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REAL-TIME IMAGE PROCESSING WITH SOFTWARE PARALLELIZATION

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Abstract. *The aim of the paper is to present a software architecture that allows developing applications for real-time parallel image processing. The challenge was that the algorithms for processing real-time low level operations on digital images can be developed and prototyped on both a cluster of desktop PCs and on a multi-core architecture of general purpose graphic processors units (GPGPU, by using a dedicated parallel processing platform model. The validation of this model shows how to use parallelizable patterns and how to optimize the load balancing between the workstations.*

Key words: Biological system modeling, Biomedical informatics, Cancer, Fractals, Tumor growth, Simulation

1. Introduction

Real-time image and video processing systems involve processing vast amounts of image data in a timely manner for the purpose of extracting useful information, which could mean anything from obtaining an enhanced image to intelligent scene analysis. Digital images and video are essentially multidimensional signals and are thus quite data intensive, requiring a significant amount of computation and memory resources for their processing. The amount of data increases if color is also considered. Furthermore, the time dimension of digital video demands processing massive amounts of data per second. One of the keys to real-time algorithm development is the exploitation of the information available in each dimension. For digital images, only the spatial information can be exploited, but for digital videos, the temporal information between image frames in a sequence can be exploited in addition to the spatial information.

The key to cope with this issue is the concept of parallel processing which deals with computations on large data sets. In fact, much of what goes into implementing an efficient image/video processing system centers on how well the implementation, both hardware and software, exploits different forms of parallelism in an algorithm, which can be data level parallelism - DLP or/and instruction level parallelism – ILP [1]. DLP manifests itself in the application of the same operation on different sets of data, while ILP manifests itself in scheduling the simultaneous execution of multiple independent operations in a pipeline fashion.

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