ISSN 0974 - 9373

Vol. 15(2011) Special Issue 2 **Journal of International Academy of Physical Sciences** pp. 525-528

Image processing Occlusion Detection and Handling*

Vivek Gouda and Sanghmitra Banerjee
Geo Informatics, University of Petroleum and Energy Studies
Dehradun- 248007, Uttarakhand, India
Email: vivekgouda1990@gmail.com , sanghmitrabanerjee1980@gmail.com

(Received June 14, 2011)

Abstract: Occlusion means hiding of an object by another object during multiple human tracking. For multiple object tracking, it is important to maintain the history of objects before and after occlusions. This paper highlights to fill the missing parts from the past history of a person if available, when occlusion is detected. When dealing with multiple objects tracking, we separate the object state into three parts: Before, during and after occlusion. An Improved Mean Shift Tracking algorithm (IMST) which is special for occlusion target tracking is used. Occlusion can be detected by calculating the centre of mass of both the objects and when the distance between them is zero. By comparing the frames, the occluded part is identified and the missing part is filled from the matched frame when occlusion is detected.
Keywords: Improved Mean Shift Tracking (IMST), Frame Matching (FM)

1. Introduction

Object tracking is an essential component of an intelligent video surveillance system. More accurate and real-time object tracking will greatly improve the performance of object recognition and high level event understanding.

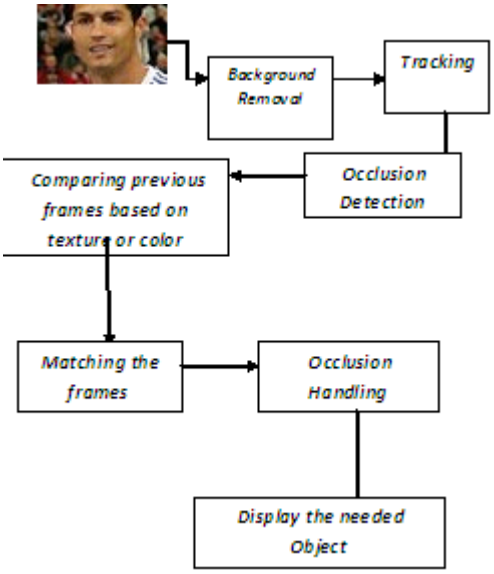
This paper introduces a multiple human objects tracking system, which detects and tracks multiple objects in crowded scene with occlusion. This system consists of (1) Moving object segmentation, (2) Removal of the non-object pixels (noise) of the segmented region, (3) Occlusion detection, and (4) Object separation from the occlusion. (5) Match the occluded part with the previous frames. (6) Fill the missing part of the current object from the matching object.

The major contribution of this system is to track the objects in occlusion, separate the object from the occlusion group, and track the separated object individually afterwards. The object of interest is separated from the current

*Paper presented in CONIAPS XIII at UPES, Dehradun during June 14-16, 2011.

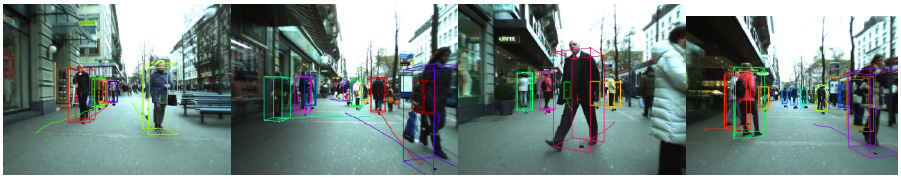
frame by filling the missing parts from the parts of the previous matched part. The rest of the paper is organized as follows:

2. Proposed work



3. Moving Object Segmentation

Motion segmentation in video sequences is known to be significant which aims at detecting regions corresponding to moving objects such as vehicles and people in natural scenes. Consider the below



4. Background Subtraction Model

|In,(x,y)-Bn(x,y)|>Tn (x, y) a1 else a0 Where Tn (x, y) is a threshold value estimated using the image sequence I0 through In-1.

5. Occlusion Detection

For occlusion detection, the distance between the center of mass of two objects in a frame is calculated. If the distance is zero, then occlusion will be detected. There are two modules in occlusion detection.

- Object separation from each frame in video sequence.
- Centre of mass calculation of each object.

6. Object Separation

For each object separation, read the current frame and the corresponding foreground image. Take each pixel from the foreground image. [White (1), Black (0)]. If the value is zero, change the corresponding red, green and blue pixels in the current frame to zero.
Z=(c(2)+c(2)+c(4))/2),(c(1)+c(1)+c(3))/2), where (c1, c2) is the starting co-ordinates and (c3, c4) is the co-ordinate value of column increment and row increment respectively. During occlusion, the distance between the centres of mass point will be zero.

7. Tracking

The state of a person is represented as a rectangle which contains the pedestrian image patch and slides in the image to represent its position and scale at each frame.

$B^j(t) = ((x^j\ y^j), hj, wj)$ is the rectangle of pedestrian j at frame t, (x^j, y^j) is the centre position, h_j and w_j are the height and width. For occlusion pedestrian tracking, we introduce occlusion layers,

$$(\Phi\ (t)) = \{\Phi\ j\ (t) = k\}^{n\ (t)},$$

where k is the pedestrian ID and n(t) is the number of related occlusion pedestrians at time (t) to present pedestrian occlusion relation. For the improved tracking algorithm, occlusion layers are introduced to represent occlusion relation and the non-occlusion parts of the persons are obtained according to the occlusion relation and used for tracking. During the tracking process, the states of the persons are gradually adjusted by one to eliminate the occlusion effects.

For the occlusion persons, more than one person could be labeled as one patch. An improved mean shift tracking algorithm which is special for

occlusion target tracking is used. The iteration number of improved mean shift tracking algorithm is smaller than that of traditional tracking algorithm.

8. Occlusion Handling

The occluded frame is identified by the above Improved Mean Shift tracking algorithm. The occluded part of the video frame is detected by separating the object from each frame and then find the center of mass for the occluded object. Using the Frame Matching (FM), the occluded part is then matched with the previous frames to find the correct match of the missing part. The missing part is then filled with the matched part and the object of interest is displayed.

9. Analysis of the Proposed Work

We perform experiments on a wide range of video sequences downloaded from the standard datasets. The input is a video file and split into number of frames. Perform background subtraction and then apply morphological operations to remove the noise. Object is separated for each frames and centre of mass is calculated to detect the occlusion. The following figures show the 30% outcome.

10. Conclusion

The proposed method contributes to the tracking field in several aspects. It adapts its priors to changing color and texture features. It tracks the complete region of the non-rigid objects. It can recover occluded object parts. But the complete occlusion of similar looking objects may cause ambiguities.

In the proposed work, occlusion could be detected by calculating the distance between center of mass and if the difference is zero, it concludes that the objects are in occlusion. Occlusion is handled by comparing the occluded part of a frame with the part of the similar previous frames and the occluded part is filled with the matched part. The proposed system will work not only on partial occlusions, but also work effectively on full occlusions.

References

1. Li Z, Q. L. Tang and N. Sang, Improved Mean Shift Algorithm for Occlusion Pedestrian Tracking, *Electronics Letters*, **44** (2008) 622-623.
2. Tao Yangl, Stan Z.li2, Quan Pan1, JingL, Real-time Multiple Objects Tracking With Occlusion Handling in Dynamic Scenes, *IEEE Conference*, **1** (2005) 970-975.
3. Dongbo Min and Kwanghoon Sohn, Cost Aggregation and occlusion Handling With WLS in Stereo Matching, *IEEE Transaction on Image Processing*, **17** (2008) 1431-1442.
4. Francisco Gonzaelea, Mateu Sbert and Miquel Feixes, Viewpoint-Based Ambient Occlusions, *IEEE Computer Society*, **44** (2008).