Query Object Detection in Big Video Data on Hadoop Framework

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***Abstract*—In the emerging era of technology filled with multimedia sources video lecturing is becoming increasingly significant. The detection of objects in such systems is crucial for application areas such as identification of person, gender, event and other non-living things. This paper throws some light on adopting the methods to handle such Big video data using Hadoop framework. Hadoop Map-Reduce technology in assistance with the video processing algorithms refined till a certain efficiency helps in detecting the objects in Big video data. The Big video data is initially distributed to various nodes of Hadoop environment where in each node functions in processing of videos. The cull mapper distributes videos to all nodes in a cluster. In the first map phase original videos are converted from RGB to gray scale since processing on gray scale videos is three times faster than that of processing on RGB videos. Then in second map phase, the background subtraction method for object detection is carried out. The detected object can be then classified into its category.**

Keywords: Object detection; Big Video Data, Hadoop, Video Assignments

I. INTRODUCTION

Video Processing: In this age of dramatic technology shifts, one of the most significant has been the emergence of digital video as an important aspect of daily life. Digital video processing is the study of algorithms for processing moving[1,3] images that are represented in digital format. A digital video is a moving picture [2,3,5] or movie, that has been converted into a computer readable binary format consisting of 0s and 1s.

Big Video Processing: Big data is no longer a new term, it's a fact, and it's one of the fastest growing areas in IT. 90% of the world's data has been created in just the last two years, and 80% of it is unstructured data such as video or photos.

Hadoop: Hadoop is an open source framework for processing, storing and analyzing massive amounts of distributed, unstructured data. It was designed to handle Peta bytes and Exa bytes of data distributed over multiple nodes in parallel. It is a large-scale distributed batch processing infrastructure.

Object Detection: Over the recent years, detecting objects in a video scene of a video dataset[4] is attracting more attention due to its wide range of applications in abnormal event detection, human gait characterization, person counting in a dense crowd, object identification, marking the content of video, etc. In case of surveillance videos, the scenes obtained are usually with low resolution. Most of the scenes captured by a static camera are with minimal change of background. Hence, Object detection analysis in automated video surveillance or any of the video datasets has become one of the most active and attractive research topics in the area of computer vision and pattern recognition.

II. METHODOLOGY

This paper provides a solution to the Big video data problem in two levels (more levels for other operations can be added), elaborated as follows:

Level-1: Hadoop MapReduce-1: Conversion of RGB to gray:

The input type used here is referred to as a Hadoop Video Bundle (HVB). A HVB is a set of videos combined into one large file along with some metadata describing the layout of the videos. A HVB can be created from an already existing set of videos or directly through some other source. In order to improve the efficiency of some jobs, it allows the user to specify a culling function that discards videos that do not meet a specified set of criteria. The series of stages here, addressed as Hadoop Video Processing Interface (HVPI), implements Hadoop MapReduce framework and thus provides an API for performing video processing tasks in distributed computing environment. Although HVPI does not directly modify any of the default Hadoop MapReduce behavior once the Mapper's take over, the user can modify execution parameters specific to video processing tasks through the HVPI job object during setup. The purpose of the map phase is to organize the data in preparation for the processing done in the reduce phase. The output consists of a collection of key-value pairs which are input for the reduce function. The content of the key-value pairs depends on the specific implementation.

Reducer reduces a set of intermediate values which share a key to a smaller set of values. Reducer has 3 phases: *Shuffle*, *Sort and Reduce*. The Reducers then reduce the results from all the nodes of the Hadoop interface and get collected in a folder named result which can be used in further stages of processing. Now, in this phase, conversion of videos is from RGB to gray is done. This conversion helps further processing to be carried out efficiently.

Level -2: Hadoop Map-Reduce-2: Classification of Object:

In the second stage of processing, the results are then passed through the phases to detect the objects which can be done through various image processing techniques. The execution parameters and the scenario in this stage are set for detection of object using background subtraction method which detects an object as a foreground by segmenting it from

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a scene. It attempts to detect moving objects from the difference between the current frame and the reference frame in a pixel by pixel or block by block fashion. The reference frame is commonly known as 'background image', 'background model' or 'environment model'. A good background model needs to be adaptive to the changes in dynamic scenes. Enhancement of videos can also be done in a similar manner, where in each Hadoop node functions for a video enhancement technique. The entire process of object detection is shown in Figure 1. The block diagram of object detection on Hadoop framework is shown in Figure 2.

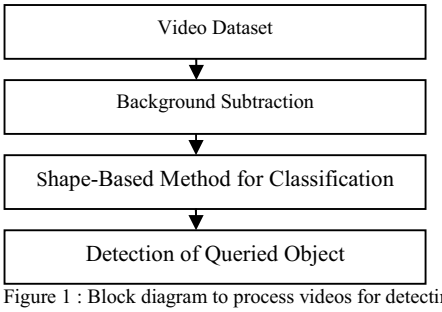

Figure 1 : Block diagram to process videos for detecting objects.

III. RESULTS AND DISCUSSIONS

Nowadays, students are capable of using electronic devices comfortably. As videos are rich source of information, submitting the assignments through videos is an efficient way for submitting the assignments. The method proposed in this paper is applied by considering such videos as the database.

A study is being carried out on the real videos submitted by the students of III year Bachelor of Technology students. The given assignment is a mathematical proof for the two of the lemmas from *Theory of Computation* course: *pumping lemmas*. The student can use any video recording devices for the submission. There is no time limit on the duration of the videos. 125 students have submitted their videos on the explanation on *pumping lemmas*, each student with their independent approach towards the explanation. Students are then asked to share their video footage on cloud storage apps like Google drive and Dropbox. The videos are of 5 minutes to 56 minutes duration[6]. The videos are then given as input to the algorithmic approach presented in the paper. The result of background detection for the given video is shown in Figure 3. Set of queries that can be given as input to the nodes in the form of parameters are shown in Table 1, and the results are found to be expected with respect to the queries.

Figure 4: Result of background subtraction.

TABLE I: SET OF QUERIES.

S.No.	Queries
1	Identifying Pens in given Video Dataset
2	Identifying Black Board in given Video Dataset
3	Identifying Laptop in given Video Dataset
4	Identifying Books in given Video Dataset
5	Identifying number of persons in given Video Dataset

IV. CONCLUSIONS

The implementation on Hadoop clusters results in significant improvement on the running times compared to serial computation on a single node. The areas which witness significant improvement due to parallelization are the processing of converting RGB to gray and object detection. It is these types of computation that benefit greatly from distributed computing clusters like Hadoop framework.

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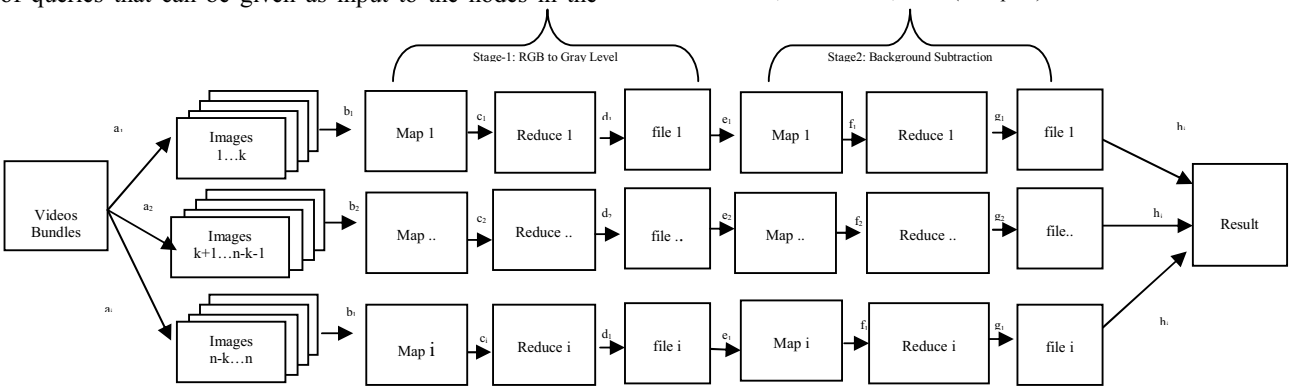

Figure 2 : Block diagram to process videos for detecting objects on Hadoop framework.