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A Real Time Video Summarization for YouTube Videos and Evaluation of Computational Algorithms for their Time and Storage Reduction

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Abstract:- Theaim of creating video summarization is for gathering huge video data and makes important points to be highlighted. Focus of this view is to avail the complete content of data for any particular video can be easy and clarity of indexing video. In recent days people use internet to surf and watch videos, images, play games, shows and many more activities. But it is highly impossible to go through each and every show or video because it can consume more time and data. Instead, providing highlights of any such shows or game videos then it will be helpful to go through and decide about that video. Also we can provide trailer part of any news/movie videos which can yield to make judgement of those incidents. We propose an interesting principle for highlighting videos mostly they can be online. These online videos can be shortened and summarized the huge video into smaller parts. In order to achieve this we use feature extracting algorithms called the gradient and optical flow histograms (HOG & HOF). In order to enhance the efficiency of the method several optimization techniques are also being implemented.

Keywords*: Summarization of video, HOF, HOG, Online Highlighting videos, Extracting Features and Contents.*

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1. INTRODUCTION

There are satellites and cameras all around us to monitor and track the individuals. These cameras are of high quality and mechanism. With enhancement in technology we find devices cameras, watches and surveillance devices being used commonly. These also contain or capture the data and provides huge database of containing messages regarding objects on earth, functions, events and so on. The creators of these footages have huge data collection and they cannot able to see their own data completely and also in many cases they fail to provide exact data of footages or messages they want to be.

To avoid this problem, we propose a method that will help to scan complete video and learn the point of overall content by using dictionary summary and then it collects the useful data used to deliver the meanings and updates the new video. For summarizing video we mainly insist on segments they are: (1) initially it captures the contents, background and also it checks with the basic dictionary. (2) Finally, it displays interesting, update and unseen data of video.

Earlier works related to summarize videos consider edited videos for the research. In other words videos of movies are already been taken according to individual scenes and then they are summarized. These individual scenes are collected and framed to get the smooth motions with continuity. In such scenario the end user may not get the actually knowledge on the video and the clarity and structure of the video may not be efficient. So, the method based on key frame used to collect the images from the frames of original to summary the video. Several strategies are applicable such as stability in motion, splitting clustering curve, colour histogram, boundary detection in shots and so on. The video with images uncorrelated, non-smooth videos doesn't help the viewer to understand the content of video.

From different frames of the actual video were collected and then objects were separated usually small scenes will have small number of objects. Then structure of that video will be formed by applying strategies mainly colour histogram, boundary detection of scene, analysis of dialogue these all combine to form a video trailer. In this method we also consider video summarization by code sparse and deployment of brute force. It yields to collect the vision of tasks mainly restoring noiseless of images and finally frames are used by code vector and applied on the parts of the videos. Then later all key frames are formed together.

2. LITERATURE SURVEY

[1] It used an approach for filtering the image to removes the darkness and improves visibility it uses a strategy to map air light by functioning the light of visual mode. To evolve the air light map procedure the author uses the Artificial Bee Colony (ABC). The darkened images are taken and evaluated them by using air light map to improve and compute the environment.

[2] The method implemented in this paper is the optimization using graph to summarize the video. It can evaluate the both visual temporal and visual coherence of the videos. Mainly, they divided into three stages. At the initial stage, the original video is fragmented into shots and is based on the features of video. Secondly, the unrelated shots are all gathered and functions called dissimilarity is considered then each shot are designed. Final stage, they used algorithm called dynamic program which can summarize the videos.

[3] Bo Yao, et.al, has considered a novel approach named as fuzzy logic system which classifies the behaviour of videos. They mainly based on the system called Big Bang Big Crunch (BB-BC) which can naturally parameterize membership of video functionality (IT2FLS). This can outflank and mostly perceive the capable of practices. This fuzzy technique can be used to have regular outflanks and patterns.

[4] Xuelang Li, et.al, has the synopsis of holding the both raw data and altered data. Mainly, it used to hold the properties of synopsis which contained in the video and there can have key-shots, content of agent videos. The structure is messed in the training data videos where they have training set approach which can make any raw or altered data to furnish with some coefficients.

[5] Thimothy, Xunxu et.al, proposed a structure for getting clarity with surveillance clusters and capacity of that data by using numerous scene distributions. This will allow finding action of subsets which were shared between the scenes. It mainly focuses on undertaking the reconnaissance to understand the scene collided oppositely and illustrate them by seeing the necessity and outline of video. The level of module and single scene has been enhanced by using their multi-scene accumulation.

[6] It has used a technique on the synopsis of real time video which was used by motion of global cameras, Colourfulness and dictionary learning. It referred the highlights of spatio-worldly occasional sets. Even though quality is measured by using motion of global cameras it used the component called Lexicon for measuring uniqueness of the connection in scene of light.

[7] Satoshi Ono and Hiroshi Nakamura have presented a strategy for utilizing (IEC) Interactive Evolutionary Computation. It is known as the bolster outline video. It focus on the qualitative and inclination of client for answering on the subjective. It permits the user to make video compression, indicates the video to be bridged and users criteria to accomplish.

[8] Amit Phadikar et.al, for making video to be effective they focused on the portrayal compact which can be worked on browsing video. The videos are made more complex by synopsis them and relay on cluster calculations. It mostly doesn't work for real time videos. They distinguished a frame that can make the application to rely on cluster calculations. Thecomparisons between different key frames can make the application more effective.

[9] K.S.R.Manjusha et.al, presents the authentication and security is under observation of region which takes place globally. This also leads to improtest of data, monitoring the recorded data. To overcome this problem they used the strategy called outlining video for displaying purpose only. The important data of complete video and framing time to form synopsis of data and in this method used was key frame to point out security and highlighted questioning of any data available.

[10] Mickel Rodriguez focused only on compact part of video which represent the sequence and important data of the complete video. Mainly, overall video they considered only related vector field in space called as Clifford Fourier to maintain the stream of data. They proceeded by analysing the importance of video relay internally. So, to proceed in this concept they used relationship between channels by greatest spatio-fleeting normalization. Though by using technique of shift optimization the video used to be shortened and shows only the related and important data.

3. PROPOSED SYSTEM

Summarization of proposed system was given in below steps:

1. Making viewers to analyze and understand the content of video we use to summarize. Data gathering is performed to collect relevant information and avoid the repeated data or event in the videos.

2. To summarize the data we utilize a method called updating of online dictionary.

3. Using the optimization techniqueto summarize the video.

4. To update and generalize the ability to uncover video segments by experimenting different techniques.

5. To achieve the effectiveness of real world data by testing them.

3.1 Highlighting Online Videos

We consider a huge video and then break into segments and minimum of 50 frames. Then only length of short temporal videos can maintain consistency. In this few can be collected and composed by taking base unit of the segments and finally video can be summarized. Sparse coding was grouped and initially the segments of video are learned by dictionaries. After learning the each segments then they start to reconstruct them by an order. The video which contain interesting content but has the high level threshold are also considered.

Mainly, the dictionaries are used to be updated frequently because when new videos are incorporated then already existed segments can effect with an error. So, this error represents that already contained in data and can be utilized internally. In this case the data can be reconstructed by using both the data's. In such way videos can be summarized and reconstructed by using existed content. Finally, by using dictionary it shows the existed video content which is seen and updated contents to be incorporated. Below algorithm represents the flow of summarization of videos.

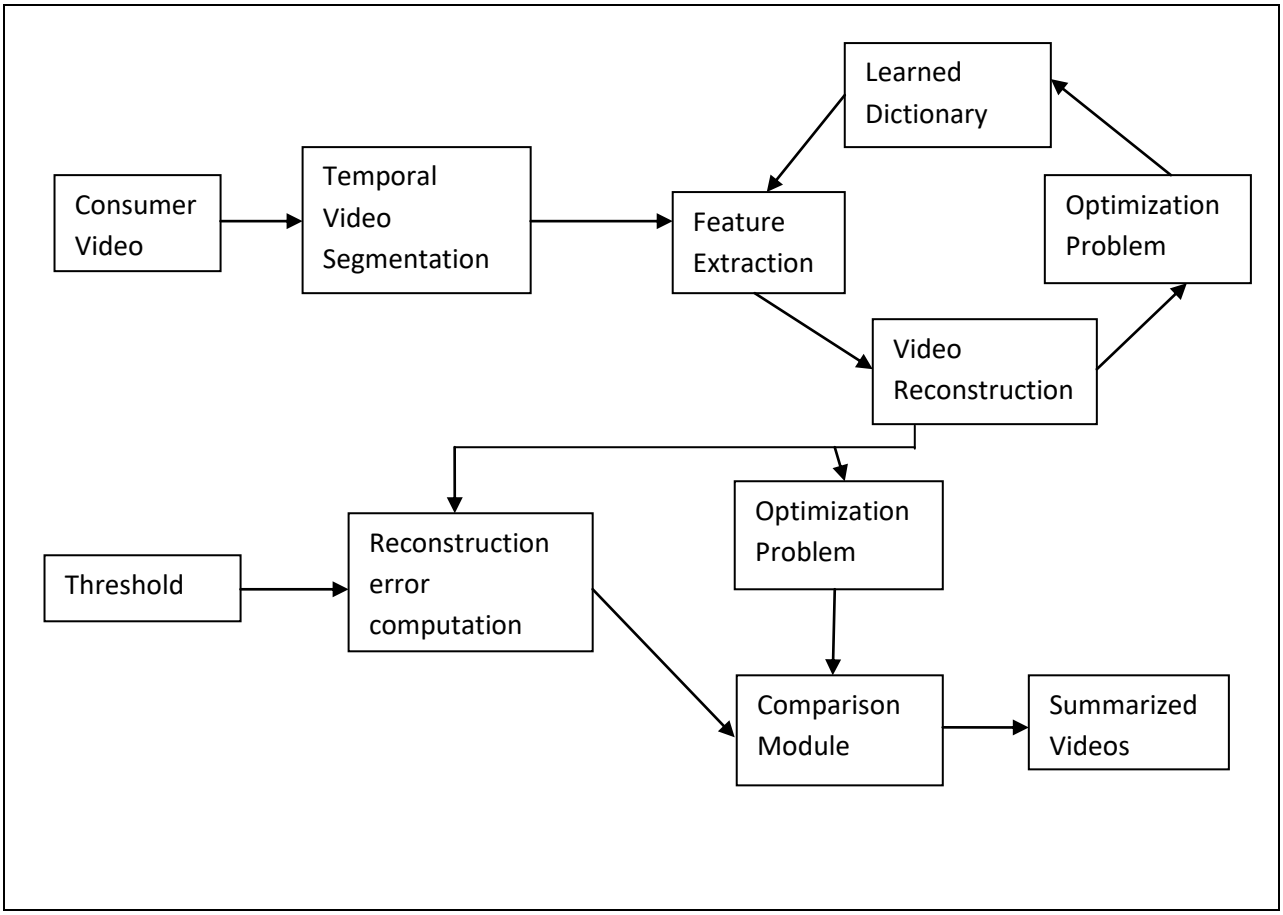

Fig 1: ARCHITECTUREFOR THE PROSED VIDEO SUMMARIZATION.

It has preset threshold for control of length and y_0= {y_1,.....,y_n} used for learning dictionary initially within (n<<k), $\in_0$.

ALGORITHM (Highlighting online video)

Input: Y' composed video for 'temporal segments.

Output: Summarizes 'X' short video for interesting and significant contents of 'Y'.

(a) Learn dictionary 'D' using Y_0= {y_1,.....,y_n} by initializing X = Y_0 and grouping sparse code.

(b) For every video segments Y_k2fy_m+1::::::y_kg do.

(c) For computing reconstruct error _ k it used to construct segment y_k by using the recent dictionary 'D'.

(D) If pre set threshold _ 0 is less than the _ k then.

(e) Incorporate y_k into video summary X = X[y_k] by using y_k with dictionary updating.

(f) End if.

(g) End.

3.2 EXTRACTIONof FEATURES

3.2.1 OPTICAL FLOW HISTOGRAMS

Optical flow histograms are magnified and oriented. At first, the data of video is divided into several regions called as cuboids. This histogram is nothing but an extended version of oriented optical flow histograms [11].

3.2.2 ORIENTED OPTICAL FLOW HISTOGRAMS (HOOF)

The HOOF extraction provides each time the 't'as instant, to each frame with block 'b', where flow of vector can be binned according to angle from the axis of horizontal and its magnitude is weighted as histogram $h_{b,t}$ = [$h_{t,1}$, $h_{t,2}$,...., $h_{t,b}$].

Then every vector in optical flow v = $[x,y]^T$ and its range in direction $\theta = \tan^{-1} y/x$.

$$-\frac{\pi}{2} + \pi b - \frac{1}{B} \leq \theta < -\frac{\pi}{2} + \pi \frac{b}{B} (1)$$

It has the magnitude (m) which can be contributed. Where, m=$\sqrt{x^2 + y^2}$ and histogram is i^{th} bin. $1 \leq i \leq B$, total of bins B where actual HOOF bins are at primary angle, representation of histogram is independent in all directions and horizontal axis, vector are between the small angle signed. Thus the normalization was done with histograms. Below figure shows the process of HOF with minimum 4 bins but in our procedure we consider 8 bins.

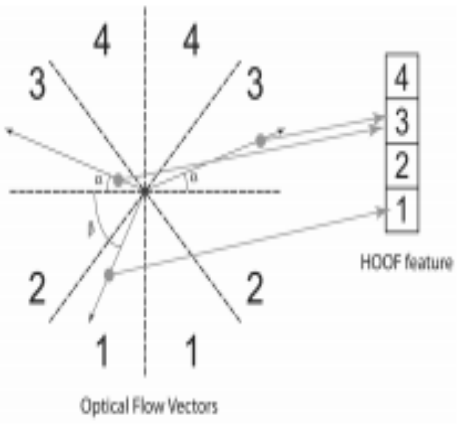

Fig 2: Four bins B = 4[4] composed by histograms

3.2.3 ORIENTED GRADIENTS OF HISTOGRAM (HOG)

In image processing and computer vision the objects are justified to employee the feature description of HOG. The regions of interest in image detection are localized in gradient orientation by using the descriptor method of HOG to count occurrences. The HOG descriptor implants an algorithm and shown below.

1) Compute the gradient directions or orientation of edges to the cells. Where cells are formed by dividing the images into smaller regions and they are connected together by cells.

2) According to the orientation of gradients each cell is discredited into bins in form of angular.

3) The angular bins are corresponded to the gradient weights by contributing each pixel of cells.

4) Blocks are called as spatial regions by considering group of all adjacent cells because normalizing histogram cell grouping is main basic.

5) Block histogram represents the normalized groups. Each set of histogram blocks refer descriptor. The following algorithm figure describes the schemes implemented.

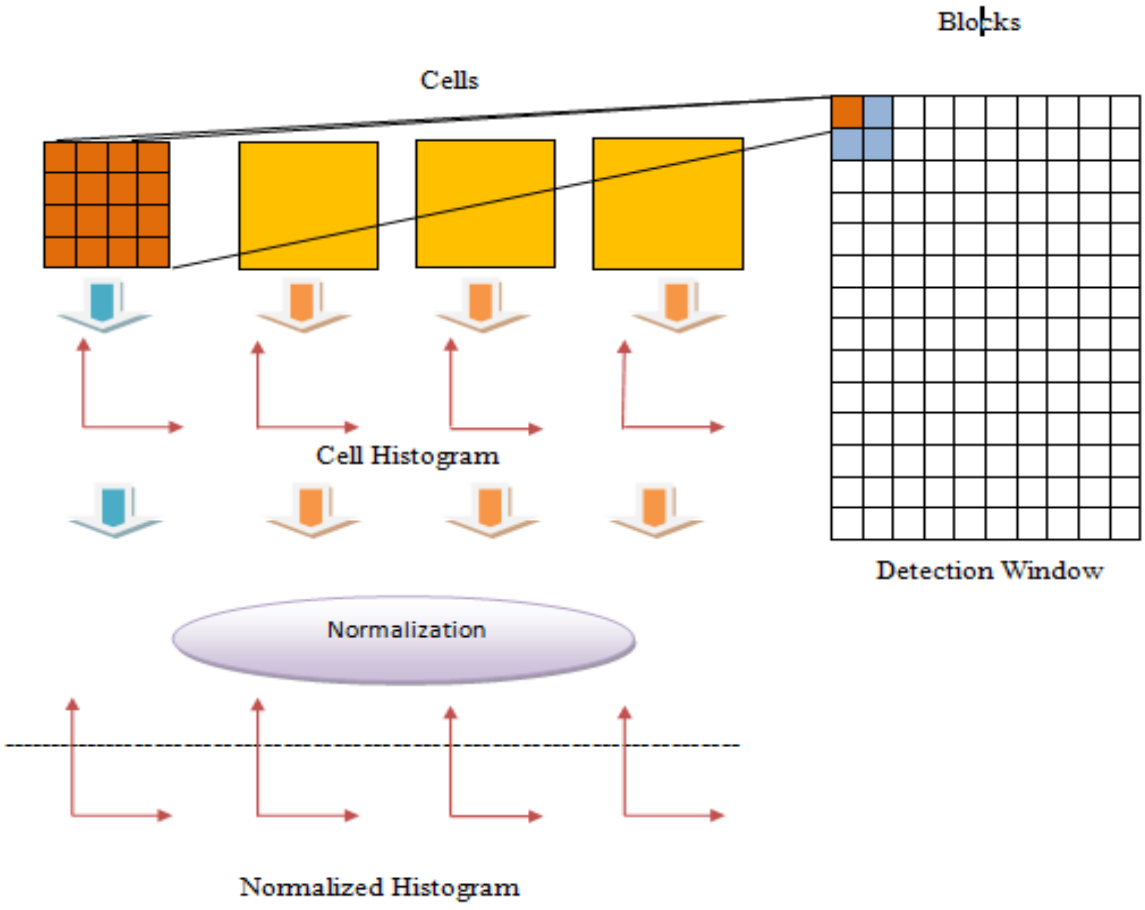

Fig 3: Descriptor of HOG

Parameter configured by descriptor of HOG and computation are as follows.

- For computing gradients and derivation masks are needed.
- Geometry in blocks by grouping cells and splitting cells from images.
- Overlapping of blocks.

- Parameters for normalization.

3.2.4 DETECTION OF EDGES BY CANNY

Suppress noise with detecting the edges at the same time can be done using detection of edges by canny and it has an algorithm called Multi-Step. To reduce the noise, textures and unnecessary details by using the Gaussian filter.

$$g(m,n) = G\sigma(m,n) \forall f(m,n) \qquad (2)$$

Where,

$$G\sigma = \frac{1}{\sqrt{2\pi\sigma 2}} \exp\left(m2 + \frac{n2}{2\sigma 2}\right) \qquad (3)$$

1) Using any operators in gradient we can compute g(m, n) by

$$M(n, n) = \sqrt{g_n^{\,2}(m, n) + g_m^{\,2}(m, n)} \qquad (4)$$

And consider,

$$\theta(m,n) = \tan^{-1}[\, g_n(m, n) / g_m(m, n)\,] \qquad (5)$$

2) Using threshold:

$$M_T(m, n) = \begin{Bmatrix} M(m,n) if M(m,n) \\ 0 \qquad otherwise > T \end{Bmatrix} (6)$$

Here T is noise suppressing by keeping all elements in edges.

3) For making ridges to thin the above M_T is used to suppress the pixels of non max in edges. For doing so, we have to check two neighbours and also gradient $\theta(m,n)$ are lesser to the M_T (m, n). If it is correct then keep M_T (m, n) as normal or else change the set to 0.

4) Where $T_1 < T_2$ then the threshold of different images has been obtaining the result. It indicates T_1 is having less noise and gaps are greater between segmentation but it is opposite if T_1 is smaller.

5) For forming edges continuously link segment edges in T_2 So, T_1 neighbours are to be searched and trace the T_2 segments because to solve the gap of T_2 edge segments for reaching another T_2 segment.

3.3 OPTIMIZATION

3.3.1 ALTERNATE DIRECTION METHOD OF MULTIPLIERS-ADMM

For solving problem (1) we need to reconstruct the optimal vectors to find interesting points in Y. Due to high efficiency of ADMM we can carry optimization as the iterations it contained.

$$\forall_i = \propto^{i}_{k+1} = \left[\frac{D^T D}{1\times 1} + \rho^I\right]^{-1} \left[\frac{D^T \rho}{1\times 1} + \rho\left(Z_K^{\rho} - U^i\right)\right] (7)$$

$$\forall_i : Z_{i,k+1} = \frac{s\tau}{\rho} (\alpha_{j,\,k+1} + U_{j,k})$$

$$\forall_i : Z_{i,k+1} = U_k^{\,i} + \alpha_k^{\,i}\, \alpha_{k+1} - Z^{i}_{k+1} \qquad (8)$$

Until it converge the alternate presented among the updates, S – operator of soft threshold, $I \in R|D| * |D|$ - matrix identity, $P > 0$ is called parameter of penalty.

$$S_k(a) = \max\left\{1 - \frac{k}{|a|}, 0\right\} a$$

$A = \{\alpha^{|x|}\}, Z = \{z^{-1}, \ldots . z^{|x|}\} = \{z_1^T, \ldots \ldots z_{|D|}^T\}^T,$

$U = \{u^1, \ldots . u^{|x|}\}, indexi\{1 \ldots . |x|\}$ (9)

K – Counter of iteration

Where, 'U' update (9) and 'Z' update (8) are the three calculations. Also start swarm, factorize caching and inversion of fast matrix are accelerated techniques by using 'A'.

3.3.2 GA

1) [Initialize] 'n' chromosomes are generated by random population. (problems have suitable solutions).

2) [Evaluate] each population has X-chromosome to fitness f (x) evaluation.

3) [New creation] until completion of new population repeat the below steps for creation.

3.1 [Select] based on the fitness the population was selected among chromosomes of two parents [the chance of selection depends on the bigger fitness].

3.2 [Cross probability] to form new offspring there should be a probability of crossover otherwise there will be exact of parents.

3.3 [Mutate] with the probability of mutation there will be positioning of chromosome and new children (offspring) forms.

3.4 [Accept] then in new population there will be placed new offspring.

4) [Reuse] for next generation we can use the same form of algorithm.

5) [Testing] finally, if the result is best and satisfied then stop the procedure and give the current result of population.

6) [Looping] rerun and go back to step 2.

3.3.3 ABC ALGORITHM

In this algorithm, mainly we have two types of bees one is onlooker and another is employed. Half of the swarm contains one type and other has another type. These two types will be equal in parts. Here, it has SN solution called as Food Sources and there will be distributed randomly according to size of swarm. Consider $X_i = \{X_{i1}, X_{i2}, \ldots..\}$ where D – size of dimensions, i^{th} is the swarm solution. Generating of new candidate solution the employed bee X_i is used and V_i will be in position of neighbourhood and it is.

$$v_{i,j} = x_{i,j} + \emptyset_{i,j}(x_{i,j} - x_{k,j})$$

For selecting candidates randomly X_k is used (i=k), selecting index dimensions randomly for set {1, 2,....., D} and having random number range [-1,1] can be $\emptyset_{i,j}$. For using greedy selection the candidate should generate new solution called V_i updating V_i and X_i it should have better fitness of V_i that it parent X_i, otherwise there will be no change. By using waggle dance the employee bees share their food resource with their onlooker bees this can be done only when employee bees stop searching for their food resources. Then these onlooker bees collect nectar by collecting information from employed bees and then probability of choosing food will be happen only according to amount of nectar related. This selection is also known as roulette wheel mechanism this can be shown as.

$$p_i = \frac{fit_i}{\varepsilon_j^{SN} fit_i} (10)$$

For evaluating value of fitness for swarm in the i[th] solution we prefer fit_ihaving better probability in the selected food source it should have high i solution. Abundance of food source can be done if there is improvement in cycles defined. Discovering new food source the scout bees will play a role for replacing the abandoned X_i source.

$$x_{i,j} = lb_j + rand(0,1).(ub_j - lb_j)(11)$$

Here, based on normal distribution random number (0,1) and are to be within [0,1] and upper, lower boundaries are of j[th] dimensions.

3.3.4 PSO ALGORITHM

PSO refers to a technique called population based stochastic optimization this is similar to intelligence algorithm of swarm. As described in genetic algorithm for population creation here it is based on the flying particles of each and optimization process. For indicating current state is PSO the hyperspace dimensional D has the particle of i and has the vector velocity $v^i = [v_{i1}, v_{i2} \ldots . v_{iD}]$ and vector position$x^i = [x_{i1}, x_{i2} \ldots . x_{iD}]$. Here D and I are dimensions of the study of problem and indexing positive integers of swarm particle. The vector velocity V_i known as direction search of particle and vector position X_i represents problem solution for candidate. During flying process each possible can decide by its position vector of globally best four as gbest = $[gb_{i1}, gb_{i2}, \ldots . . gb_{iD}]$and vector position can be trajectory of best personal historical as pbesti = $[pb_{i1}, pb_{i2}, \ldots . . pb_{iD}]$. The position and velocity of particles updating rules are defined as.

$$v_{ij}^{t+1} = w.v_{ij}^t + c_1.r_1\left(pb_{qij}^t - x_{ij}^t\right) + c_2.r_2\left(gb_j^t - x_{ij}^t\right)$$

$$x_{ij}^{t+1} = x_{ij}^t + v_{ij}^t$$

The weight of inertia is denoted by 'ω', coefficient acceleration can be C_1 and C_2 which used to learn the relative weight of gbest and pbesti. These are also known as influence in social and self-cognitive distributing uniformly over [0,1] it has two numbers randomly as r_1 and r_2. Representing dimensions and particle currently it has j and i.

4. RESULTS AND DISCUSSION

Table 1: Reconstructed frames, % reduction in storage using various methods

Sl	Video name	Total frames	reconst frame in PSO	% reduction	reconst frame in GA	% reduction	reconst frame in ADMM	% reduction in storage	reconst frame in ABC	% reduction in storage
1	Car race 1	1118	678	39.34	543	51.43	651	41.77	678	39.35
2	Bank Robberry 1	2972	2252	24.22	1670	43.80	2010	32.36	2252	24.23
3	Car race 2	3266	2477	24.16	1729	47.06	2075	36.47	2750	15.80
4	Bank Robberry 2	110214	53727	51.25	54700	50.37	69768	36.70	53725	51.25

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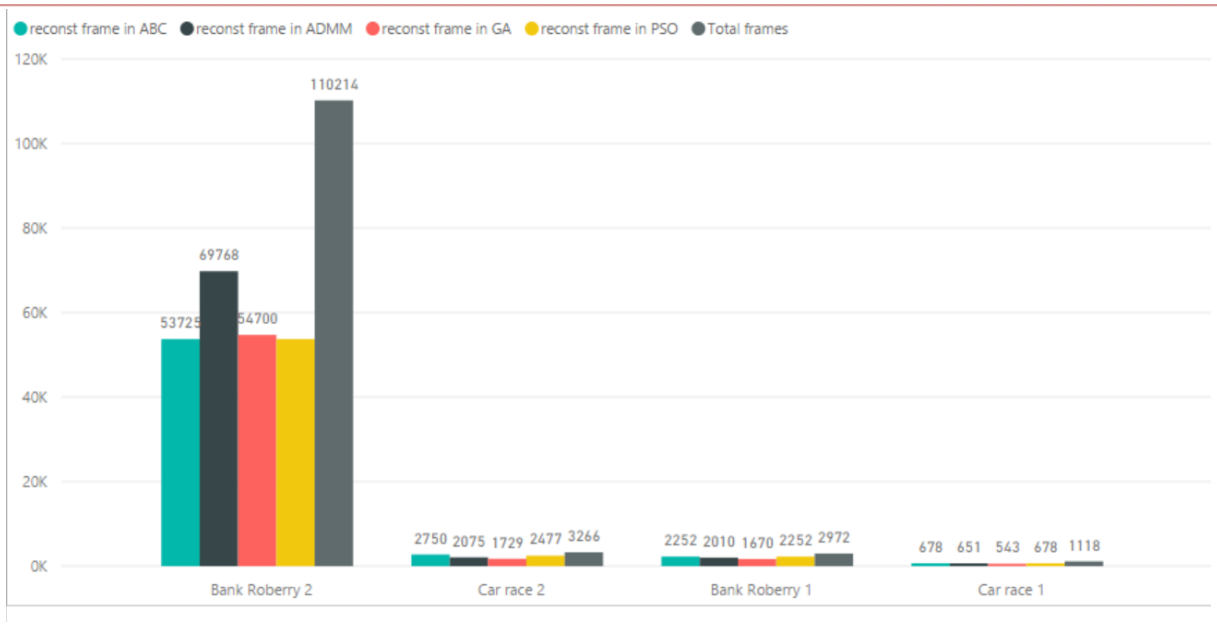

Chart 1: Reconstructed frames by video names and optimization method.

Chart 2: Depicts storage reduction percentage by optimization methods and videos, total frames as in chart 1.

Table 3 Time taken in secs

Sl	Video name	Total frames	time in pso	time in GA	time in ADMM	time in ABC
1	Car race 1	1118	288.41	307.17	80.80	62.37
2	Bank Roberry 1	2972	1335.16	2471.80	266.83	224.7
3	Car race 2	3266	1330.13	15639.35	342.53	813.91
4	Bank Roberry 2	110214	77924.83	77924.83	82553.31	57022.37

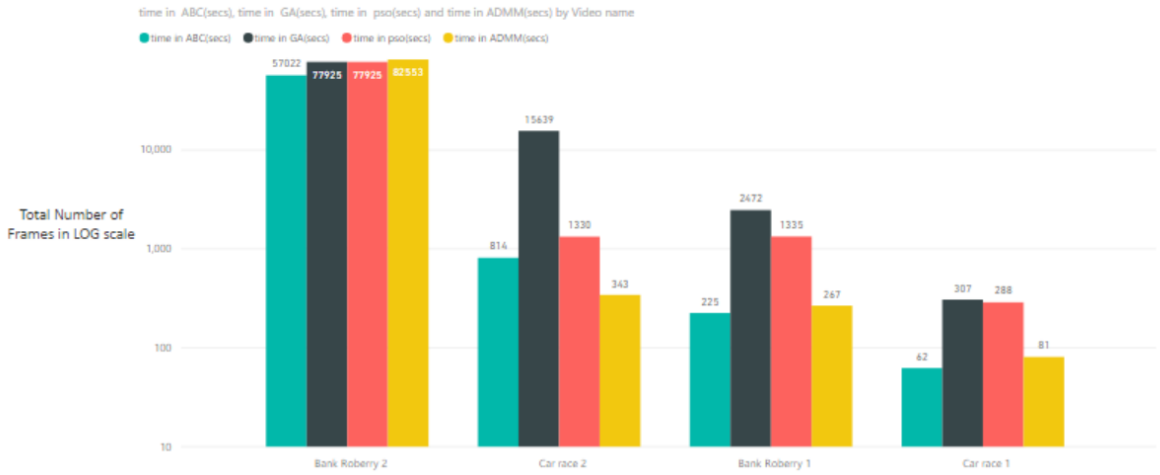

Chart 3: Time reduction in various methods based on different videos.

We test the performance of proposed methodon 4 consumer videos, including both YouTube videosand surveillance videos. We compared the proposed method with several methods and the results are tabulated. Table 1 depicts that each input video's total number of frames and the number of reconstructed frame results using various optimization methods. From table 1 we can see that GA performs well comparing to PSO, ADMM and ABC. In Table 2 percentage of storage reduction is compared. From that we can inferred ABC optimization gives the better results among all the methods. Table 3 shows that the total time taken for frames reconstruction. In ABC optimization method we can see that timeis reduced to the maximum. In GA method we see that the storage reduction is the highest.

CONCLUSION

Summarizations of videos and video applications have a major role in several fields. Combination of several segments in a video, involving graphics and descriptors, using still images are all done using summarizing videos. In this work we use techniques like PSO, GA, ADMM and ABC in order highlight and create a summarize video that contains important and relevant information. This approach saves viewers and users from watching long videos and understands the content in short. Feature work will include the study of algorithm time and storage when sparse coding is used on pre-classified labeled activities.

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