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Multiple Target Tracking Applied With Memory-Based Particle Filter

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ABSTRACT: Multiple targets tracking which posse's random motion is a challenging task and an active area of research in the field of video processing. There are various approaches for single target tracking with non linear motion but multiple target tracking is still questionable. Our approach is capable enough to track the multiple targets even when they cross each other. In spite of having a random motion which can be effectively tracked using the proposed approach. The experimental result will prove these facts.

KEYWORDS*:*Multiple targets, Memory-Based, Particle filter, Cross each other

I. INTRODUCTION

Multiple Human, Vehicle or Objects tracking in general is a very challenging task and has very useful applications. Some of the useful application areas are defense, bank ATMs, Security areas that include CCTV footages and even for activity recognition and characterization. In a simple way tracking can be defined as keeping a record of the detected object (in general) so that it could be useful in the mentioned applications above. The tracking problem can be solved using various approaches and the probabilistic tracking is one such approach which is robust yet simple to understand. There are various ongoingresearches happening in the field of tracking and few of them are, in [1], an improved version of MCMC (Markov Chain Monte Carlo) particle filter with the combination of color model is discussed. The suggested plan is durable to distortion of non-rigid targets, partial occlusion, and rotation. An object color model is built by calculating its histograms in the tracking rectangle, Since the RGB color space is dependent once and hence the HSV space is used for the color histogram which is an independent one. In [2], the paper deals with the two features of the Object to be tracked that is color and shape. The color histogram is sufficient for the object but sometimes the same color with different objects gives a conflict result and hence an additional feature to be added that is shape. The color histogram is calculated separately with the RGB separate buffers and those are normalized to some range. The Histogram of Oriented Gradient (HOG) is also calculated with the magnitude matrix, to do this the image is first converted to grey scale image and instead of three buffers only one buffer is considered.In [3], the proposed method discussed about the color feature of the object and thus helpful in finding the object in a static environment (though the background color should be distinctive compared to the object) and the update model discusses the sensitivity and the performance issue of the color feature of the object. It can tolerate non-rigid distortion of sample targets, I the cluttered background and also partial occlusion of object. The algorithm can also be extended for two or more targets for tracking. The mentioned methodology can be fixed up to eliminate the limitation by incorporating learning based tracking with it. There are variations of the particle filters [4][5][6] discussed for tracking. Once such variation is non linear state estimation during occlusion with the help of particle filter which is the proposed methodology of this paper.

II. MEMORY BASED PARTICLE FILTER

The particle filter fails due to various reasons, like occlusion or the human goes out of the frame or same featured object presence or any other reason. The memory based particle filter addresses one such occlusion issue. The target

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history is maintained in the each frame of the video, so during occlusion with the help of this target history or a memory update the state of the object by calculating feature from this memory and hence the memory based particle filter works fine even during the occlusion but to some extent.

Memory-based particle filter[7] is a new approach of particle filter which uses the memory estimation to track the object which is missed by the tracking system using its previous state and measurement information.
The latest position and measurement of the object under tracking is memorized in the tracking process and is used to approximate the state of the target whenever the tracking is missed. The previous state of the object is considered as the current state and the prediction model is called to reinitiate the tracking process with this current state as the initial position.

The boundary condition is checked every time so that the particles near the boundaries will not have the inappropriate weights due to the consideration of the area outside the frame to calculate the weights for those particles.

III. WORKING PRINCIPLE

To track multiple targets we need multiple particle filters, say for example if we have N number of targets, then we need N different instances of particle filter, since the number of targets are more the possibility of occlusion is also more, so to handle the scenario of occlusion the below steps will be helpful.

1. Spread the Particles around the humans with the initial position So that the number of good particles will be more say almost equal to number of particles.
2. Call the Observation model for the frame.
3. In the Observation model calculate the color histogram and the hue for the particles and then call the distance formula to calculate the similarity of the particles.
4. With this similarity calculate the weight of the particles and the likelihood of the object using the Observation Likelihood Function.
5. Update the new state of the particle by the likelihood model.
6. Resample the low weighted particles.
7. Suppose if the good weight particles falls below threshold (i have taken the threshold value as 20% of the number of particles) then take the previous frame state(memory) as the current state and spread and repeat the procedure from step 2 till last video sequence is achieved.

The below flow chart explains the work flow of the proposed method.

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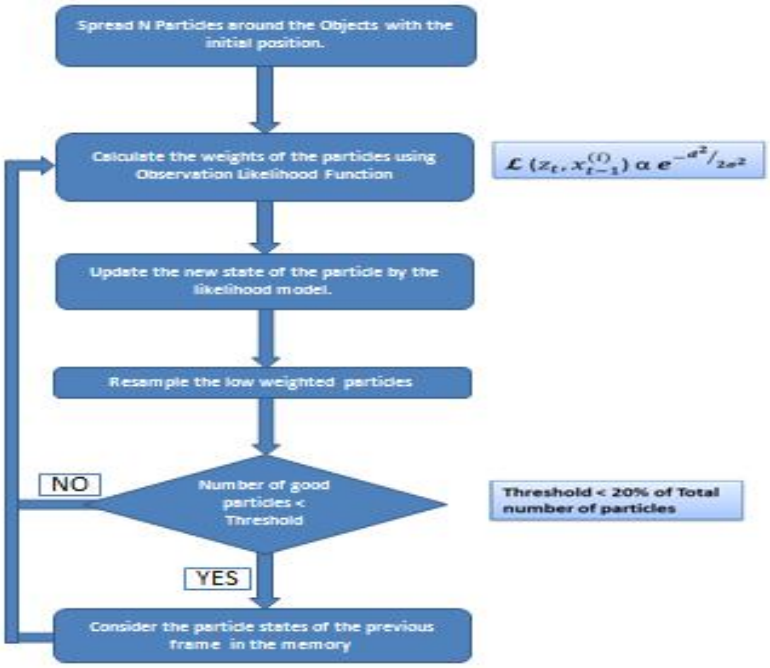
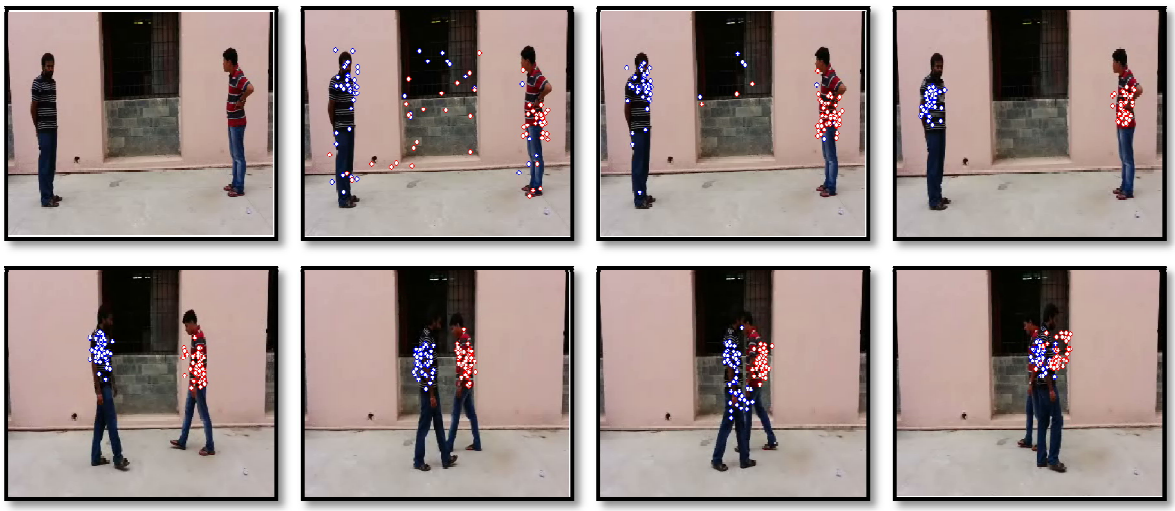


Fig 1: Memory-based particle filter for target tracking

IV. EXPERIMENTAL RESULT V.

The execution environment demands certain software and hardware requirements like Windows family as OS, MS VC6 ++ as a tool in the software side, 1GB RAM with 1GHz or above processor speed is preferred as the hardware requirement. From section III we take target as human and N as 2, the scenario considered is the two human being walking opposite to each other and crossing several times. The following results show the accuracy of tracking by the proposed approach during occlusion and random motion detection.



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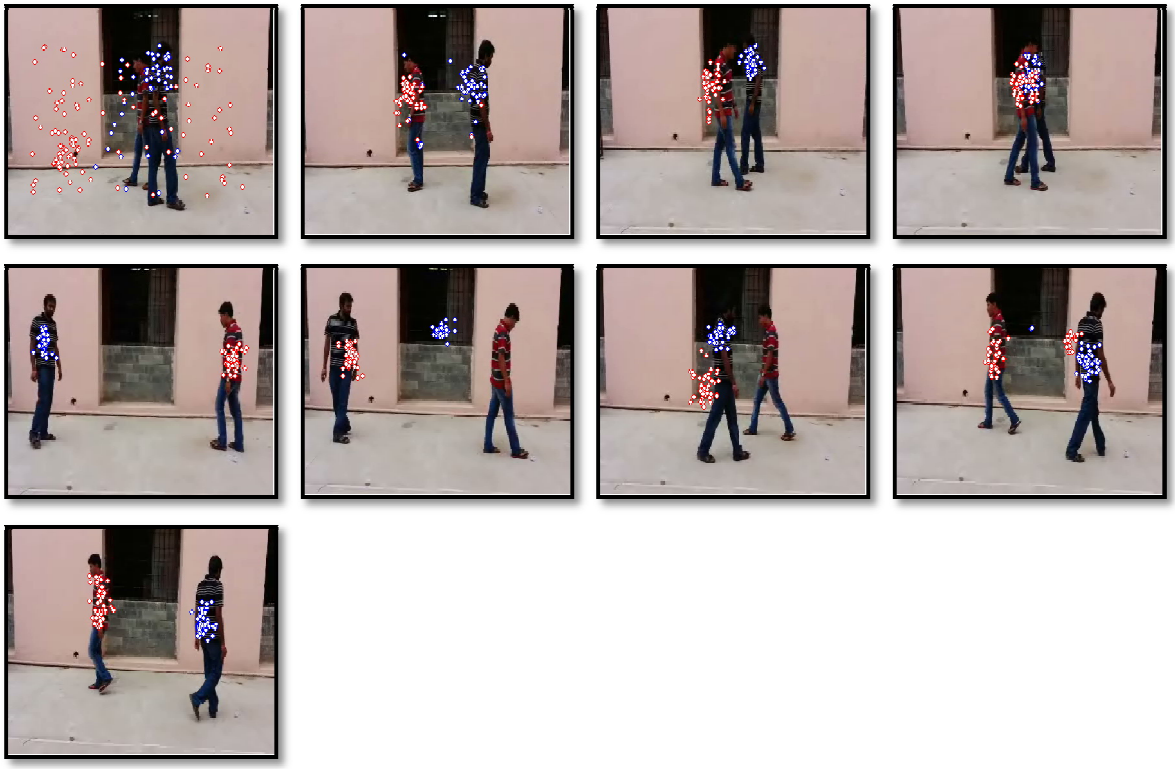

Fig 2: Memory based particle filter for 2 human tracking

VI. CONCLUSION

The paper started with the valid problem for proposing a new approach to track multiple targets with random motion. The Ongoing research in the similar field is mentioned. Finally the proposed method works well compared to conventional method by keeping the target history as the key point during the failure. By applying the proposed method the experimental results approves the proposed method is simple yet robust to track multiple humans. The above problem can extended to more than two without failures.

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