaptively, by calculating moment functions on weight values, which are estimated during the Mean Shift procedure. Ning et al. have transferred this calculation to SOAMST as a pedestrian tracking module. The performance of all MS algorithms is strongly depending on the modeling of the target and the seperability against the background. Different approaches try to handle these problems, like CBWH-MS by Ning et al., who corrected the BWH-MS approach of Comaniciu et al. by reducing the influence of prominent background features in the target model calculation. Object modeling is commonly done with color histograms, so they have become a standard in combination with the MS tracking algorithms and achieved reliable and robust tracking results. For grey-scale image sensors, like they are used in state of the art driver assistance systems, the object modeling based on pixel intensity histograms is not discriminant enough to reach a comparable performance .Many different pedestrian detection and classification systems are already based on HoG-features (histogram of oriented Gradient), a standard feature in this research area. Introducing the HoG-features for object modeling inside the MS algorithms requires a method to build up object model histograms. A Bag of Words (BoW) approach is proposed that clusters similar HoG-features and summarizes the object features inside a histogram based on a nearest neighbor matching to the cluster centers. The BoW-histogram of HoG-features fits perfectly to the requirements of the MS algorithms. The proposed algorithm adapts state of the art MS-algorithms, described in the following part, to a monochrome image sensor system for pedestrian tracking. Like in SOAMST, the target is modeled with a weighted kernel function, but prominent background features are suppressed additionally like in CBWH. Salient object detection is the task of marking regions of interest in a scene. It is a difficult problem in computer vision as natural scenes can have objects with cluttered backgrounds and can contain multiple objects. Judd et al. learned a model of saliency from 33 features (including low, mid and high level features) to predict human eye fixations. They used Support Vector Machines (SVMs) with linear kernels to learn feature weightings. Zhao et al. used least square regression to learn eye fixation prediction using basic saliency features (i.e., color, intensity and orientation). Borji in a later work also tested linear regression to learn a model of saliency from eye tracking data. All the above mentioned approaches achieve reasonably good results, however lose generalization as they only a learn a single set of weights for all image types. Ada Boost learns the task of salient object detection using an assembly of weak learners (hence increasing generalization).However the quality of final solution depends upon the performance of individual learners and can be affected drastically by one of the learners in the decision tree, which badly affects the generalization of the overall system. Once again, Ada Boost does not divide the image set into domains depending upon image type, which degrades generalization on unseen images. Traditionally Muhammad et al. [5] represents an LCS a rule-based agent that incorporates evolutionary computing and machine learning to solve a given task by interacting with a previously unknown environment. After observing the current state of the environment, the agent performs an action and the environment provides a reward. The generalization property in LCS allows a single rule to cover more than one state provided that the action-reward mapping is similar. Ramanan et al. [6] describe two approaches that learn appearance: one bottom-up and another top-down algorithm. Much previous work has focused on high-level reasoning but, in the experience tells that, the "devil is in the details"—low-level image features play a crucial role. Vijayalakshmi et al. [7] proposed many threshold techniques for moving object detection and tracking system. It applies more than one threshold techniques during segmentation phase of the work. Object detection is done by background subtraction with Alpha method and object tracking is carried out by feature point tracking approach. It is observed that Otsu threshold method seems to have produced a perfect extraction and yielded good result in moving object tracking. Prashant et al. [8] applied filters to remove noise and to avoid minute changes in the scene then used the frame differencing method to detect and segment the moving object. Contour tracking approach is applied to track the object of interest in all consecutive video frames.

B. *Existing methodologies*

1. *RF based technique*

First, PC-DfP, a lightweight and accurate RF-based device-free localization technique is presented for one person. Second, an SCPL an efficient 2-step algorithm is presented to accurately count and localize multiple people. Last, Crowd++ an accurate and energy efficient speaker counting system to estimate the number of people in social public space is presented Device-free passive (DfP) localization has been proposed as a way of detecting and tracking people without the need to carry any tags or devices. It has the additional advantage of being unobtrusive while offering good privacy protection.

2. *RGB analysis*

A proposed system has been developed to track and count dynamic objects efficiently with color histogram analysis. Initially a real time video footage is read and decomposed into number of frames (still images). Next, using these frames as inputs the color histogram (RGB) is analyzed. After the RGB analysis the processed target image is stored as stationary backend image. Then the interference of noise is suppressed by adding filter. A digital counter is placed in order to count the people flow at the target place. Motion detector used to detect the motion of people entering or going out from the target place. Finally after several processes the edge detected image is processed with filtered output.

3. *Mean Shift Tracking*

The mean shift tracking algorithm has become a standard in the field of visual object tracking, caused by its real time capability and robustness to object changes in pose, size, or illumination. The standard mean shift tracking approach is an iterative procedure that is based on kernel weighted color histograms for object modeling and the Bhattacharyyan coefficient as a similarity measure between target and candidate histogram model. The benefits of the approach could not been transferred to monochrome vision systems yet, because the loss of information from color to grey-scale histogram object models is too high and the system performance drops seriously. The author proposed a new framework that solves this problem by using histograms of HoG-features as object model and the SOAMST approach by Ning et al. for track estimation. Mean shift tracking requires a histogram for object modeling. In the proposed framework a set of high dimensional HoG-features is clustered via K-means and features inside the object area are matched to the cluster centers via a nearest neighbor search.

III. PROPOSED METHODOLOGIES

Fig 1 shows the block diagram for the proposed methodology. Dynamic Threshold Optimization (DTO) is used to detect objects in moving environment. Though DTO is an algorithm independent technique it will be more effective to be used with any search and optimization algorithm. A simple and robust method is proposed for background subtraction in dynamic texture scenes. The underlying principle behind the model is that color variations generated by background motions are greatly attenuated in a fuzzy manner. Therefore, compared to preceding methods using local kernels, the future method does not require estimation of any parameters (i.e., nonparametric). This is quite advantageous for achieving the robust background subtraction in a wide range of scenes with spatio-temporal dynamics. Specifically, a proposal is made to get the local features from the fuzzy colour histogram (FCH). Then, the background model is dependably constructed by computing the similarity between local FCH features with an online update procedure.

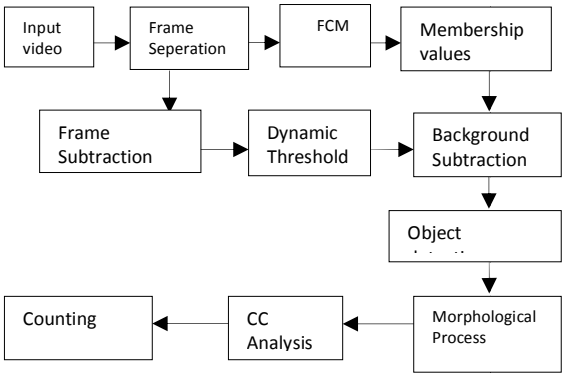

Fig. 1. Block diagram

IV. POSSIBLE OUTCOMES AND RESULT

Background subtraction method is very accurate for moving object detection and counting from dynamic texture as comparing with background subtraction with through simple threshold method. The proposed system will detect human motion and counts the number of persons present in the video sequence, precisely.

CONCLUSION

In this project a background subtraction method is proposed for object detection and counting based on fuzzy color histogram. Background subtraction method is very accurate for moving object detection and counting from dynamic texture as comparing with background subtraction with through simple threshold method. The proposed system effectively detects human motion and counts the number of persons presents in the video sequence. In future system, contour projection analysis can be combined with the shape analysis to remove the effect of shadow, and thus the moving human bodies are accurately and reliably detected.

REFERENCES

[1] C. Xu,"Device-Free People Counting and Localization" ACM 978-1-4503-2215-7, pp. 367-372September 8-12,2013
[2] R. Dutta , K. Mitra, S.Mukherjee, P.Sharma,"Real Time Edge Detected Advanced Image Acquisition System using RGB Analysis" pp 87-91,2013
[3] Schugk, D., Kummert, A., and Nunn, C., "Adaptation of the Mean Shift Tracking Algorithm to Monochrome Vision Systems for Pedestrian Tracking Based on HoG-Features," SAE Technical Paper 2014-01-0170, 2014, doi: 10.4271/2014-01-0170.
[4] A.O.Ercan, Abbas el gamal and Leonidas j. guibas," Object Tracking in the Presence of Occlusions Using Multiple Cameras: A Sensor Network Approach", ACM Transactions on Sensor Networks, Vol. 9, No. 2, Article 16, Publication date: March 2013.
[5] M.Iqbal, S.Saud Naqvi, W.N.Browne, C.Hollitt and M.Zhang," Salient Object Detection Using Learning Classifier Systems that Compute Action Mappings", *GECCO'14,* July 12–16, 2014, Vancouver, BC, Canada. Copyright 2014 ACM 978-1-4503-2662-9/14/07&#0133$15.00 .http://dx.doi.org/10.1145/2576768.2598371.
[6] D.Ramanan, D.A. Forsyth A.Zisserman," Tracking People by Learning Their Appearance", *IEEE Transactions On Pattern Analysis And Machine Intelligence*, vol. 29, no. 1, pp. 65-81 january 2007.
[7] S.Vijayalakshmi, D.Christopher Durairaj,"Use of Multiple Thresholding Techniques for Moving Object Detection and Tracking", International Journal of Computer Applications (0975 – 8887) Volume 80 – No1, October 2013, pp.1-7.
[8] Prashant Kumar, Rupak Chakraborty , Arup Sarkar, "Robust Object Tracking under Cluttered Environment", International Journal of Emerging Technology and Advanced Engineering ,ISSN 2250-2459, ISO 9001:2008 Certified Journal, Volume 4, Issue 2, February 2014.