ISSN: 2321-8169
056 – 059

An Optimization on Key Frame Extraction in Highly Dynamic Video Scenes with Rain Pixel Recovery

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Abstract**—** Highly dynamic weather conditions such as heavy rainfall or snow, fog greatly reduce the quality effect of outdoor surveillance videos. Enhancement of videos to achieve good quality will helps to improve clearer videos or images with complete details. Appearances of visual effect of rain are very complex in nature. Sharp intensity changes produces due to rain drops in both videos and images can severely degrade the performance of outdoor surveillance systems. With the help of this paper the comprehensive analysis of dynamic rainy video and its effects can be easily visualized. For efficient and effective accessing of video documents key frame indexing and labeling methods are introduced. This paper provides technique for key frame extraction and shot boundary detection. After that rain pixel removal algorithm is applied in highly dynamic rainy video scenes to visualize clear and complete video. The photometric model and the spatio-temporal properties of rain provide way to distinguish rain from complex motion of scene objects and other time varying contents. Main goal of this paper is to remove the complexity of intensity pattern which are visible in the raindrops that are closed to camera parameter with feasible indexing and labeling methods.

Keywords*- Weather conditions, photometric, spatio-temporal properties, key frame extraction, indexing, labeling.*

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I. INTRODUCTION

In surveillance video applications, video quality enhancement plays a very important role. The effectiveness and accuracy of poor video quality algorithm reduces the human operators which are responsible for monitoring security surveillance videos. For detecting more accurate threat and fewer false alarms improved visual quality and improved video analytic algorithms are perceived. Bad weather conditions such as heavy rain, snow or fog reduces the visibility and may hide the details of the scene and degrades the contrast information of video signal [1]. Algorithms designed for segmentation, feature detection and object recognition provide the outdoor vision system such as surveillance and navigation. These algorithms have adverse effect due to bad weather conditions. Hence to make outdoor vision robust with varying weather conditions rain pixel recovery algorithm will help to remove rain pixels [2].

Weather conditions are broadly classified with their visual effects and physical properties into steady (fog, mist and haze) or dynamic (rain, snow and hail). Rain droplets are too small (1–10 μm) in the steady weather condition with varying intensity having aggregate effect of large number of droplets (See fig. 1(a)). In dynamic weather condition the droplet's size are 1000 times larger than those in steady weather condition. With this size particles are visible to a camera (See fig. 1(b) and (c)).

(a)A scene in fog (b) A scene in rain (c) A scene in snow

Recently, video content can be produced with various mobile devices with built in camera, automobile black boxes, digital video recorders and surveillance cameras. Moving video is a set of still images or frames which gives the illusion of motion with the faster rate to the viewer. For framing and indexing key frame is extracted from the consecutive frames. Matching difference between the reference frame and the current frame with thresholding provide the way for shot boundary detection and key frame extraction [3]. So, the analysis of multimedia information and the demand for intelligent processing can be easily possible.

To remove the effect of rain from dynamic video, it is necessary to find fluctuations caused due to rain. Various algorithms are proposed for this purpose. Proposed algorithm in this paper with indexing and labeling is based on segmentation of dynamic scene. To detect rain photometric and chromatic constraints are applied. After that rain removal filters are used to get spatial and temporal information. These methods will help to recover rain pixels over highly dynamic scenarios.

II. LITERATURE REVIEW

P. Kansare etal.[1] gives the description on frame indexing and labeling in dynamic rainy video scenes with rain pixel recovery. Garg and Nayar successfully detected rain in dynamic rainy videos [4]. With continue observing, they faced certain problems that when rain is much heavier or lighter rains cannot be detected or removed. After analysis they concluded that the camera parameters can remove the rain without blurring its background and the parameters may not remain the same always. So, with heavy rain condition this method cannot work.

Garg and Nayar [5] proposed one more method in which assumptions are made with photometric model. The concept of photometric model with their physical properties of rain helps to visualize the concept of model. Various comprehensive analyses are made on the visual effect of rain and the dynamic factors. Observations said that the affecting raindrops show its impact only on single frame. Due to this intensity varies which is equal to the intensity difference between the pixel in the current frame and in the consecutive frame. It gives a lot of false detections. False detection of pixels can be avoided with linear photometric constraints of raindrops. Consecutive frames are affected due to heavy raindrops. Here, after observation it seems that assumptions on photometric model can be violated with the varying size and velocity of raindrops.

Zhang [6] proposed a method which is based on both temporal and chromatic constraints of the rain. While considering the chromatic constraints assumptions are made with RGB colour component of raindrops. To bound variations a threshold value is provided. Limitation for chromatic constraints is that it will not identify rain streaks in a slight motion and gray regions.

Barnum [7] proposed a method in frequency space. He made assumptions on individual rain streak and snow in frequency space. Then detected result is transferred to image space. With the light rain this method will not be possible. This is the major drawback of this method.

Zhou [8] proposed a method for rain removal in sequential images with the use of spatial temporal property and the chromatic property. In this method rain is detected using k-means method. Here, the rain is removed from the video but some new images remains blurry.

Bossu proposed a method based histogram model. This histogram data are used to model Gaussian-uniform mixture model. The presence or absence of rain can be detected with this model. So,the intensity can be easily estimated and detected. But, in the presence of light rain the Mixture of Gaussian is no longer relevant.

III. PROPOSED SYSTEM

The objective of proposed work is to represent the most “important” or “meaningful” scenes of the large amount of visual information by only a few images: the key frames. Hence, key frame extraction technique with indexing and labelling will be used .The challenges in the detection of rain are heavy wind during rainfall, reflection in rainfall, misclassifications between text and rain, time-varying textures such as water ripples and when foreground is too cluttered. A pixel at a particular position is not always covered by the raindrops in every frame. Dynamic rainy video taken from the static camera raindrops are randomly distributed in space due to the random distribution of raindrops. A multimedia technology recently advances in accessing and retrieving of video data on computers with fewer expenses. Hence, proposed system will help to retrieve video content easily.

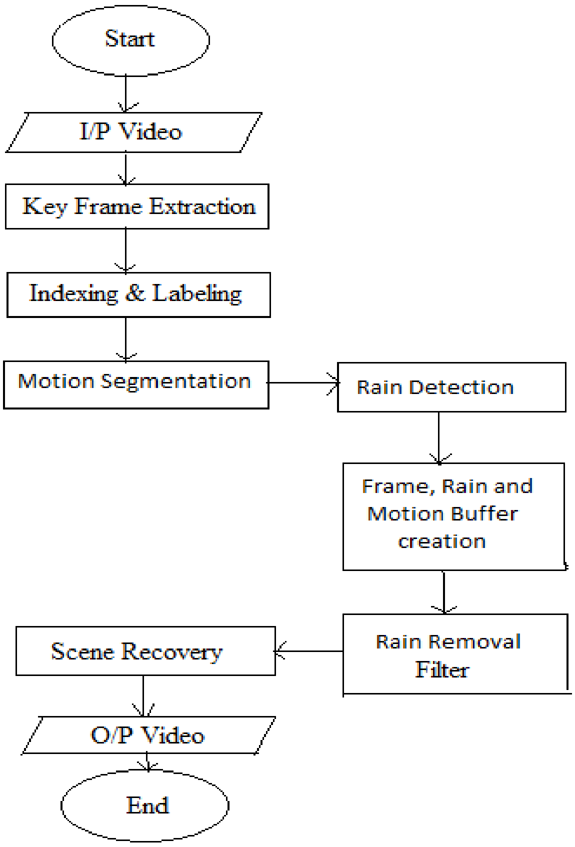

Figure 1: Architecture of Proposed System

In this paper the proposed work is based on the segmentation of motion in dynamic scenes with frame indexing and labeling. Rain will be detected after applying photometric and chromatic constraints, also on pixels rain removal filters are applied to get their dynamic properties. Our module starts with the use of efficient algorithm for shot boundary detection and key frame extraction. This algorithm helps to segment each frame with their matching difference and threshold. Automatic threshold helps to detect shot boundary. Key frame will be extracted with referenced frame. It may helps to provide accurate boundary detection and the content of the video can be easily extracted using key frames. Automatic threshold can be computed by calculating mean and standard variance over whole video sequence of x^2 histogram matching difference.

If

$$T = M\Delta + \alpha \cdot \Sigma T\Delta \qquad (1)$$

Where T is threshold. Shot candidate detection: if $\Delta(\iota,\iota+1)$ ε *T*, the *i*th frame is the end frame of previous shot, and the $(\iota+1)$τη frame is the end frame of next shot. The extracted key frames can satisfactorily represent the content of video.The appearance of intensity fluctuations in dynamic rainy scenes is caused due to rain and object motion pixel. Hence the fluctuations caused by object motion need to be retained, and caused by rain need to be removed. Thus the main fundamental procedure in our proposed work is motion field segmentation.

Independent motion objects can be detected using motion segmentation. The existence of motion is identified by using optical flow which uses a parametric Gaussian Mixture Model (GMM) to simulate distribution. In this first, K GMM components are presumed to exist in optical flow path. The motion field is determined by the combination of all Gaussian components. Rain pixels within the motion object and the background need to be treated separately. This method provides better optical flow estimation accuracy, however with an increased computational complexity.Object map technique is used to identify objects in the background pixels. Between two successive frames gray scale intensity difference and threshold will be calculated. Threshold value helps to detect fluctuations caused due to rain. After that photometric and chromatic constraints are applied. For rain removal frame buffers will be created. Scene recovery can be recovered on central frame for better performance.

IV. IMPLEMENTATION

Our implementation is started by first finding the number of frames from the input video. Current frame block difference is calculated with the reference frame. Mean, standard deviation and threshold is calculated for finding out the key frames as shown in the fig.2. After that key frame is detected with threshold value shown in fig. 3. These key frames are used for labeling which helps to identify main frames from the large number of frames shown in fig. 4. Object map technique segment the motion objects and background pixel for rain pixel recovery as shown in fig.5.

```
Frame 225 Block Difference:7.541838e+06
Frame 226 Block Difference:7.580036e+06
Frame 227 Block Difference:2.196124e+07
Frame 228 Block Difference:2.360338e+08
Frame 229 Block Difference:4.183003e+06
Frame 230 Block Difference:5.001024e+06
Frame 231 Block Difference:1.219412e+07
Frame 232 Block Difference:6.688208e+07
Frame 233 Block Difference:1.942976e+07
Frame 234 Block Difference:8.840214e+06
Frame 235 Block Difference:4.104472e+07
Frame 236 Block Difference:2.910304e+07
Frame 237 Block Difference:2.726491e+07
Frame 238 Block Difference:1.271374e+07
Frame 239 Block Difference:4.279271e+07
Frame 240 Block Difference:1.424506e+08
Frame 241 Block Difference:2.210962e+07
Frame 242 Block Difference:9.300555e+07
Mean:19471163.976973, Std Deviation:24934978.939025
Threshold:44406142.915999
```

Figure 2: Calculating current frame block difference with reference frame

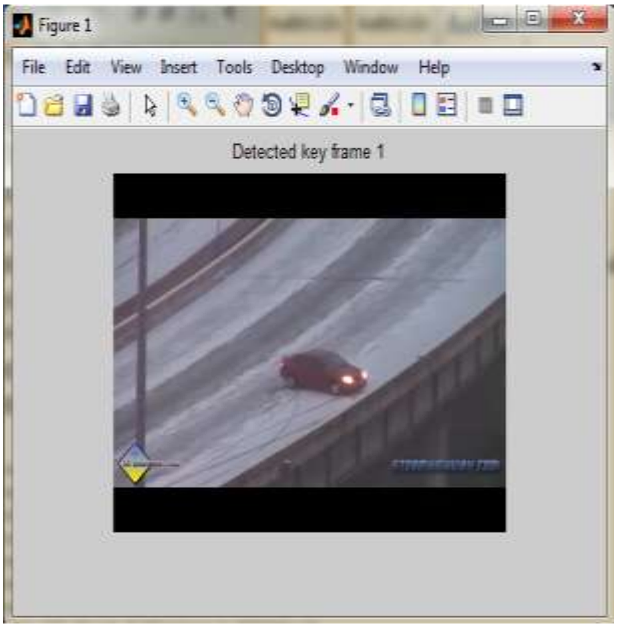

Figure 2. Detected Key Frame

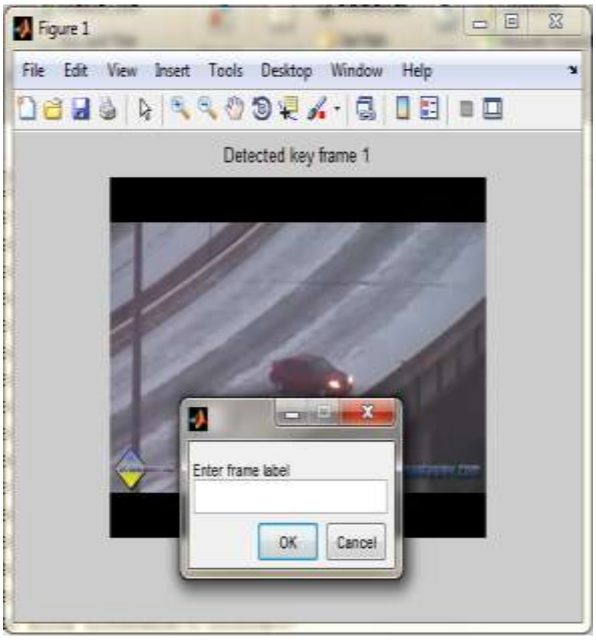

Figure 3: Labeling of key frame

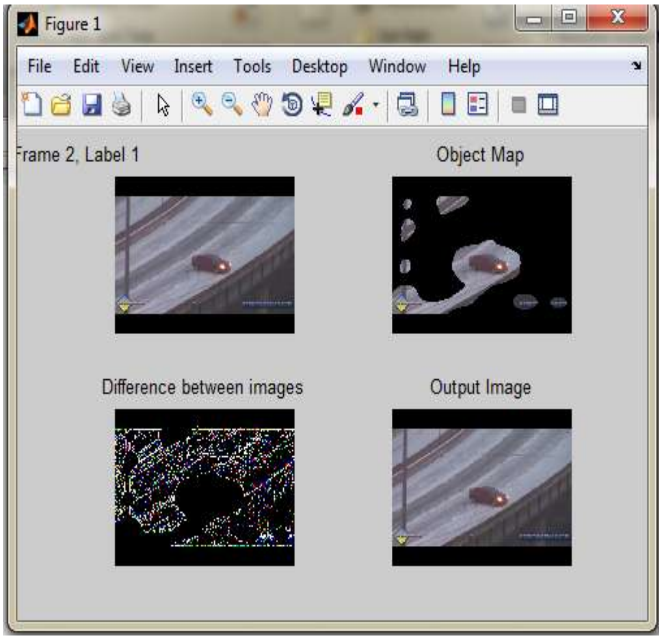

Figure 4: Rain pixel recovery with object map technique

V. Conclusion

In this paper, we have presented a method for key frame extraction in highly dynamic video scenes with rain pixel recovery for efficient and flexible frames access for video representation and analysis. The key frame extraction method is applied for shot boundary detection. Motion segmentation is an independent area of research whose primary goal is to separate borders. The proposed approach integrates video retrieval with rain pixel recovery will help to avoid limitations and drawbacks of the previously existing methods. Frame indexing and labelling may help to retrieve useful events from any rainy videos efficiently.

Acknowledgment

We would like to thank author of base paper Jie Chen and Lap-Pui Chau for a concept of rain pixel recovery algorithm for videos in highly dynamic scenes. We also thank our anonymous reviewers for their feedback.

References

[1] Punam P. Kansare and Ashwini Meshram "A Review on Frame Indexing and Labeling in Dynamic Rainy Video Scenes with Rain Pixel Recovery", International Journal of Computer Sciences and Engineering, Vol.-02, Issue-12, Page No (98-100), Dec- 2014, E-ISSN: 2347-2693.

[2] Jie Chen and Lap-Pui Chau, ''A Rain Pixel Recovery Algorithm for Videos with Highly Dynamic Scenes", *IEEE Image Processing*, vol. 23, no. 3, March2014.

[3] ZHAO Guang-sheng "A Novel Approach for Shot Boundary Detection and Key Frames Extraction", International Conference on MultiMedia and Information Technology,2008.

[4] Kshitiz Garg and Shree K. Nayar, "Vision and Rain", International Journal of Computer Vision 75(1), 3–27, February 2007.

[5] K. Garg and S.K. Nayar, "Detection and removal of rain from videos," in IEEE Conf. Computer Vision and Pattern Recognition, vol. 1, pp. 528-535, 2004.

[6] X. Zhang, H. Li, Y. Qi, W.K. Leow and T.K. Ng, "Rain Removal in Video by Combining Temporal and Chromatic Properties," in IEEE Int. Conf. Multimedia and Expo, pp. 461-464, 2006.

[7] Peter C. Barnum ,Srinivasa Narasimhan ,Takeo Kanade "Analysis of Rain and Snow in Frequency Space", Springer International Journal of Computer Vision 86,256-274, 2010.

[8] Ming Zhou, Zhichao Zhu, Rong, Deng, Shuai Fang,Rain, "Detection and Removal of Sequential Images", IEEE Chinese Control and Decision Conference (CCDC), pp. 615-618, 2011.

[9] Sajitha Krishnan and D.Venkataraman "Restoration of Video by Removing Rain", International Journal of Computer Science, Engineering and Applications (IJCSEA) Vol.2, No.2, April 2012.

[10] Archana.V.Potnurwar and Mohammad Atique "Visual Attention Key Frame Extraction for Video Annotations**"**, International Journal of Computer Science Engineering, Vol. 3 No., ISSN : 2319-7323,Jan-2014.

[11] Abhishek Kumar Tripathi, Sudipta Mukhopadhyay, "A Probabilistic Approach for Detection and Removal of Rain from Videos", IETE Journal of Research, vol. 57, pp. 82-91, 2011.