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Non-Parametric Background Modeling for Foreground Extraction using Detection Theory and Object Tracking

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Abstract— Foreground extraction in dynamic environment is a challenging task in video surveillance. In computer vision evaluation of movement is a major task which requires only the changes in the scene. While the number of technique available to analyze the video sequence in real time using parametric model, here we use non-parametric model to extract foreground using coarse-to-fine detection theory, performance is measured using various formula. Later SILTP algorithm is used to detect the object and track them. Foreground objects are extracted using binary descriptor based background modeling method. Foreground and background instance are represented using galaxy descriptor. In region and pixel levels the detection theory is applied to obtain rough and detailed shapes of foreground objects. Illumination changes and dynamic background problems of background modeling are dealt in this method. Here we propose a technique to focus on foreground tracking and event analysis in background detection. Performance is measured using recall, precision and f-measure.

Keywords— non parametric; coarse-to-fine; SILTP; object tracking; object detection.

I. Introduction

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Foreground extraction is an indispensable part in object extraction and object tracking. Where detection of moving objects without breaking is difficult task in many cases. While in static the results are robust but in dynamic it is sensitive. Gaussian model is updated to deal with this area of research with a non parametric methods were each pixels are modeled directly. Non parametric model provides better results compared to parametric models. The main process here is to deal with dynamic changes and illumination problems. Were two or more than two objects moving in same dimension may be difficult to identify and track them.

Initially descriptor is used to label a region or pixel values. Binary image descriptor is used to encode the patch appearance. Infinite set of parameters is used where no assumptions are made in detection process. Ability to find the information that has scattered patterns in the information. Galaxy descriptors are used to provide the image regions are observed were it is more robust for illumination changes. Foreground detection detects the object by differentiate the color or gray scale frames in video to a background model to determine whether individual pixels are part of background or foreground. Segmentation is done to observe the image with the help of threshold values to create binary images. Coarse-to-fine detection theory identifies the region level and pixel level instance.

II. Literature Survey

Makrand samvatsar, Vinayak G Ukinkar proposed an approach using image segmentation in a dynamic background for object detection. This method helps in detection of object in both indoor and outdoor environment which will be robust against a rapid illumination changes in video. It excludes waving leaves, rain drops, snow fall and moving objects shadow cast as a non-stationary background. While the internal background model react as soon as the changes occur in starting or stopping of vehicle. In this method they followed 3 steps they are 1.foreground segmentation, 2.background extraction, 3.feature extraction and tracking.

A technique was proposed by Larry Davis, Kyungnam Kim with the help of codebook model, layered modeling/detection and adaptive codebook adaption for segmentation to improve the algorithm features. It has number of values along with the adaptive and compact background model which encode dynamic background and to cope up with global and local illumination changes. MNRL is used to represent pixel values of image while PDR is used for performance evaluation of the algorithm. It plays a assured performance only in trained sequence of short time.

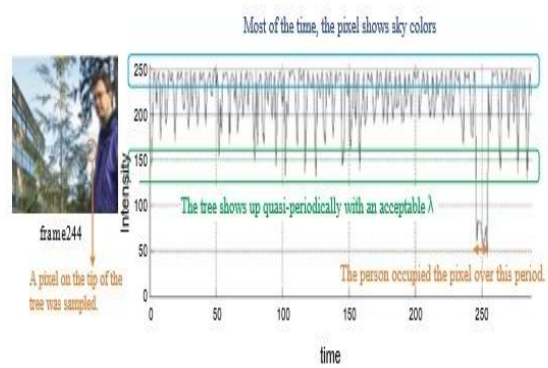

Fig.1.example showing how MNRL is used.

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Padam kumar, Durgaprasad gangodkar proposed an algorithm FSSAD (Full-search sum of Absolute Difference) to be used in a busy dynamic environment. Sequence of frames are used to differentiate moving objects(vehicles) and dynamic environment. BMA(Block Matching Algorithm) is used to identify moving regions by motion detection. Blob detection and Threshold is focused mainly to get better segmentation results by removing unwanted regions including false motion occurred due to dynamic environment.

A method for foreground and background separation from the frame difference was proposed by Amitabh Wahi using a method known as BFSD. In this method the key idea is to store the background image as the first frame image, if the bound difference is larger than it is set to be background pixel. If the threshold value is small then false result will be present while threshold choice is large then the scope of movement changes will be reduced. Hence appropriate threshold value must be selected based on the wavelength of light color changes. Based on the time difference two images before and after the pixel in the frame difference method vary with small time intervals. Background is static and foreground is dynamic which are interested in surveillance. Updating of reference image is an essential part in object detection in dynamic environment it is achieved by frame difference method.

Kyungnam Kim and Larry Davisa had proposed that by Improving foreground segmentations with markov random fields in probabilistic super pixel the efficient technique used here is **PSP**_MRF. While it gives a major explanation on it converts the pixel based segmentation into a probabilistic super pixel representation Super pixel: shape depends only on the image not on the foreground segmentation. Random fields: use neighborhood relations between super pixels to improve segmentation. The basic drawbacks of the paper are similar to other papers while Lack of detailed shape of foreground objects and does not deal with illuminations and dynamic background problem.

Chris Stauffer and W.E.L Grimson have proposed that Background segmentation with feedback: the pixel based adaptive segmentor. The technique used here is **PBAS** pixel based adaptive segmentor where it gives basic information about It is a non parametric model The parameter values are given by the history of images. To deal with changes in background we use state variables in PBAS which is adaptive. The short comings of this paper are the data is affected by noise, illumination and dynamic changes.

Padam Kumar and Ankush Mittal, proposed that in A universal background subtraction algorithm for video sequences here technique used is ViBe Visual Background extractor were it explains in detail Non parametric method It records pixels of background as samples in video rather than using explicit parametric model for each pixel It can represent exact background changes in the recent frame. Few drawbacks in this paper is Distinction between segmentation and Improve performance of updating the mask.

III. Methodology And Results

The method proposed is the combination of the coarse-to-fine detection theory and SILTP information for effective object detection in a dynamic environment using a mean shift algorithm.

Fig.2.input video

A. Background and Foreground Model Construction

A background modeling method is proposed with a binary descriptor which plays a effective role in dynamic environments by using a non parametric model. The backgrounds observed by using binary descriptors far better than the state-of-art methods. To construct a model of several histograms to represent the appearance of one block in video sequence and get the foreground detection decision by matching the new block histograms with the existing background histograms.

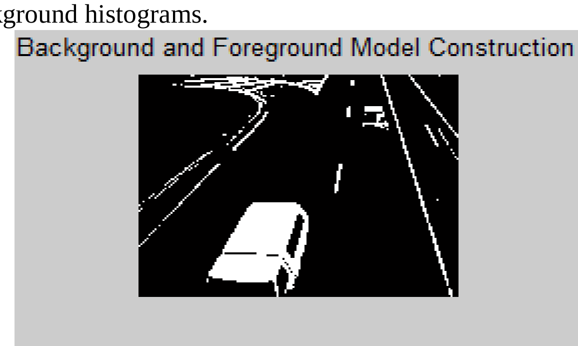

Fig.3.background modeling

B. Coarse-to-Fine Detection Theory for Foreground Object Extraction

To reduce the number of thresholds used nonparametric methods,. We propose a new coarse-to-fine detection theory algorithm to identify the labels of each region and pixels. Here we need additional threshold of the number of similar background samples with respect to the incoming samples.

1. Coarse Level Detection Theory

This method we first identify the labels of each instance by the detection theory in coarse level. It is a non parametric where we do not assign the threshold values during foreground subtraction, were it automatically removes the unwanted noise from the detected frame.

An instance Ip(t') belongs to either a background instance or a foreground instance, identifying the label of Ip(t') naturally forms a binary hypothesis-testing problem. Here, we consider two hypotheses. Given an instance Ip(t'), the hypothesis H0 is defined as Ip(t') is a background instance. The hypothesis H1is defined as Ip(t') is a foreground instance.

Fig.4.coarse level detection

2. Fine Level Detection Theory

The labels of each pixel are identified by the detection theory in the fine level as a result we can then decide the labels of each region and pixel. This is an next level algorithm for non parametric method is more accurate coarse level detection algorithm.

Instance represents an image region, all of the pixels in the region are then considered to be the same label. As a result, only rough shapes of foreground objects can be retrieved. To further extract detailed shapes of foreground objects, i.e. identifying if a pixel is a foreground pixel or not, we employ the fine level detection theory to decide the label of the pixel.

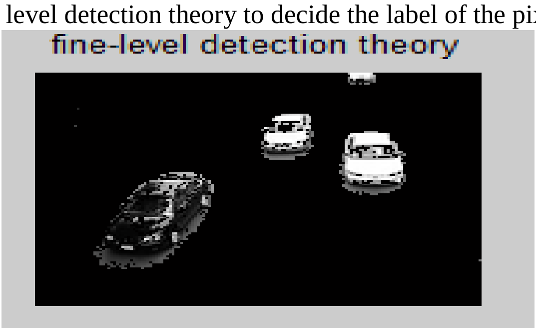

Fig.5.fine level detection

C. SILTP Information (Scale invariant local ternary pattern)

The SILTP feature has a shortcoming in dealing with smooth surface. Some common types of backgrounds (e.g. roads) may be smooth, and there will also be smooth foreground types like the body of cars or pedestrians with single-color clothes. Since SILTP features of smooth backgrounds and foregrounds are nearly the same; it is hard to detect smooth foregrounds from smooth backgrounds. Hence this SILTP is more robust to illumination changes.

In this strategy each image is divided into small blocks four small blocks form a big block, while the big blocks are partially overlapping, then a background model is calculated for each big block but the final foreground detection decision is made for each small block.

D. Mean Shift Algorithm for moving object tracking

Objects in background are tracked using mean shift algorithm with the help of color space. As the object moves, an unusual distance transform improves the accuracy of the target representation and localization which minimize the distance between two color distributions. By using mean shift algorithm we track the moving objects from the foreground detection output. The outcome of the detection theory is taken as a input to the tracking algorithm which will provide the output.

COMPARISON GRAPHS

An input video with dynamic environment and illumination changes are evaluated using few metrics such as precision, recall, f-measure and time. The performance is measured with the true positive, true negative, false positive and false negative values from the processed frames.

1.Precision

Precision is a method to retrive instance that are relavant which is based on understanding and similarity. While the precision value is high then the algorithm results in a more relavant results.

$$Precision = \frac{tp}{tp + fp}$$

This is also known as positively predictive value. The graph given below is an measure for the video taken as input.

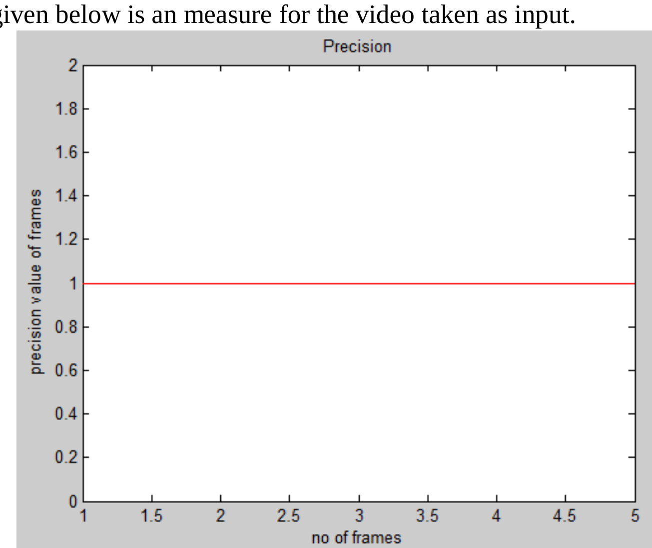

Fig.6.precision

2. Recall

Recall method is used as a relavant instance that are retrived which is also based on understanding and relavance. Here if the recall value is higher than the algorithim returns a relavant results.

$$Recall = \frac{tp}{tp + fn}$$

Recall is also said to be sensitivity value. The graph provides the measure of the input video.

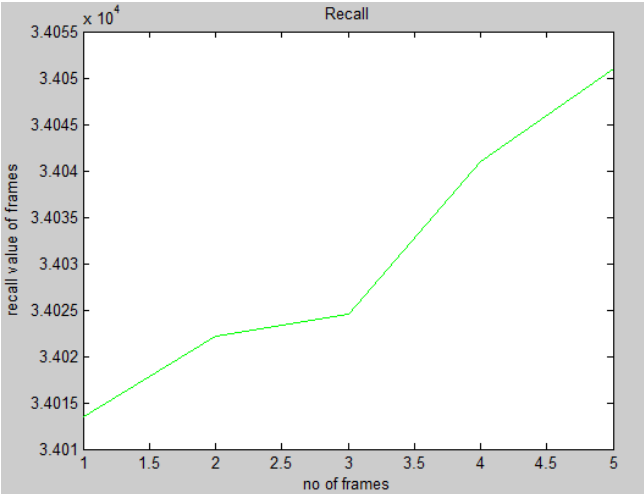

Fig.7.recall

3. F-measure

F-measure is the harmonic mean of precision and recall. It is a measure of tested accuracy.

$$F - measure = \frac{2 * recall * precision}{recall + precision}$$

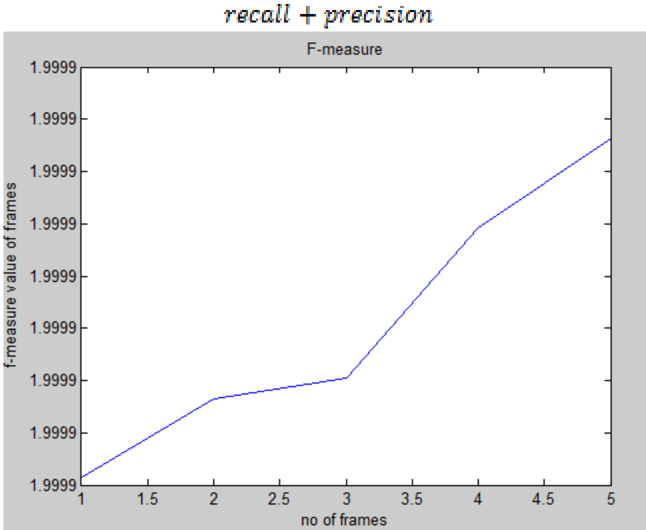

Fig.8.f-measure

Finally the time taken for the process is measured and evaluated using a graph.

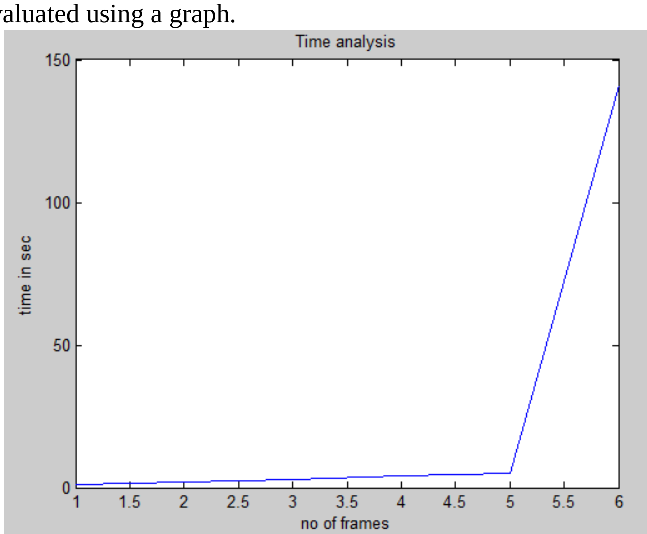

Fig.9 time analysis

IV. CONCLUSION

The background modelling using non-parametric model estimates the object detection and object tracking using mean shift algorithm. Comparing and estimating the better performance using coarse-to-fine detection theory and SLITP algorithm. Here the object with rough and detailed shapes are retrived from the dynamic environment.

REFERENCES

[1]Vinayak G Ukinkar and Makrand Samvatsar, "Object detection in dynamic background using image segmentation" International Journal of Engineering Research and Applications (IJERA) ISSN: 2248-9622 www.ijera.com Issue 3, May-Jun 2012.

[2] Niranjil Kumar A and Sureshkumar C, "Background Subtraction in Dynamic Environment based on Modified Adaptive GMM with TTD for Moving Object Detection", J Electr Eng Technol.2015;10(1): 372-378

[3]Sivabalakrishnan.M and Dr.D.Manjula, "Adaptive Background subtraction in Dynamic Environments Using Fuzzy Logic", International Journal of Video & Image Processing and Network Security IJVIPNS-IJENS Vol: 10 No:01 13109701-8282 IJVIPNS-IJENS © February 2010.

[4] D. Culibrk, O. Marques, D. Socek, H. Kalva, and B. Furht, ―Neural network approach to background modeling for video object segmentation, ‖IEEE Trans. Neural Netw., vol. 18, no. 6, pp. 1614– 1627, Dec.2007

[5] Kyungnam Kim, Thanarat H. Chalidabhongse, David Harwood and Larry Davis, "Real-Time Foreground- background segmentation using Codebook model", 1077-2014/$-see front matter 2005 Elsevier Ltd.

[6] Durgaprasad Gangodkar, Padam Kumar, Member, IEEE, and Ankush Mittal, "Robust Segmentation of Moving Vehicles Under Complex Outdoor Conditions", IEEE TRANSACTIONS ON INTELLIGENT TRANSPORTATION SYSTEMS, VOL. 13, NO. 4, DECEMBER 2012

[7] D.Stalin Alex and Dr.Amitabh Wahi, "BSFD: BACKGROUND SUBTRACTION FRAME DIFFERENCE ALGORITHM FOR MOVING OBJECT DETECTION AND EXTRACTION", Journal of Theoretical and Applied Information Technology 28th February 2014. Vol. 60 No.3.

[8] Danping Zou and Ping Tan, Member, IEEE, "CoSLAM: Collaborative Visual SLAM in Dynamic Environments", IEEE TRANSACTIONS ON PATTERN ANALYSIS AND MACHINE INTELLIGENCE, VOL. 35, NO. 2, FEBRUARY 2013.

[9] Rafael C. Gonzalez and Richard E.Woods, "Digital Image Processing", PEARSON Third Edition 2011.

[10] Hong Han, Jianfei Zhu and Shengcai Liao "Moving Object Detection Revisited: Speed and Robustness" Journal of latex class files, vol. 11, no. 4, December 2014

[11] Min-Hsiang Yang, Chun-Rong Huang ,Binary Descriptor based Nonparametric Background Modelling for Foreground Extraction Using Detection Theory" IEEE Transactions on circuits and systems for video technology,2014.

[12] Chris Stauffer and W.E.L Grimson "Adaptive background mixture model for real time tracking", The Artificial Intelligence Laboratory Massachusetts Institute of Technology Cambridge 2000

[13] Kyungnam Kim and Larry Davisa "Real-time foreground–background segmentation using codebook model" 1077-2014/$-see front matter 2005 Elsevier Ltd.

[14] Olivier Barnich and Marc Van Droogenbroeck "A universal background subtraction algorithm for video sequences" IEEE Transactions on Image Processing, 20(6) :1709-1724, June 2011.

[15] Martin Hofmann, Philipp Tiefenbacher "Background segmentation with feedback: the pixel based adaptive segmentor" Institute for Human-Machine Communication Technische Universit at Munchen June 2012.

[16] D.-N. Ta, W.-C. Chen, N.Gelfand and K. Pulli, "SURFTrac: Efficient Tracking and Continuous Object Recognition using Local Feature Descriptors," in Proc. Conf. Comput. Vis. Pattern Recognit., Jun. 2009.

[17] D. Li, L. Xu and E. D. Goodman, "Illumination-Robust Foreground Detection in a Video Surveillance System," IEEE Trans. Circuits Syst. Video Technol., vol.23, no.10, pp.1637–1650, Oct 2013.

[18] A. R. Rivera, M. Murshed, J. Kim and O. Chae, "Background Modeling Through Statistical Edge-Segment Distributions," IEEE Trans. Circuits Syst. Video Technol., vol. 23, no. 8, pp.1375–1387, Aug. 2013.

[19] M. Haque, and M. Murshed, "Perception-inspired Background Subtraction," to appear in IEEE Trans. Circuits Syst. Video Technol.,vol. 23, no. 12, pp. 2127–2140, Dec. 2013.

[20] Z. Zhang, C. Wang, B. Xiao, S. Liu, and W. Zhou, "Multi-scale fusion of texture and color for background modeling," in IEEE Ninth International Conference on Advanced Video and Signal-Based Surveillance (AVSS), 2012