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Gradual Shot Boundary Detection using SVM Optimization Technique and HOG Feature

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Abstract: ***Rapid growth in the field of data capturing and storage along with the increase in the availability of multimedia content in the web, has resulted in many large personal and public digital video databases. The Shot Boundary Detection (SBD) is the very first step in the research arear of video application. The objective of the SBD is to address the issues in Video Content Analysis (VCA), namely, Video Segmentation. From the analysis it is identified it is difficult for the human being to analyze the contents manually. Therefore, many methods is needed to automate the process of videos. Gradual Transition detection is based on the Support Vector Machine (SVM). To improve the result of this shot boundary detection, SVM with Histogram of Gradient (HOG) is used. HOG feature is calculated for further shot detection. Finally gradual shots are detected based on the above methods. Here the performance is evaluated by the parameters called precision and recall value.***

Keywords**:** ***Optimization, Support Vector Machine (SVM), Precision Recall, Histogram.***

I. INTRODUCTION

In today's advanced world, there is a rapid changes in the area of multimedia and web technologies with the growth of Internet. The generation of multimedia contents is also increased. This leads to the problem of effective utilizing and managing the video data. A variety of data's are available in the form of image and video. These data's are need to be process, store transmit and analyze using variety of techniques. To do this process, many efficient and effective technique are needs to be identified and developed for to improving the quality of research in this SBD system. As the basis of video processing and content analysis, Shot Boundary Detection (SBD) techniques are plays an important role in video content management. Video short transition is generally divided into abrupt and gradual shot transform.

Abrupt transition (hard cut) is the sudden change of the consecutive frames in a video. Gradual Transition (GT) is the automated transition to detect the transition difference between two consecutive shots in video with the purpose of time-based segmentation of videos. GT is four types: fade-in, fade-out, dissolve and wipe transition. The content of the video can be taken by first, performing the video segmentation: dividing the video into meaningful shots and analyzing each features of the segments (shots) which is key features of the each segment. Many methods have been proposed, developed and compared with existing techniques to detect the temporal transitions in video sequences. Pixel differences and color histogram algorithm are two typical methods used so for in this research field. In recent years, some new methods are proposed to solve this problem. This paper mainly focus on gradual shot boundary detection. All these gradual transitions are result of the editing effect in a video. Fade-in and fade-out are caused by the lightness value. Dissolve and wipe transition is an effect due to overlapping of the current scene and future scene. [1] The focus of this paper is to address issues in gradual transition detection.

Feature extraction is the one of the pixel processing technique. This technique is used to find and calculate the arbitrarily shape of pixels and a small regions in an image. It is derived by existing method called, spatial segmentation algorithm. This technique identifies salient features based on the set of all homogeneous regions, this is facilitating a better discovery of time-based discontinuities. The main disadvantage of this techniques is high computational complexity and uncertainty of region segmentation. [2] False detection means to detect the negatives. This existing method is used to reduce the number of false detection in continuous camera actions. From two succeeding frames, likelihood ratios are calculated and it was compared with statistical structures. This will be continued blocks in two successive frames. From this method if the calculated likelihood ratio is greater than the defined threshold value, then it will assume that region of block should be is modify. [3] In this paper proposed a multi-model graphical feature-based shot boundary detection. Objective of this technique is to examine the behaviours of visual representation in terms of the incoherence signal. A segment selection of a candidate is implemented without calculation of threshold value instead of this the aggregate moving average of the discontinuity is calculated for neglecting the non-boundary video frames in shot boundaries. The transition between boundaries are detected fundamentally by differentiate the candidate segment into a abrubt transition and a gradual transition, including number of fade in/out and logo existence. [4] Genetic algorithm used as an optimizer for the fuzzy system. The GA system uses a pre-observed actual input output values of shot boundaries for some videos for calculating the range of fuzzy membership values for the fuzzy system. The fuzzy system is used as a classifier which classifies the frames into abrupt and gradual transitions by using GA as optimizer. Normalized Colour Histogram Difference is used for feature extraction and for finding the differences between two consecutive frames in a video.

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From the investigational result, it is observed that the detection of shot boundaries increases based on the number of iteration or number of generation in Genetic Algorithm (GA) optimization techniques [1]. Video Shot-Boundary Detection method combining grey model based on set sequence with colour histogram. In this Paper traditional grey model technique is proposed and evaluated. In this proposed technique multi-stream sequences are identified and it identifies some abnormal simulation even its fail. To investigate the video stream, sequence of frames are taken and the all the video streams are processed by graey model techniques. This will be increased the number of gradual sequence transition [5]. In this paper Li deposition/dissolution techniques in the STEM cell. A video analysis techniques used for identifying the shot boundary detection in the moving object with discontinuity. This technique is proposed to removal and terminating the process when stem cell is identified. Shot boundary detection is proposed in a wide variety of techniques that can be practically to find the change points from the different types gradual transitions and based on the variety of conditions. This proposed techniques agreed for the direct operations on compressed video. Improvement of this technique is full-frame decoding is achieved without threshold. Finally, computational complexity is decreased. [6] Jiyun *et al*., a method for extracting the features from video is proposed. The proposed technique is mainly based on Fuzz color Distribution Chart (FCDC). FCDC is distributing the colors like RGB in a sequence manner. This technique describes the three dimensional of colors and reduced the amount of influences of noise, slight brightness changes and adding or removing the logos. [7] However, the performance of the algorithm may be quickly decreased in the methods above when there are camera movement, object movement and bright sudden change in the scene. Shot boundary detection algorithm based on SVM optimization model and HOG feature is proposed in this paper.

II. METHODOLOGY

A. SVM Classification in boundary sequence

First, the proposed technique is implemented by Support Vector machine (SVM). This technique is mainly based on the geometric theory. It reduced principle of organizational risk. The standard method for SVM classification is to mapping the variety input space sequence into a very high dimensional feature space and build an optimal separating hyper plane in the corresponding space sequence. This method is implemented to attain the decision function in many classifier [8, 9]. Because of the convexity of the quadratic optimization problem with linear and box constraints, The global optimum classifying and retreating solution can be guaranteed by the convexity of the quadratic optimization technique along with linear and box restrictions.
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B. Gradual Boundary Detection along with PSO-SVM

In this gradual boundary detection the particle optimization method is implemented and evaluated based on the evolutionary computing techniques which will mainly stimulated by artificial life research migration of group behaviours. It identifies each individual transition in the group as a particle without mass and volume. This will be continued in many iteration. In each iteration, all the particles are modified by its direction and velocity it means of optimal value produced by it and others. Finally, the positive feedback mechanism is designed during the group optimization process. Based on the features mention above, to select PSO technique algorithm to optimizing the various parameters in SVM. This is completely an iterative optimization method until it simulate them into particles. [10].

C. Initialization of Groups and parameter settings

In this evaluation technique, the number of population is contained set of 20 particles with velocities are produced in randomly. In addition to this, the parameters of c and γ is intended to differ in the range of [0,100] and [0, 1000] respectively, from the above calculation, if the step is 0.1. c1, c2 is set as 1.4 and 1.8. Finally, assigning the local search capacity and global search capacity into deliberation synthetically. The fitness of the function is evaluated by accuracy. The function f (c, γ) = accuracy is implemented to evaluate the fitness of the function. In this proposed work, the strategy of cross validation is exploited to compute the fitness which matches the value of accuracy in the training sets. In other hand, the accuracy express the positive correlation with number of fitness value. In this experiment the training sets are classified into 3 parts in the form of cross authenticating operation.

D. Update the particle velocity and fitness position

To update the particle velocity and the fitness position calculate the optimal local and global solution for the present generation. Based on the calculated local and global solution values, the particles are restructured according to the velocity and fitness position. The restructured equations are well-defined as given below in equation (1) and (2).

$$v_{i+1} = \omega v_i + c_1 rand(pbest - x_i) + c_2 rand(gbest - x_i) \quad (1)$$

$$x_{i+1} = x_i + v_{i+1} \quad (2)$$

In equation (1) rand is denoted by a random number between 0 and 1; ω denoted by inertia weight factor which is used to regulate the effect from the previous particles. x_i and v_i exemplifies the particle position and velocity respectively; and finally, pbest, gbest denotes the local optimal and global solutions of fitness position.

E. Update the local and global fitness of the particles

The pbest is substituted by the current value whenever the current fitness is prior to the local best fitness. At the mean time it modified position that particle occupies; and also, if the current fitness is prior to the global best fitness, it modifies the gbest with present value, finally, all modified position of the particle stopped.

F. Iterative Methods

The iterations are continued until the iteration reaches the iterative times otherwise it reaches to quite great solution. If it is reached then to stop the iterations and resulted the optimal solutions; otherwise, repeat the step of calculate the fitness.

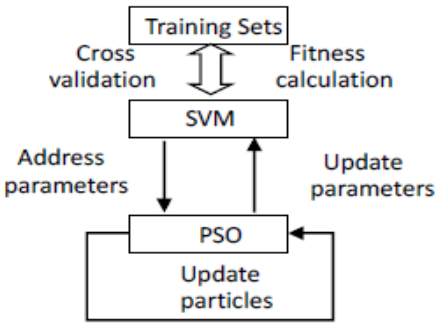

Fig.1: Process of obtaining SVM mode

The parameter optimization process specifies that different SVM parameters create a prominent differences in classification correctness. The point figure shows the best predictive situation in terms of the optimal parameters. The enactment of parameter optimization is based on LIBSVM [11]. Although the gradual shot boundary detection algorithm based on the PSO-SVM to a certain extent, it is not suitable for very fast movement of the object and also not robust to brightness change and images with similar background. Therefore, HOG feature is used for secondary testing.

Table I: shows the precision and recall values for gradual transition detection using PSO-SVM method.

Category (Input Videos)	Number of Frames	Number of Shots	Precision in %	Recall in %
News	17653	56	96.4	95.4
Cartoon	14321	45	94.9	97.5
Sports	31238	37	96.3	93.2
Movie	15897	39	95.8	96.1
Commercial	18993	42	95.3	97.2
Documentary	23568	49	94.2	93.5
Average	**20278**	**44.6**	**95.48**	**95.4**

G. Gradual Shot Boundary Detection Based on HOG Feature

The presences and shape of the local object is well designated by the gradient or the edge of the direction density distribution. Meanwhile, in terms of image geometry and optical distortion, HOG feature can keep good invariance. Therefore, HOG feature is calculated for further shot detection by using the method in [12].The specific steps of HOG feature extraction are as follows:

Step 1: Gray color image and then use Gamma to check image which reduces the impact of local image shadows and lighting changes while suppresses noise interference.

Step 2: Compute the gradient size and gradient direction of each pixel to obtain edge information.

Step 3: Divide the image into several cells of the same size and the size of the cell is set to 16×16.

Step 4: Divide the gradient direction into 9 bin and count the gradient direction histogram of the cell, and then HOG feature of the cell is obtained.

Step 5: Each 2×2 cell forms a block and put features of all blocks in the image together which constitutes final HOG feature.

H. Gradual Detection Algorithm

Firstly, assume that shot boundary set is {S1, S2 ,..., SN} after preliminary detection, calculate HOG feature of each frame in the video and then calculate the two adjacent frames' HOG feature difference for feature matching. The HOG feature difference of two adjacent frames is shown as follows where the HOG feature difference between i frame and i-1 frame is Fh (i), N represents the number of blocks and Hi represents HOG feature of i-frame

$$Fh\ (i) = \sum_{n-1}^{N} \sum_{m-1}^{36} |Hi - H(i-1)| \quad (3)$$

The HOG difference of obtained shot boundary from Section 2 and previous frame is Fh (S_i) which is respectively compared with the set threshold 'T' which is set as 5 through experiments. If Fh (S_i) is much smaller than 'T', brightness transformation may have occurred in S_1 shot boundary where the border is wrong division, which need to be excluded from the results after the preliminary shot division. Then boundary {B1, B2, BM} which are suspected shots will be obtained after comparing Fh (i) with adaptive threshold. In the results of the shot boundaries obtained above, if the separation distance between two adjacent shot boundaries is less than 15, the shot boundaries, which may contain object moving quickly and flash effects, are removed and the resulting shot boundary set {B1, B2,..., BM'} is added to resulting shot boundaries.

Table II: shows the precision and recall values for gradual transition detection using HOG feature method.

Category (Input Videos)	Number of Frames	Number of Shots	Precision in %	Recall in %
News	17653	56	99.1	98.9
Cartoon	14321	45	98.9	99.8
Sports	31238	37	100	99.2
Movie	15897	39	99.8	100
Commercial	18993	42	98.8	99.7
Documentary	23568	49	99.8	98.8
Average	**20278**	**44.6**	**99.4**	**99.4**

III RESULTS AND DISCUSSION

The experimental outcome of Gradual transition detection in shot boundary implemented with support vector machine and histogram of gradient method according to local and global fitness solutions.

The enactment of the proposed technique is appraised on a database of three hours of news, commercials, documentaries, sports, movies and cartoon video sequences. The video clips taken at a rate of 30 frames per second, at 320 × 240 pixel resolution are used. The video data are observed from famous video data sets such as TRECVID 2006, Open Video Project and MOCA project [13].

The enactment of Gradual transition detection in shot boundary based on support vector machine and histogram of gradient method according to local and global fitness solutions is evaluated in terms of Recall and Precision and they are d

efined as:

Precision, it evaluates the quality, which is the percentage of correct detection.

$$precision = \frac{Number\ of\ correct\ detection}{Number\ of\ all\ detection} \times 100 \quad (4)$$

Recall, it evaluates the quantity, which is the percentage of true detection

$$Recall = \frac{Number\ of\ correct\ detection}{Number\ of\ true\ detection} \times 100 \quad (5)$$

Table 3: shows the comparison of proposed gradual shot boundary detection using PRO-SVM method with HOG feature.

Category (Input Videos)	Proposed Gradual Detection using PRO-SVM		Proposed Gradual Detection using HOG Feature	
	Precision in %	Recall in %	Precision in %	Recall in %
News	96.4	95.4	99.1	98.9
Cartoon	94.9	97.5	98.9	99.8
Sports	96.3	93.2	100	99.2
Movie	95.8	96.1	99.8	100
Commercial	95.3	97.2	98.8	99.7
Documentary	94.2	93.5	99.8	98.8
Average	**95.48**	**95.4**	**99.4**	**99.4**

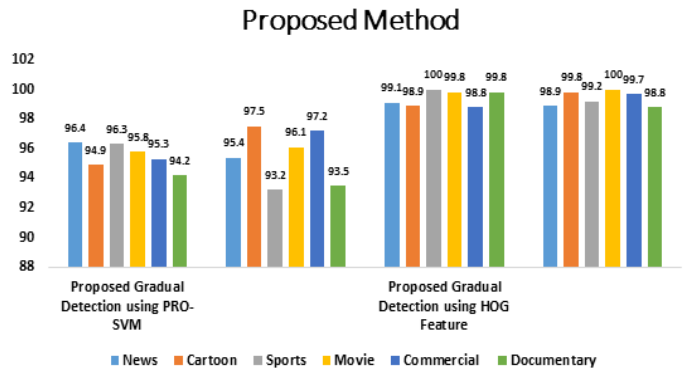

Fig.2: Proposed gradual shot boundary detection using PRO-SVM method with HOG feature

IV CONCLUSION

A gradual transition detection using Support Vector machine based on Group initialization and parameters settings, Update the velocity and position and Update the local fitness in iteration times for various videos (News, Cartoon, Sports Movie etc.). Then calculated the Histogram of gradient feature using HOG feature algorithm. Finally gradual shots are identified. The proposed method achieved 99.4% in terms of average precision and average recall. In future can be applying the fuzzy rules in gradual curve, it will improve the quality and quantity.

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