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# To Reduce the Execution Time for Image Segmentation Algorithms Using Multi-Core Architecture

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**ABSTRACT:** One of the recent innovations in computer engineering has been the development of multicore processors, which are composed of two or more independent cores in a single physical package. Instead, applications are switching to parallel algorithms to take advantage of multicore system performance. Image processing applications exhibit a high degree of parallelism and are excellent candidates for multicore architectures. This dissertation deals with the utilization of the multicores of the systems. The main objective is to reduce the time of execution and waiting time of a job. To achieve the objectives of this research work, we have implemented image segmentation algorithms using MATLAB. Focus of this research work is to achieve better speedup and efficiency by reducing the execution time and increasing the response time.

## I. INTRODUCTION

### 1.1 Distributed and parallel computing

Distributed computing is the process of aggregating the power of several computing entities, which are logically distributed and may even be geographically distributed, to collaboratively run a simple computational task in a transparent and coherent way, so that they appear as a single centralized system.

**1.2.1 Data Parallel:** In data parallel approach, the data is divided and distributed among the computing units. [10] The main challenge is efficient data decomposition and result composition. The main issue must be considered for efficient parallel execution is load balancing. Image data should be distributed among computing units in such a way that there will be less unnecessary communication among computing units and each unit gets approximately same load.

**1.2.2 Task Parallel:** In task parallel approach, image processing instructions/ low level operations are grouped into tasks and each task is assigned to a different computing unit. An image processing application consists of many different operations.

**1.2.3 Pipeline Parallel:** If image processing application requires multiple images to be processed, then pipeline processing of images can be done. In pipeline processing, images will be in different stages at same time.

### 1.3 Image Segmentation

Image segmentation is the process of partitioning a digital image into multiple segments. [1]. The goal of segmentation is to simplify or change the representation of an image into something that is more meaningful and easier to analyse. The result of image segmentation is a set of segments that collectively cover the entire image, or a set of contours extracted from the image.



Fig1.4: (a)original image (b) segmented imag



## II. LITERATURE SURVEY

**Agrawal, Pankaj, S. K. Shrivastava, and S. S. Limaye [1] (2016)** presented the implementation using the GUI feature of the MATLAB and one best result is selected for any algorithm using the subjective evaluation. This implementation helped to find out the best suitable value of parameters for the segmentation of different types of imagery. One best algorithm has considered for each method of image segmentation.

**Calderero, Felipe, and Ferran Marques [2] (2017)** has proposed a family of unsupervised region merging techniques providing a set of the most relevant region-based explanations of an image at different levels of analysis. These techniques were characterized by general and nonparametric region models, with neither color nor texture homogeneity assumptions, nor a set of innovative merging criteria, based on information theory statistical measures.

**Chowdhury et. al [3](2019)** reported method for image segmentation that combines region growing and edge detection. Existing schemes that use region-based processing provide unambiguous segmentation, but they often divide regions that are not clearly separated. Algorithm begins by using region growing to produce an over-segmented image. better results than the subtraction technique where small curly regions produced by less significant regions in segmentation were not eliminated.

**Felzenszwalb et. al [4] (2020)** addressed the problem of segmenting an image into regions. A predicate was defined for measuring the evidence for a boundary between two regions using a graph-based representation of the image.

## III. PROBLEM FORMULATION

### 3.1 Problem definition

The concept of using more than one computational resource for solving certain time consuming problems seems more interesting and valid. This dissertation work deals with the utilization of the multi-cores of the system. The main objective is to reduce the execution time and waiting time of the users. To achieve this we have used fork and join policy of parallel algorithms which will enable given job to run in parallel so that we can achieve maximum speed up of the cores of multi core system. To achieve objectives of this research work, we have used image segmentation algorithms. Also other image metrics are evaluated for quality measurement of the proposed algorithm.

### 3.2 Objectives

The objectives of this dissertation are:

1. The main objective is to reduce the amount of required time to segment the digital images.
2. This research work deals with the process to collect, analyse and evaluate the digital images to prove the effectiveness and efficiency of proposed strategy.
3. The objective of work is to maximize multicore utilization for image segmentation based parallel algorithms.



IV. PERFORMANCE METRICS

Results of implementation are as follows:

4.1 Watershed Algorithm

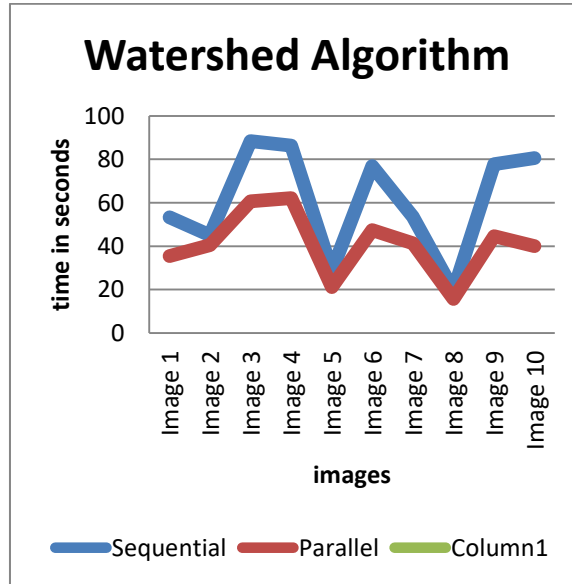


Fig 4.5.4 Execution time of Watershed Algorithm on all images.

4.2 PSNR

Table 4.5.3 shows peak signal to noise ratio (PSNR) of all images

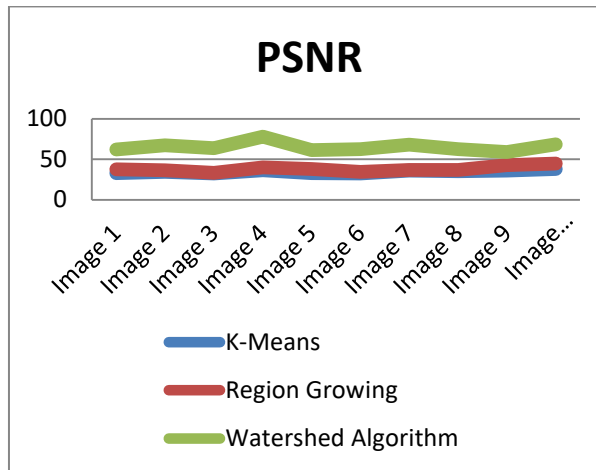


Fig 4.5.5 shows peak signal to noise ratio (PSNR) of all images

### 4.3 MSE

Table 4.5.4 shows mean square error(MSE) of all images

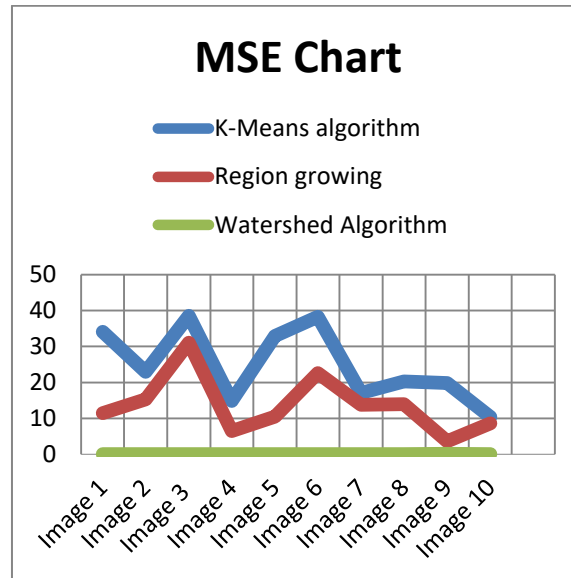


Fig 4.5.6 shows mean square error (MSE) of all images

## IV. CONCLUSION AND FUTURE SCOPE

Image segmentation is one of the important operations on a digital image to represent the objects in the image. This work presents parallel implementation of sequential image segmentation algorithm. Parallel implementation of algorithm is done using MATLAB threads in order to leverage the parallel processing capability of current processors with multiple cores and results prove that the speed up, efficiency, parallel time that is computed is good. Other image parameters are also focused and results are evaluated. The focus of this implementation is to improve the performance of image processing algorithm and maximum utilization of the multicores. In terms of performance, parallel implementation is about 1.5 times faster than the sequential processing. In the future, the intention is to use the same principle of division of work in tiles to calculate more and more parameters and proposed the ways to utilize resources better.

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