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CLOUD-BASED OPTIMIZED KEY FRAME EXTRACTION MODEL FOR VISUALLY IMPAIRED PERSONS

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ABSTRACT. Key frame is extricated from the video to detect the objects present and visually impaired person is communicated about the obstacle. As key frame extraction is done in real time video to help out the visually impaired person, so minimum latency should be their considering the cost of the system also, system cost should be minimum. And it is not possible for the visually impaired person to carry out the bulky things with him/her all time for moving. Inspired by the cloud computing technology, in this article we proffer a key frame extraction model in which the video will be captured through the mobile phone camera and will be forwarded to cloud server. On the cloud, key frames will be extracted, video will be processed by applying "Thepadea's Sorted Ternary Block Truncation Coding (TSTBTC)" and "Binary Bat Algorithm (Already Proposed)" to exploit the high computing ability of the cloud platform instead of using limited processing capability of the mobile device. Proposed model leads towards fast processing and minimum latency.

1. INTRODUCTION

To detect the obstacle an image is needed, mobile phone camera is used to take the video, key frame must be extracted from the video sequence and then visually impaired person is signaled about the presence of the obstacle by processing key frame selected. The excessive grade frame that is enough capable of

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portraying and is able to reflect the obstacle clearly present, in a video sequence is considered as key frame [1]. As mobile have low processing capability so it will take time to process the video to fetch the key frame and then further process it to find the obstacle if any. Cloud computing paradigm uses the internet allowing many clients to get coupled at the same time as a cloud and emerged as a backbone of modern industry [2]. Latterly, a mobile application called "Face" has been bloomed in 2017 and gained popularity as in January, 2019. It is a photo editing application by which the client takes the image on their own mobile terminal, and processed on Google Cloud and Amazon Web Services. In today's era, lot of focus is on object detection by using computer vision, to have algebraic locomotion particulars, such as speed, trajectory and location, to aid visually impaired persons do other wok. At this time, object detection plays a vital role in area of education, media, medicine, sports, etc. However, owing to increased video quality and superior noting accuracy, video editing highly relies on computing power, which further leads to large number of mobile target recognition systems executing only on a stable WorkCentre. Consequently at current, ambulant terminal movable object recognition functions are concern to constraints [3].

This article proposes a cloud based object recognition approach addressing ambulant terminal moving object functions restraints. With this approach, user will take the video in mobile device and will then forward the video to cloud server for object recognition. At the same time, number of ambulant consumers can couple with a cloud server to have distant access, enabling multi-threaded object recognition, compensating for the need of ambulant terminal executing power using resources more efficiently. The aim and motivation of this paper is to develop a cloud based key frame extraction model to reduce the delay and cost by utilizing the high computing capability of cloud platform. Video will be captured by using the mobile camera and then will be forwarded to the cloud server, where it will be processed by using block coding technique. Proposed model is an extension of our previous developed technique "Effective key frame extraction approach using Thepadea's Sorted Ternary Block Truncation Coding (TSTBTC) and Binary Bat Algorithm" [4]. Less no of key frames selected will be processed fast, helping to intimate visually impaired person in short span of time. The remaining article is structured as following. Section 2 describes correlated work of existing key frame techniques. Suggested model is introduced in

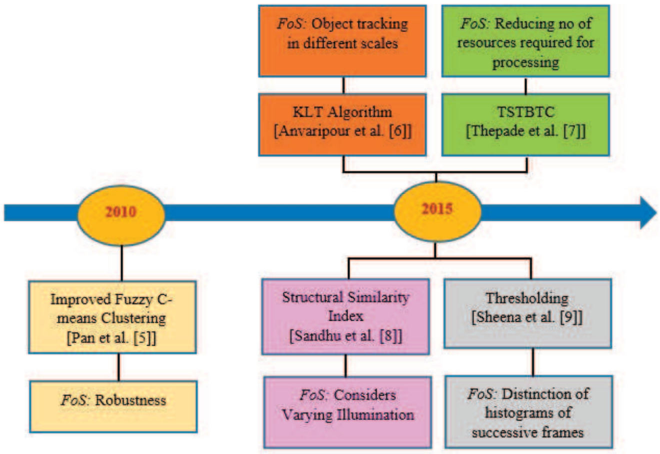

FIGURE 1. Evolution of key frame extraction techniques

Section 3. Section 4 presents investigating setup and results. Conclusions and future work is presented in Section 5.

2. RELATED WORK

A broad range of study is available in the field of "Key Frame Extraction" for video information. In 2010, Pan et al. [5] gave an improved fuzzy C-means clustering algorithm to extricate key frames. Based on consistency of clustering content, frame having highest entropy is marked as key frame, but accuracy is only possible when clustering centroid is close to sample. In 2015, Anvaripour et al. [6] proposed KLT (Kanade- Lucas- Tomasi) algorithm to track multiple movable objects by considering spectral residual technique and KLT algorithm to consider optical flow. Limitation of this method is that it is very time consuming process. In 2015, Thepade et al. [7] gave TSTBTC based key frame extraction technique. The principal plan of this scheme is to extract keyframes using block encoding but it leads to Information Redundancy, this limitation will be eliminated by using optimization algorithm in our proposed model. In 2015, Sandhu et al. [8] gave an automated approach comprising structural closeness index and optic features for video information, but with low quality summaries. In 2015, technique based on absolute distinction of histograms of successive frames was proposed by Sheena et al. [9], consisting of two phases, 1st pass

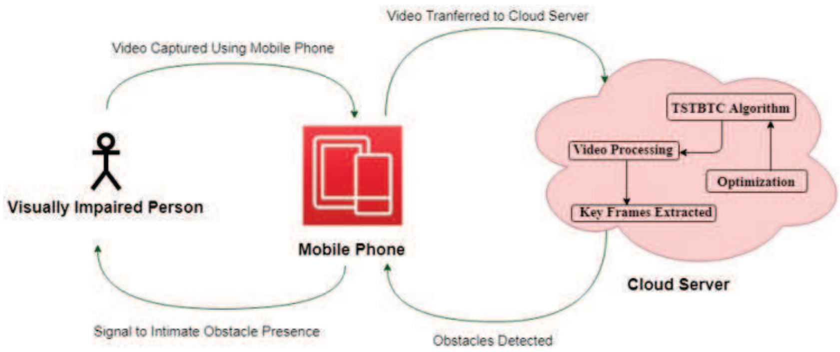

FIGURE 2. Cloud based key frame extraction model

calculating threshold of absolute distinction of successive image frames and analyzing threshold against absolute distinction of successive image frames in 2nd pass. Focus of Study (FoS) of obstacle detection by evolution of key frame extraction across the various years is described in timeline of key frame extraction techniques as shown in Figure 1.

3. CLOUD BASED KEY FRAME EXTRACTION MODEL

In this section, we proposed a cloud based key frame extraction model to extract key frames which will further be used to detect objects and signal the visually impaired person about the presence of the obstacle. Figure 2 portrays cloud assisted model design consisting of following elements:

- Mobile Phone: This is the main component to be held by the visually impaired person. This component must have camera embedded in it to capture the video to detect the obstacles. After recording the video, it will be transferred to the cloud server for processing. After the video is processed at the cloud, intimation will be sent to the mobile device about the presence of the obstacle. This component will further intimate the visually impaired person about the obstacle through various means like in the form of beep or vibration.
- Internet Connection: Internet connection should be present in the mobile phone used to feed the real time video to the cloud for processing.

Further internet connection is also required to get intimated by the cloud about the presence of the obstacle.

- Cloud Server: Figure 3 depicts the processing of video received. During processing of video, this module performs the video pre-processing, which transforms the video into frames. After converting the video to frames, TSTBTC algorithm is applied to extract the features and then Binary Bat optimization algorithm will be applied to calculate the threshold to find the difference between the consecutive image frames. Further depending upon the difference between the frames, it is recognized as a key frame or non-key frame. Various similarity measures can be used along with the TSTBTC to extract key frame. TSTBTC algorithm will be applied along with the Sorensen distance, Euclidean distance, Mean square error, Canberra and Square Chord. After applying the various similarity measures, the one giving the best results with minimum delay will be considered. As color is prime component of the video, so TSTBTC algorithm may be applied with various color spaces (RGB, Kekre's LUV, YCbCr, YUV and YIQ). Color space giving the best results with TSTBTC will be further considered.

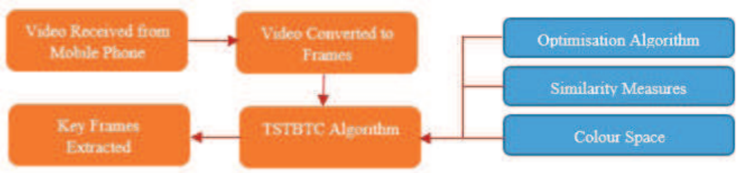

FIGURE 3. Video processing at cloud server

4. EXPERIMENTAL SETUP AND RESULTS

In proposed research article, basic event simulation functionalities of CloudSim have been used for implementing cloud server and Matlab 2017b framework have been used for image analysis. Videos from Open Video Dataset and Youtube Dataset have been considered to compare the performance analysis of the processing with cloud and with mobile. Figure 4 represents the performance of the proposed model by calculating the latency with cloud and with mobile against number of key frames. Cloud based model performs better in terms of latency. Figure 5 shows extracted key frames using the proposed method.

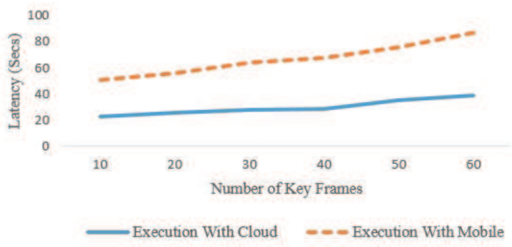

FIGURE 4. Latency vs. number of key frames

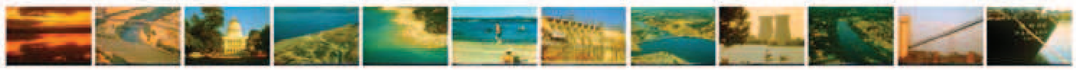

FIGURE 5. Keyframes extracted using proposed method for video 23 (Open Video Dataset)

5. CONCLUSIONS AND FUTURE WORK

In proposed research article, we introduced a cloud based key frame extraction model, which provides obstacle detection as a cloud service and accurately processes the video, which is coming from mobile phone, to identify the obstacle present if any. The efficiency of proposed model is gauged using various similarity measures and color spaces. In future, this model will be ratified in a real time environment for the practical recognition.

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