# Improved Human Opinion Dynamics Based Particle Filter Object Tracking For Videos

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***Abstract:*** **Object tracking is a technique that is being used from past centuries. In the surveillance system, several vision based methods are utilized for various objects. In the first part, a fast method is presented for background subtraction to handle various scene changes. The maximum likelihood estimation algorithm found within the above paragraph try to modify the objective functions. These approaches are still sensitive to initialization and other parameters like predicted position of the tracked object, occlusion time etc. The proposed method combines the background modeling and particle filter to track multiple objects. In the object tracking process the object is considered to be in motion if its location is changing with respect to its background. By using background subtraction method the change of frame is detected, in case if there is no difference between the two frames then the object is considered to be in a static position. The proposed work is to use human opinion dynamic algorithm for particle filter tuning in order to make the prediction more effective. As the proposed algorithm involved solving the minimization problem for each drawn sample with the proposed model, the proposed system has been planned for real-time applications. The results will be presented to verify the same.**

***Keyword: GSA, HOD, CODO, MLE***

## I. INTRODUCTION

Now a day's vision based techniques are units used for tracking several objects. But it's still a difficult task for a few reasons. To avoid this issue, specializing in the item of interest is important. Some techniques are devised to the present appearance and that they hold background modeling to extract foreground or mistreatment color data to target involved object. A number of illustrious techniques of background modeling include the Gaussian average, kernel density estimation, Gaussian mixture model. Tracking is a number of set targets in closed-circuit with same color could be a difficult task. In this way the algorithm is projected to trace several objects mistreatment particle filter and background subtraction. The proposed methodology minimizes the quality of drawback by proscribing the generation of particles. That is, spreading of particles is controlled by specializing in the item. The methodology used completely different colored particles to trace multiple objects. Straight forward background subtraction methodology is employed to extract foreground.

Multi-target tracking could be a classical, however; it is a troublesome task if one consider it in a laptop vision.This is often characterized to many aspects. A main problem is ofcomplexness of state, hence; one must deal with the quantity of potential target trajectories over time which is extremely massive, and there's a simulated phenomenon for every separate variety of targets. However, there has been some amount of uncertainty in the estimation of the position of the target. As an example, every object's linear and angular speed should be physically acceptable, and also the distance between any two objects cannot become too small to be detected. Since the separate trajectories aren't irregular of every other, maximizing their joint posterior is normally NP-complete.

To compound that, inter-object occlusions cause appearance change and missingproof. To resolve the object interactions, many approaches are planned that aim to incorporate them within the model and observe a combined response, as critically chasing each target singly. This is often typically achieved by limiting the generated particles to a finite set of candidate locations, either by threshold the observation chance or by frequently discrediting the situation position. The discrimination, at side of sure simplifications of physical constraints, yields energy functions where global minimum are often found. Though this property is actually engaging, the worth to operate that solely roughly approximates the underlying posterior. Here, a tendency to raise the question whether or not it's extremely judicious to seek out the global optimum of associate function, or whether or not it's going to be additional acceptable to construct a function that reliably represents the particular object.

In several of the previous developed track techniques, the primary elementary drawback encountered is that the object segmentation that extracts the areas of interest from the scene. The extracted regions are used as measurements for the tracking algorithms. These foreground segmentation methods are usually computationally expensive as a result of they operate over the complete image scene. Algorithms that decide to notice the target of interest while not interest segmentation are planned for single target track supported cues like edges, color and textures. Lately, the integrated detection and track mistreatment particles have been extended for multiple targets. Several of those schemes place confidence in hybrid serial state estimation. In, the state

vector denoting all the prevailing targets is increased by a distinct variant that displays the quantity of existing objects in an exceedingly video sequence. The particle filter has developed in several models for object motion, and contains a further distinct state part, denoting that of the motion models is active. The Bayesian Multiple-Blob hunter displays a several person tracking system support statistical appearance models. The several blob tracking is managed by incorporating the quantity of objects show within the state vector and state vector is increased once a brand new object enters the scene. The problem of multiple target tracking is tougher than the only target tracking and a number of other problems that don't exist for single target track, needs to be resolved for the booming application of multiple target track algorithms. One issue is that the management of several tracks caused by new showing targets and also the disappearance of already existing targets. Within the references mentioned before, this is often solved by the hybrid state estimation framework for joint track of all existing target. Joint track of targets avoids the likelihood of many independent filters, however the identity of the individual targets may be lost, particularly once targets area unit near one another. A separate single track filter can be applied to multiple target track, only all targets area unit fairly well spaced. Once the targets area unit nearer and/or cross one another, it has been displayed in aerospace applications, that information association techniques may be used to track while not losing the identity of every targets. However, the ways developed for microwave radar information aren't applicable to vision issues because of the absence of activity equations in express type. Within the varied variety of targets is calculable via cluster techniques and also the information association is performed by the 2-D assignment formula.

Security is being a major issue in this era. Following this there are various ways to secure people from the security threats. Video surveillance at public places is contributing in a large extent to secure people from these evil threats. Video surveillance is an application of real-time multiple object tracking which includes the detection of objects by comparing it with the background. The detection of object's motion does not require the person to stay isolated for the process. And hence, there is a requirement of an efficient system for tracking multiple people.

## II. RELATED WORK

**Hoseinnezhad Reza, et al. in 2013 [1]** followed an approach which operated directly on the video data and does not require any detection. Case studies from the CAVIAR dataset used which showed that the method can automatically track multiple targets and quickly find targets entering or leaving the scene.Proposed algorithm gradually learned and updated a probabilistic background model which was then used to generate a grey-scale foreground image. A tractable multi-target measurement model had been proposed for the grey scale foreground image, which enabled an efficient multi-target filtering technique known as the multi-Bernoulli filter to be applied. The method has been evaluated in three tracking scenarios from the CAVIAR data sets, showing that multiple persons can be tracked accurately. Comparative results showed that with a comparable computational cost, the method outperforms competitive and similar methods in terms of accuracy, especially for a relatively large number of targets.

**Khatoonabadi SayedHossein and Baji´c Ivan V. in 2013 [2]** presented a method for tracking moving objects in H.264/AVC-compressed video sequences using a spatio-temporal Markov random field (STMRF) model which was updated from frame to frame in order to follow the changes in the object's motion. The proposed method was tested on a number of standard sequences, and the results demonstrated its advantages over some of the recent state-of-the-art methods.A novel approach has been presented to track a moving object in a H.264/AVC-compressed video. The only data from the compressed stream used in the proposed method were the motion vectors and block coding modes. As a result, the proposed method had a fairly low processing time, yet still provided high accuracy. The results of experimental evaluations on ground truth video demonstrated superior functionality and accuracy of their approach against other state-of-the-art compressed-domain segmentation/tracking approaches.

**Liu Jingchen, et al. in 2013 [3]** employed hierarchical data association to track players in team sports. Player movements were often complex and highly correlated with both nearby and distant players. Using this insight, a set of game context features were defined and decomposed the motion likelihood of all players into independent per-player models contingent on game state. Higher-order inter-player dependencies were implicitly encoded into a random decision forest based on track and game context features. Because the conditioned model decomposes into pair wise terms, the formulation remained efficiently solvable using cost flow networks. Validated approach on 30 minutes of international field hockey and 10 minutes of college basketball has been used. In both sports, motion models conditioned on game context features consistently improved tracking results by more than 10%.

**Manikandan R. and Ramakrishnan R. in 2013 [4]**In this research paper the main topic of concern is the movement of object (Player) in sports video analysis. To obtain a more complete behavior of moving player a dynamic optimization threshold method is used. Players are detected on the ground by using background subtraction when a player is moving on the ground than the motion of the player in video stream is studied and detection of velocity is done for analyzing the position of a moving object or human body centriod is computed. In this research paper background subtraction and foreground subtraction both are done on video frames while detecting the object (human bodies, Players).

**Milan Anton, et al. in 2013 [5]** tracked multiple targets in crowded scenarios, modeling mutual exclusion between distinct targets became important at two levels. The experiments showed state-of-the art results on public benchmarks, with clear improvements from the simultaneous exclusion constraints.

**NingJifeng, et al. in 2013 [6]** In this research paper background subtraction model can be used for detecting multiple objects having different colour contrasts. There are various filters that can be used for subtraction of background in real time object tracking i.e. mean shift and kalman filters. Thresholding technique is the widest used technique for extracting the background and foreground of the image. In this method unnecessary details can be removed from that image and we can easily extract the required things from a real time image. Algorithms analyze the moving objects frames and output of the location of the object within that video frame. In early pre processing stage temporal or special smoothening is used to eliminate various noises present in the video frame or the image under consideration. There are various environmental changes so we also use the technique of background modelling against those environmental changes occurring in the video frame.

## III. PROPOSED METHOD

A new hybrid population-based algorithm (MHODGSA) is proposed with the combination of Modified Human Opinion Dynamics and Gravitational Search Algorithm (GSA). The main idea is to combine the exploitation ability of MHOD with the exploration capability in GSA to synthesize both algorithms' strength. The optimal Virtual Machine Scheduling or selection for current job will be done using the hybrid algorithm with both the standard MHOD and GSA algorithms in evolving best solution.

The hybridization of two algorithms can be done in high-level or low-level having a relay or co- evolutionary method approach. They can be either homogeneous or heterogeneous. In this thesis, we hybridize MHOD with GSA using low-level co-evolutionary approach which is also heterogeneous. The reason for the hybrid to be low-level can be attributed to the fact that the functionality of both algorithms has been combined. But the co-evolutionary approach is used since both algorithms are used one after another. i.e. they both run in parallel. It is heterogeneous because there are two different algorithms that are involved to produce final results. The basic idea of MHODGSA is to combine the ability of social thinking in MHOD with the local search capability of GSA.

In MHODGSA, at first, all opinions are randomly initialized. Each opinion is considered as a candidate solution. After initialization, Gravitational force, gravitational constant, and resultant forces among opinions are calculated respectively. After that, the accelerations of particles are defined. The social ranks of agents are considered which is calculated on the basis of mass of each agent. This rank is utilized for weighting the updation of each agent according to the formula given by gravitational search algorithm. Thus the local search capability of GSA and social influence of MHOD are utilized and the results are compared.

In the proposed method each object is tracked using particles on object. The performance of particle filter attains to deteriorate as the total number of objects increases in the scene. To decrease the issue, it is desirable to restrict the region where the particles are placed. In the defining region, the foreground was released from each frame using background subtraction or particle filter was applied to track the objects. For the experiment, these three objects have been tracked in video.

**Algorithm**

Here initially, choose a particular region. s1=φ; η = 0.

1. At first, set all new randomly generated particles (n). Sampling (j) the particle set that is relied by popular weights, and it is calculated through the distribution.
2. the particles are replaced by showing priority to probability of selecting this particle that is similar to the prominence weight (w)
   For initializing the loop i=1,2,3,4…n and sample j is replaced with sample (w).
3. State transition probability is generated the input (sj) by using one of associated factors for a particle filter algorithm.
$$X^1 \sim P(X^1 \left| u^1 S_j \right|)$$
4. The input is a measurement vector (z) which is used to calculate the important weight for certain particle.
$$W^1 = P(Z|X^1)$$
5. $X^1$ is used to determine the new particle and new non- normalized weight is produced.
6. In this step, $S^1$ is calculated into new particle then set it as prime and repeat calculating S1.

$s^1 = s^1 U\{< X^1, W^1 >\}$ (loop ends)

7. to calculate missing normalized weight, keep out the running count in for loop, which carry all weight in the set and accordingly normalize them (Wi)
   i. for i=1,2,3,…n
   ii. $w_i = {}^1/_\eta \, w_i$
   iii. $end.$

8. Fitness values are given to eachparticle which has been produced arbitrarily.In order to attainthe better results, objective function should be minimum. Also, those particles having same fitness values are given the similar social rank. The

distinct particles obtain lesser social rank if it has larger fitness value and vice versa. The SI wij(t) of distinct j on distinct i

$$W_{ij}(t) = SR_i(T)/E_{ij}(t)$$

Where, Eij(t) is the Euclidean distance between j and i.

9. $\Delta O_i = \frac{\sum_{j=1}^{n} (o_i(t) - o_i(t) W_{ij}(t)}{\sum_{j=1}^{n} W_{ij}(t)} + C_i(t) \quad , j \neq 1$

The above equation signifies the updating rule. Where

oi(t), opinion of distinct particle i for their neighbors and N, number of particles around.

wij(t), Social Influence and ci(t) is the normal distribution.

10. Standard deviation σi(t)

$$\sigma_i(t) = S \sum_{j=1}^{n} e^{-fij(t)}$$

Where t is time. The modulus of the difference is calculated from distinct i and distinct j.

## IV. RESULT AND DISCUSSION

The experimental results display the tracking information of several objects when there is similar color object placed in background. The results are presentedfor both methods of one is background subtraction and second is without subtracting background. It displays the phenomenon in other particles which are spreading too much. It shows the obtained results with background subtraction in all the particles which are on the object. When the background is subtracted, apart from disturbance due to existence of similar colored object in background has removed and particles focus only on foreground. In another problem of particle filter is to specify the accurate blob's centroid value. The blob's centroid value has affected by minimum variation of light. If blob's centroid value, which has not specified correctly, the particles, can be disturbed because of taking equivalent weight in particles that are spreading too much because of few blob's centroid values exist in the background. In this, problem can be minimized because the particles can get the weight either from foreground or 0 from the background. As there is high difference in weight so particles can be moved on object.

Figure 1: Frames with detected object

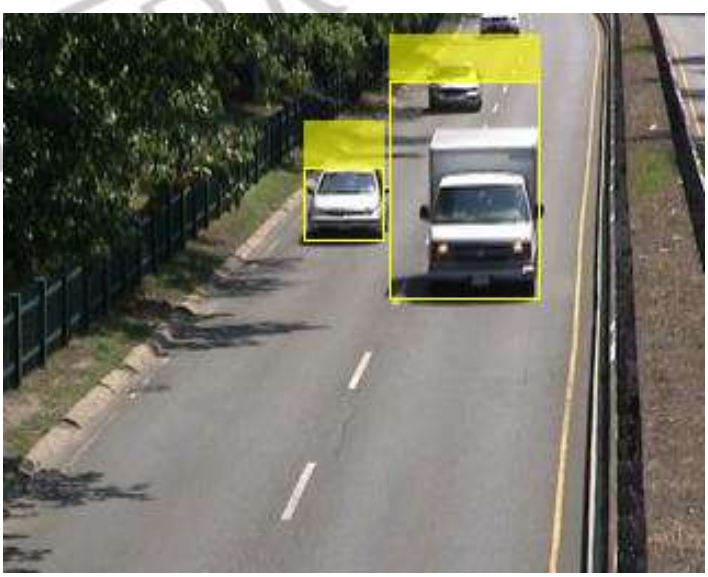

Figure2**:**Frames with tracked objects

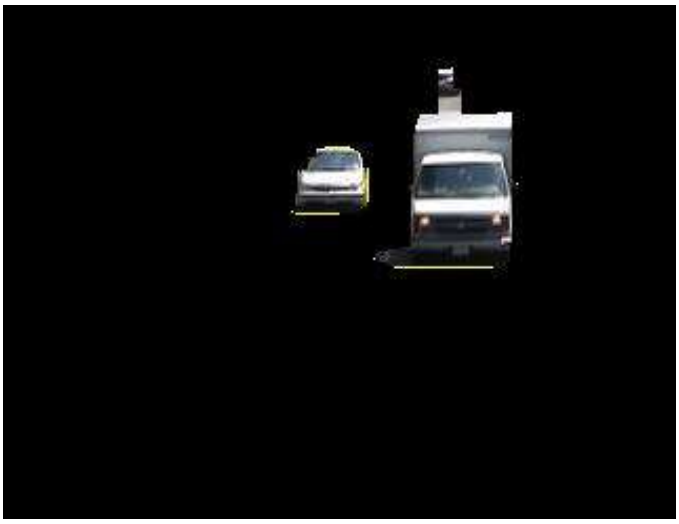

Fig. 3:Frames representing continuity of tracking method

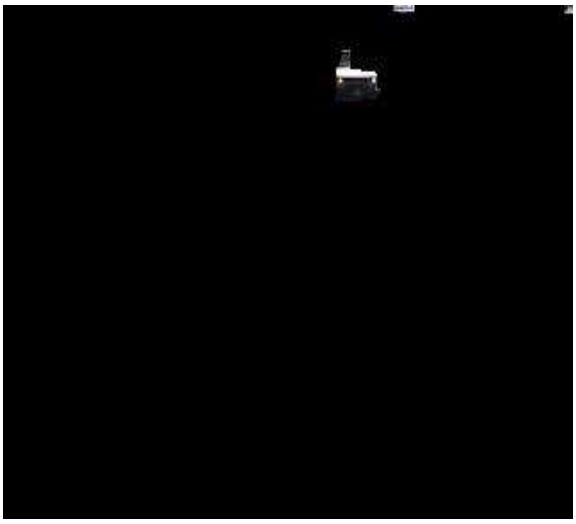

Fig. 4 Representing Background Subtracted from Frame

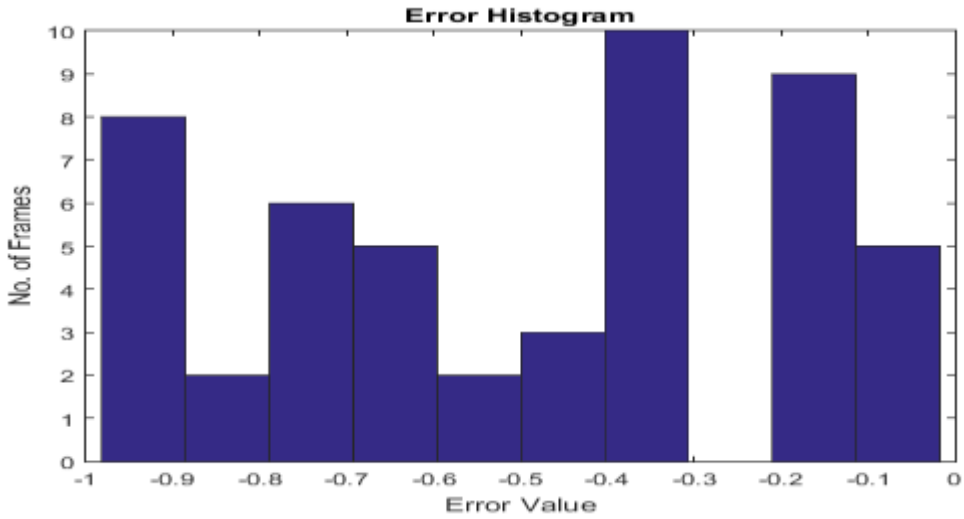


Fig5:Error histogram

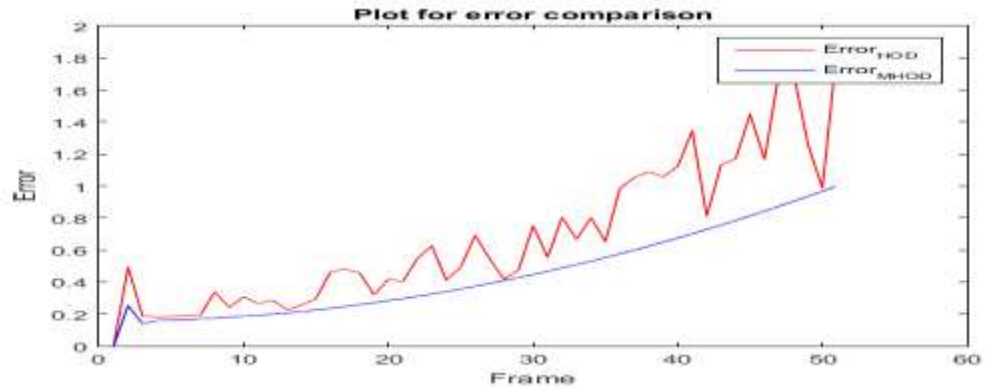


Fig. 6:Comparison Graph for Prediction Error between Original and Proposed Method

Figure 5 is an error histogram for error differences in terms of pixels for each frame. Error histogram gives the distribution of error. If the mean is less than 0 then the proposed method has less error than the base method. This is because Error=Error(MHOD) - Error(HOD).

Table 1: Comparison Table

| | **Base Method** | **Proposed Method** |
|---|---|---|
| **Mean Error** | **0.71** | **0.22** |

## V. CONCLUSION

Utilizing the gravitational search algorithm, we introduce an enhancing dynamic optimization into particle filtering for multiple object tracking. It combines opinion operator into continuous dynamic optimizer. Optimization-seeking procedure of human opinion dynamic can shift particles to the local maxima of the subsequent density and reduce implicitly the particle failure problem at the same time. The experimental results on multiple target or object tracking with noises demonstrate that compared to the conventional HOD based particle filter, the proposed algorithm can produce more robust tracking and has smaller computation cost.

The experiments demonstrate that the proposed method has performed well in some complex scene. In future, we need to enhance the efficiency of the Modified Human Opinion Dynamic or MHOD algorithm in the particle filter so as to guide the particles to distribute reasonably when occlusion occurs, which is our next research.

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