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# An Online Video Segmentation using Improved Particle Swarm Optimization Technique

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***Abstract*: *Video segmentation is the original needed stage in the video method wherever the whole video is splits into volumetric sections, each segment consists of spatial substantive with temporal domain information. We proposed a video segmentation algorithm using Short Term Hierarchical Fast Watershed Algorithm (STHFWA )and Fractional Order Darwinian Particle Swarm Optimization(FODPSO) technique. In STHFWA ,the k-means clustering is used to find out the initial segments based on the color intensity present in the frames and Fast watershed algorithm is applied to construct the rigid lines based on the catchment basin coordinates to avoid over segmentation. Finally, FODPSO optimization is used to reduce the computational complexity. Also, the experimental results are analyzed on a VSB100 dataset, shows that the proposed algorithm outperforms modern online video segmentation techniques significantly.***

***Keywords* : *Video Segmentation, Dual Complex Tree Wavelet Transform, Fast Watershed Algorithm, Fractional Order Darwinian Particle Swarm Optimization (FODPSO).***

## I. INTRODUCTION

Segmentation is dividing an standard image into several segments. The segmentation goal is to rearrange and change an image's representation into something meaningful. Segmentation of image or a video is used to find the objects in images. The segmentation is to break up a entire video into small segment[1]. It is applicable to various applications such as video retrieval, action recognition, video summarization, 3D reconstruction and scene classification,. However, video segmentation is still remains a very challenging problem in video processing due to object motions[17]. To overcome these issues, various attempts have been performed.

A video segmentation has a hierarchical structure of m ultiple scenes[1], each scene has a collection of shots, and each shot has a series of video frames. From the data analysis point of view, all current methods addressed the issue of video segmentation. A analysis of techniques for video segmentation shows many constraints that arise in the segmentation process. This work identifies the video segmentation problem by proposing a video model based on the technique of optimization. The optimization of Image and video segmentation is used to improve the results and to offer greater reliability and efficiency[10]. The Optimization is the technique of making mathematical techniques to make some capabilities to work extra efficiently or locating alternative performance below given constraints, as possible by way of maximizing desired parameters and minimize the undesired parameters which might be concerned within the problem. Section 2 presents the literature review. Section 3 discuss the model of video segmentation algorithm and proposed an optimization technique. The experimental results and the plots are explained in section 4. A summary

## II. RELATED WORKS

**Grundmann *et al.*,** [1] have proposed a hierarchical graph-based algorithm for spatiotemporal long video sequences. A tree of space-time segmentation begin by segmenting the video graph into space-time regions and building a region graph over the segmentation and repeating this process iteratively over multiple levels. This hierarchical approach creates high-quality segmentations that are temporarily compatible with stable boundaries of regions. **Kuo-Liang Chung *et al.*, [2],** have proposed an efficient segmentation algorithm focused on watersheds with motion vectors. Their algorithm has a lot of computational merit as subsequent edges can acquire the sectioned effects of the current frame on the next frame's motion vector information, yet this algorithm has a problem of over-segmentation.

**Vazquez-Reina,A *et al.*, [3],** proposed a MHVS unsupervised segmentation algorithm for video groupings. MHVS fragments subjectively lengthy streams of video by means of thinking about only a tiny amount of frames at any given moment, and handle the automated introduction, continuation and end of names with no client advent or supervision. They appoint each course, a score and allow the instructions rival every other to element the grouping. They determine the arrangement of this segmentation difficulty as the MAP marking of a better-request irregular area. **Corso *et al.*, [4],** depicted an estimate gadget for streaming hierarchical video segmentation stimulated by means of statistics move calculations each video define is deal with simply as soon as and cannot alternate the segmentation of beyond frames. They actualize the graph-based totally hierarchical segmentation approach.

**Couceiro *et al.*,[5]** proposed a study on PSO calculations predominantly focusing at the DPSO.

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in addition they additionally proposed controlling method for the Convergence rate utilizing Fractional Calculus (FC) thoughts. They attempted fractional-request development calculation, indicated as FO-DPSO, utilising some capacities, and they watched the relationship among the fractional-request speed and the convergence of the set of rules.

**Mohsen *et al.*, [6]** proposed the multilevel thresholding strategy segmenting images supported Particle swarm improvement (PSO). They utilised the PSO to find the most effective estimations of limits associate degree to offer fitting segment for an objective image as indicate as fitness function. They in addition utilised another assessment work as a objective function for the PSO formula to manage segmented pictures as a collection of regions, the target image is partition into lots of locales. **Galasso *et al.*, [7],** have presented a frame-based superpixel segmentation depicted together with some movement and appearance-based affinities is equivalent to obtaining good segmentation. Video segmentation benchmarks, sanctioning coarse-to-fine video segmentations, and varied human explanation results are also being tested on BMSD. (Bekeley Motion Segmentation Dataset).

**Sudhanshu Sinha *et al.*, [8],** portrayed A video segmentation is represented using the simple mean-shift filter and k-means grouping. For background estimation they make use of MOG and KDE, so forth. They attempted their technique on video statistics got from Wallflower check footage from its deliver site. **Li *et al.*, [9],** proposed a general calculation, referred to as SOLD, that seeks once the low-rank portrayal for video segmentation. sold appearance for a sub-optimal arrangement by creating the grid rank unambiguously determined. Through applying the calculation Normalized-Cut (NCut) with the anticipated low-rank representation, the image is divided into some spatio-temporal regions, but it works clearly best on very small images. **Arul Kumaran *et al.*, [10],** proposed segmentation technique for images and introduces the combined calculation of FCM and fractional order PSO classification accuracy. They additionally classifies different highlights that are identified with any remote detecting hyper spectral picture.

**AbhijitKundu *et al.*, [11],** presented the related approach to spatio-temporal regularization in semantic segmentation of video. They calculated the euclidean distance within the space-time volume is something however a good negotiate for correspondence. thence they advance the mapping of pixels to associate Euclidean distace space and limit distances between corresponding points. **Jang WD *et al.*, [12]** proposed an segmentation calculation for online videos, supported STHS and MRF improvement. during this STHS technique, they turn out introductory fragments by sliding a brief window of frames and apply spatial agglomerate cluster to every frame, and then they receive between frame bipartite graph matching to construct starting parts. At long last the segment every frame into a little by limiting a MRF optimization. Their results are verified using benchmark VSB100 dataset.

In this work we consider the case where the streaming video segmentation is performed to avoid over segmentation.

## III. PROPOSED SYSTEM

The proposed video segmentation uses constant memory despite the dimensions of the video and it's the extension of the previous work [22].The proposed algorithm is clearly shown in figure 1. First the Short Term hierarchical fast Watershed algorithm (STHFWA) is applied to a short window of frames. The primary segmentation is completed using K-means clustering which could be a semi-supervised grouping of objects within one frame assisted color intensity and thus the final segmentation is performed by Fast Watershed Algorithm (FWA) wherever the rigid lines are generated by the characteristic of the catchment area coordinate[14]. The watershed algorithm has an impressive result on the weak margins, and the closed continuous edge guarantees it. Furthermore, the closed catchment basin obtained by the watershed algorithm provides the opportunity to evaluate the regional image characteristics. DTCWT is used to look for the relationship between the frames based on the frequency approximation of the frames. In this work, the improved FODPSO is employed with a smaller population and reduces the computational complexity using fractional calculus. the whole method is completed in an exceedingly sequence of frames.

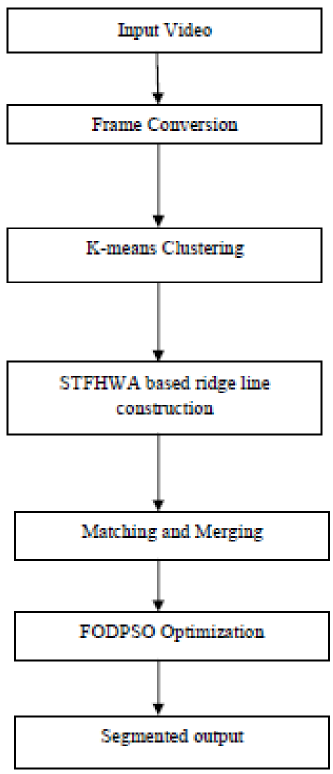


**Fig.1 Flowchart of the Proposed Algorithm**

### A. Fractional Order Darwinian Particle Swarm Optimization

The eminent bio-inspired algorithm utilized in optimization issues is PSO, the FODPSO algorithmic program that extends the PSO using natural process to reinforce the power to flee from local optima. The FODPSO calculation works by having a population called swarm of hopeful arrangements known as particles.

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The developments of the particles are guided by their own best well-known position within the pursuit area also as the whole swarm's best-known position. Whenever created strides positions are found then it will demonstrate the movements of the swarm..

The procedure is rehashed and appropriate arrangement will be found. The process of FODPSO is given by

**Step 1** : Set the initial parameters
$v_n(0), x_n(0), x_{1n}(0), x_{2n}(0)$

**Step 2**: Assign the coordinate of i= 1:1: Max The number of iteration to generate the swarm matrix.

**Step 3**: Generate the swarm matrix.

**Step 4**: Calculate and compare the fitness value (Configuration of min fitness functions)
Where min fitness function (i) < (i-1)
Update $x_{1n}[t], x_{2n}\ [t]$
Update $v_n[t+1], x_{2n}\ [t+1]$

**Step 5**: Destroy all the member of the swarm matrix.

**Step 6**: Go to step3.

Thus the FODPSO reducing the computational complexity, and it improves the efficiency of the result when compared with the conventional Algorithms.[1],[4],[7],[12],[19-22].

## IV. SIMULATION RESULTS

The proposed video segmentation algorithm is tested utilize various set of selected VSB100 dataset videos consisting of 40 training videos and 60 test videos whereas the number of frames per video is limited to a maximum of 121 frames[13]. The image sequences spatial resolutions range from 960 × 720 and 1920 × 1080. Further the simulated result of the given proposed algorithm is compared with the conventional algorithm which are using the same dataset VSB100. First the STHFWA is applied to a short window of frames i.e. to a set of consecutive frame. The initial segmentation is performed using K-means clustering which is based on color intensity and the final segmentation is performed by Fast Watershed Algorithm (FWA)[14-15], where the rigid lines are created by defining the catchment basin coordinate. DTCWT is used to assess the temporal relationship between the images. In order to get the optimized result, FODPSO is used. The whole process is done one after the other in a series of frames. Further the proposed algorithm with optimization and without optimization values are calculated and compared. The proposed algorithm with optimization FODPSO shows an optimized result in terms of Optimal Dataset Scale (ODS) and Optimal Segmentation Scale (OSS). The conventional algorithms consist of both online and offline video segmentation algorithms.

The parameters calculated include BPR, VPR and their corresponding ODS, OSS, AP are measured. The Table I compares The performance of the proposed VSB100 dataset algorithm with traditional algorithms and also shows that the proposed algorithm performs well in contrast with the existing BPR and VPR algorithms. [1],[4],[7],[12],[19-22].

The figure 3 explains the comparison of the proposed algorithm with standard video segmentation algorithms with respect to BPR and VPR. BPR is the statistical calculation of the per-body boundary correlation between video segmentation and human annotation..VPR defines the temporal consistency of the video segmentation outcomes.


**Fig.2 Simulation Results: (a) Input Frame; (b) Consecutive Frame;(c) Segmented Output Without Optimization and (d) Segmented Output With Optimization**

**Table I :Comparison of Video Segmentation performances on the VSB100 [13].**

| CONVENTIONAL METHODS | BPR | | | VPR | | |
|---|---|---|---|---|---|---|
| | ODS | OSS | AP | ODS | OSS | AP |
| Corso *et al*.[20] | 0.47 | 0.48 | 0.32 | 0.51 | 0.52 | 0.35 |
| Galasso *et al*.[7] | 0.51 | 0.56 | 0.45 | 0.45 | 0.51 | 0.42 |
| Grundmann *et al*. [1] | 0.47 | 0.54 | 0,41 | 0.52 | 0.55 | 0.52 |
| Ochs and Brox*et al*.[21] | 0.17 | 0.17 | 0.06 | 0.25 | 0.25 | 0.12 |
| Xu*et al*.[4] | 0.38 | 0.46 | 0.32 | 0.45 | 0.48 | 0.44 |
| Is Arbelaez et al.[19] | 0.62 | 0.66 | 0.61 | 0.26 | 0.27 | 0.16 |
| Jang WD et al.[12] | 0.63 | 0.66 | 0.53 | 0.66 | 0.68 | 0.62 |
| Durga et al.[22] | 0.74 | 0.73 | 0.48 | 0.74 | 0.73 | 0.51 |
| Proposed Algorithm with FODPSO | 0.75 | 0.74 | 0.66 | 0.99 | 0.97 | 0.44 |

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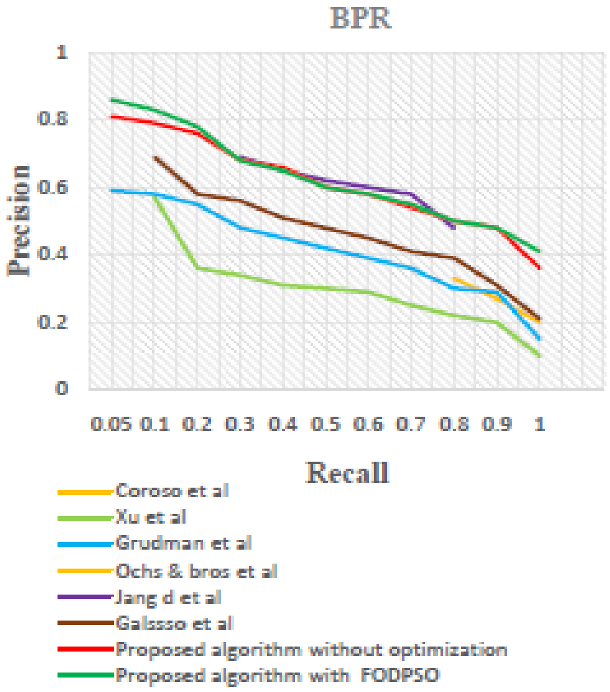
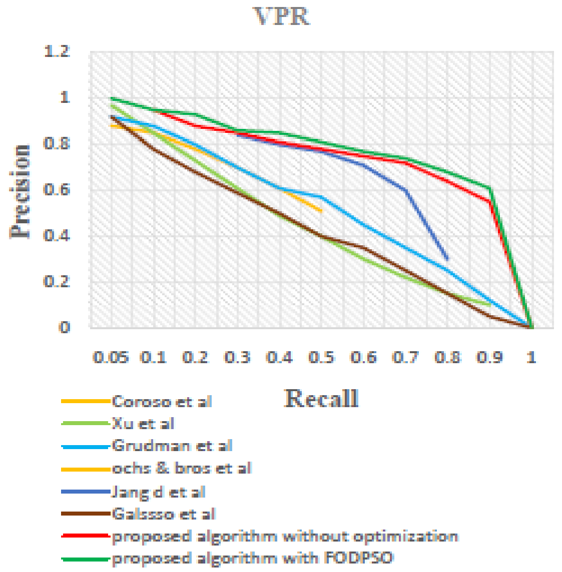



(a)




(b)

**Fig.3 BPR and VPR curves of the Benchmark State of Art of VSB100.**

## V. CONCLUSION

In this proposed technique, the Streaming video segmentation is finished by victimization STHFWA together with FODPSO. Also, the planned approach has been implemented on the platform of Matlab and therefore the performance of the approach has been evaluated on VSB 100 dataset. during this the initial segments is obtained by K means clustering and therefore the final spatial temporal segments are obtained by fast watershed and DCTWT. In order to get the optimized result, FODPSO is employed. From the simulation results, we've got evidenced that performance metrics of the planned approach are superior to it of the existing add terms of each BPR and VPR.

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