World Applied Sciences Journal 29 (Computer Sciences, Engineering and Its Applications): 121-125, 2014
ISSN 1818-4952

DOI: 10.5829/idosi.wasj.2014.29.csea.2222

A Parallel Implementation to Schedule the Detection of Moving Object in a Video Sequence by a Genetic Algorithm Approach

R. Udayakumar, K.P. Thooyamani, Khanaa and A.V. Allin Geo

School of Computing Science, Bharath University, Chennai-73, India

Abstract: The problem of scheduling a set of dependent or independent tasks to be processed in a parallel fashion is one of the most challenging problems in parallel computing. The goal of a Schedule is to assign tasks to available processors such that precedence requirements between tasks are satisfied and the overall length of time required to execute the entire program, the schedule length or make span is minimized. A Genetic Algorithm Approach has been developed to the problem of task scheduling. GA is competitive in terms of solution quality if it has sufficient resources to perform its search. The Job taken for the Scheduling is the Detection of a Moving Object in a Video Sequence. The Moving Object Segmentation is suitable for real time content-based multimedia communication systems. First a background registration technique is used to construct as reliable background image from the accumulated frame difference information. The moving object region is then separated from the background region by comparing the current frame with the constructed background image. The implementation is optimized using parallel processing and achieved on a personal computer with a 3.0 GHZ Pentium IV Processor. Good segmentation performance is demonstrated by the simulation results.

Key words: Background Registration · Moving Object Segmentation · Genetic Algorithm · Fitness function

INTRODUCTION

Video processing algorithms are usually computationally challenging because the amount of data to be processed is voluminous and processing this data in real time rates requires immense resources. Video segmentation, which extracts the shape information of moving object from the video sequence, is a key operation for content – based video coding [1], multimedia content description [2, 3] and intelligent signal processing. For example, the MPEG-4 multimedia Communication standard enables the content – based functionalities by using the video object plane as the basic coding element. Each video object plane includes the shape and texture information of a semantically meaningful object in the scene. New functionalities like object manipulation and scene composition can be achieved because the video bit stream contains the object shape information.

However, the shape information of moving objects may not be available from the input video sequences; therefore segmentation is indispensable tool to benefit from this newly developed coding scheme. In addition, many multimedia communication applications have real time requirement and an efficient algorithm for automatic video segmentation is very desirable.

Traditionally, a programmer must schedule an algorithm on available processors manually so that the program can run efficiently. However, this approach is time consuming and impractical for a video processing system that must perform a variety of different algorithms; particularly since newly developed algorithms need to be constantly incorporated. A Genetic scheduler is used to schedule input tasks with precedence constraints onto available processors in parallel would greatly facilitate program development.

Corresponding Author: R. Udayakumar, School of Computing Science, Bharath University, Chennai-73, India.

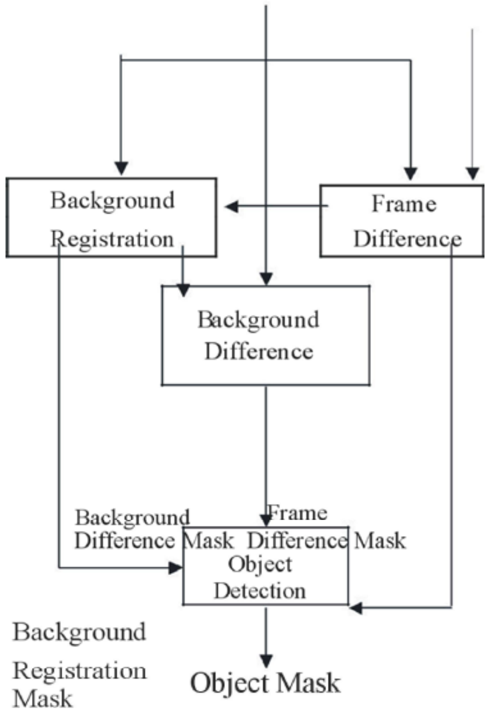

Fig. 1: Moving Object Detection

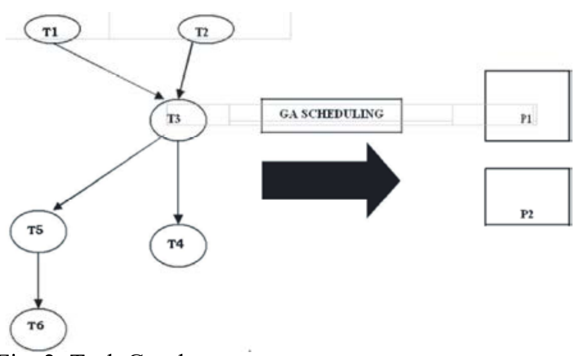

Fig. 2: Task Graph

Task Scheduling is one of the most challenging problems facing parallel programmers today. List scheduling heuristics like Critical Path (CP) or highest-level first (HLP) scheme is within 5% of the optimal in 90% of the cases [4].

Heuristic approaches to the scheduling problem do not necessarily lead us to optimal solution. As a result, the average performance of the heuristic methods was evaluated by using randomly generated graphs and real video processing algorithms [5].

Models And Definition: The basic idea of segmentation is change detection. The moving object region is separated from other part of the scene by motion information [3].

Table 1 GANTT CHART

P1	GA	T1		T5	T6
P2		T2	T3	T4	

Background information is constructed and maintained from the video sequence and each frame is compared with the background. Any pixel that is significantly different from the background is assumed to be in object region.

An obvious assumption of this approach is stationary background. Since, in many video conferencing and remote surveillance applications, the camera is fixed and the algorithm is focused on these applications. Therefore, the input sequence has been properly compensated and the background region is stationary The Block Diagram of the moving object detection is shown in Fig 1. Frame Previous Frame.

The Task Graph of the moving object detection is illustrated in Fig 2

T1 - - - - - - - - - - Boundary Detection
T2 - - - - - - - - - - Frame Difference
T3 - - - - - - - - - - Background registration
T4 - - - - - - - - - - Background Difference
T5 - - - - - - - - - - Object Mask
T6 - - - - - - - - Object Detection

The following represents the Gantt chart for the scheduling of the two processors.

Moving Object Detection 3.1Moving Object Detection: The first step is to calculate the frame difference mask by thresholding the difference between two consecutive input frames[6]. Then, according to the frame difference mask of past several frames, pixels, which are not moving g Object Detection Algorithm for a long time, are considered as reliable background in the background registration step. This step maintains an up-to-date background buffer as well as a background registration mask indicating whether the background information of a pixel is available or not.

Comparing the current input image and the background image stored in the background buffer generates the background difference mask. This background difference mask is our primary information for object shape generation.

The object mask is constructed from the background difference mask and the frame difference mask. If the background registration mask indicates that the background information of a pixel is available, the background difference mask is used as the object mask.

Frame Difference: Threshold the difference between two consecutive input frames is the basic concept of change detection based segmentation. However, since the behavior and characteristics of the moving objects differ significantly, the quality of segmentation result depends strongly on background noise, object motion and the contrast between the object and the background [7].

The frame difference mask is generated by thresholding the frame difference. This information is sent to the background registration step where the reliable Background is constructed from the accumulated information of several frame differences.

Background Registration: The goal of background registration step is to construct reliable background information from the video sequence [8]. Approximated background information is not helpful for object detection and even worse, it will cause error in the later segmentation result until the background information is corrected. Therefore, for information that is not sure to be background, we tend to reject and leave the corresponding area in the background buffer empty.

In the background registration step, the history of frame difference mask is considered in constructed and updating the background buffer. The value in the background registration mask indicates that whether the background information of the corresponding pixel exists or not. If a new pixel value is added into the background buffer, the corresponding value in the background registration mask is changed from nonexistent to existing corresponding area in the background buffer empty.

In the background registration step, the history of frame difference mask is considered in constructed and updating the background buffer [5]. The value in the background registration mask indicates that whether the background information of the corresponding pixel exists or not. If a new pixel value is added into the background buffer, the corresponding value in the background registration mask is changed from nonexistent to existing.

Background Difference: This step generates background difference mask by thresholding the difference between the current frame and the background information stored in the background buffer.

Object Detection: The Object detection step generates the object mask from the frame difference mask and the background difference mask. The background registration mask, frame difference mask and background difference mask of each pixel are required information.

Genetic Algorithm

Fundamentals of Genetic Algorithm: Genetic Algorithm was developed by Holland [4] to study the adaptive process of natural systems and to develop artificial systems that mimic the adaptive mechanism of natural systems. A genetic algorithm consists of a string representation of the nodes in the search space, a set of genetic operators for generating new search nodes, a fitness function to evaluate the search nodes and a stochastic assignment to control the genetic operators.

Typically, a genetic algorithm consists of the following steps [9].

- Initialization – an initial population of the search nodes is randomly generated.
- Evaluation of the fitness function – the fitness value of each node is calculated according to the fitness function.
- Genetic Operations – new search node are generated randomly by examining the fitness value of the search nodes and applying the genetic operators to the search nodes.
- Repeat steps 2 and 3 until the algorithm converges. Thus, a schedule for n tasks and p processors is a permutation of n numbers with p cycles. One of the merits of genetic algorithms is that it searches many nodes in the search space in parallel. The list of tasks within each processor of the schedule is ordered in ascending order of their height.

Fitness Function: The fitness function in genetic algorithm is typically the objective function that wants to optimize. The fitness function used is based on the finishing time of the schedule. The finishing time of a schedule, S is defined as follows:

$$FT(S)=\max_{Pj} ftp(Pj)$$

where ftp (Pj) is the finishing time for the last task in processor Pj [10]

Implementation: A basic idea for faster implementation is to compute in parallel, therefore the paper exploits parallelism. For image processing, the 32 bit or 64 bit data path of the processor. The scheduling of task of a video application is done by Genetic Scheduler to have a optimum solution.

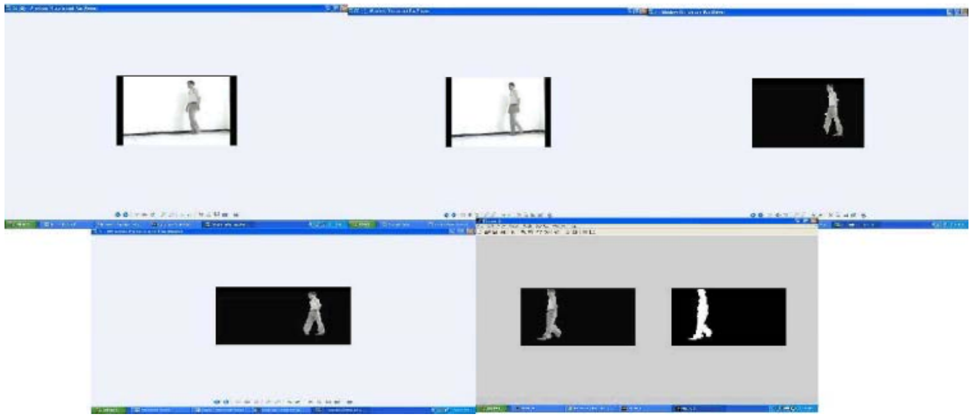

Fig. 3:

Table 2: Run Time Analysis

Function Name	Time in seconds
Boundary Detection	7.504
Input Running	31.717
Extract Foreground	31.732
Object Mask and Object Detection	68.668
Error Rate	0.67100

Table 3: Run Time Analysis

Function Name	Time in seconds
Boundary Detection	7.15
Frame Difference	6.837
Background Registration	27.722
Background Difference	20.215
Object Mask and Object Detection	60.875

Experimental Results: Results with test sequences have been obtained. The video detection algorithm detects the moving object from the video sequence. The following figures show the typical video sequence and the object mask Pictures to detect the moving object.

The following table shows the run time analysis of the work using a single system.

The total execution time of the entire task using a single system is **157.637 Seconds**. The following table shows the run time analysis of the work using two systems.

The total execution time of the entire task using two systems is **117.091Seconds**. According to **Amdahl's Law** Speed up is defined as the ratio of the execution times.

Speed up = Execution Time old
Execution Time new

According to our problem the speed up ratio is the execution time for the single system to the execution time new and is given by

Speed Up = 157.637/117.091=1.334

CONCLUSION

In this work, Genetic Algorithm is used for scheduling the moving object detection in a video sequence. The problem of scheduling and detection of the moving object is being evaluated by using single and two systems. The performance of sequential GA is evaluated. Experimental results show that the genetic approach reduced the computation time by a factor of 1.334 when compared with the single system without GA. By analyzing the results it is inferred that genetic algorithm based solution is suitable for many practical applications like robotics, scheduling of aircraft takeoffs and landing onto one or more landing strips. The results encourage further research by employing parallel GA, Adaptive GA and Distributed GA.

REFERENCES

1. Sikaro, 1997. The MPEG–4 Video Standard Verification Model, EEE Trans Circuits Syst.Video Technol., 7: 19-31.
2. Nack, F.and A.T. Lindsay, 1999. Everything you want to know about MPEG –7: part-2, IEEE Multimedia, 6: 64-73.
3. Thooyamani, K.P., V. Khanaa and R. Udayakumar, 2013. Application of Soft Computing Techniques in weather forecasting : Ann Approach, Middle-East Journal of Scientific Research, ISSN:1990-9233, 15(12): 1845-1850.
4. Saravanan, T. and R. Udayakumar, 2013. Optimization of Machining Hybrid Metal matrix Composites using desirability analysis, Middle-East Journal of Scientific Research, ISSN:1990-9233, 15(12): 1691-1697.

5. Thooyamani, K.P., V. Khanaa and R. Udayakumar, 2013. Weed control system of tea garden using GIS based database Management system, Middle-East Journal of Scientific Research, ISSN:1990-923315 (12): 1702-1706.
6. Udayakumar, R., V. Khanna, T. Saravanan and G. Saritha, 2013. Cross Layer Optimization For Wireless Network (Wimax), Middle-East Journal of Scientific Research, ISSN:1990-9233, 16(12): 1786-1789.
7. Holland, J., 1975. Adaptation in Natural and Artificial Systems, Aann Arbor, MI:University of Michigan Press.
8. Saravanan, T. and R. Udayakumar, 2013. Optimization of Machining Hybrid Metal matrix Composites using desirability analysis, Middle-East Journal of Scientific Research, ISSN:1990-9233, 15(12): 1691-1697.
9. Thooyamani, K.P., V. Khanaa and R. Udayakumar, 2013. Weed control system of tea garden using GIS based database Management system, Middle-East Journal of Scientific Research, ISSN:1990-923315 (12): 1702-1706.
10. Edwin, S.H. Hou, Nirwan Ansari and Hong Ren, 1994. A Genetic Algorithm for Multiprocessor Scheduling, IEEE Transactions on Parallel and Distributed Systems, 5(2).