SCIENCE*SPRING*DAY

Departamento de Informática da Faculdade de Ciências e Tecnologia da Universidade Nova de Lisboa

PSE for tomographic data analysis

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Objectives

This work aims to design, implement and evaluate techniques to address computational tasks involving large data sets. The platforms under consideration are desktop computers equipped with accelerators. At the present time we are developing an octree-based data structure dedicated to the management of X-ray microtomography data.

This octree tries to address a major problem posed to computer tomography analysis: the huge amount of data to be processed. Indeed, the extraction, analysis and visualization of material reinforcements is computationally intensive. Hence our objectives will focus in three main areas: a) Parallelization of algorithms; b) Visualization capabilities; c)

Interactive facilities for defining a proper sequence of processing steps.
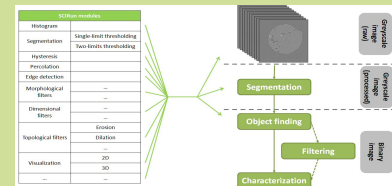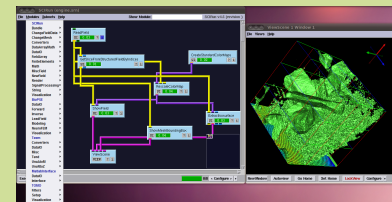
Methodology

We are developing Tomo-GPU, a joint research project undertaken by the research centers CITI and CENIMAT, at FCT/UNL. The system is designed around SCIRun, a toolkit for building Problem Solving Environments (PSE). With Tomo-GPU, a non-specialist in computer science can define a sequence of processing steps in a visual manner, interconnecting modules chosen from a repository.

Tomo-GPU supports 3D image processing and visualization functionalities, tailored to be executed efficiently in desktop PCs equipped with accelerators, mainly GPUs. In order to tackle the problem of processing large datasets but offering user interactivity, the algorithms rely mostly on targeted parallel heterogeneous platforms. Optimized data structures alongside OpenCL

and OpenMP are crucial in that respect.

Expected Results

The pointerless octree we are developing fits the requirements we have set for the project, both in terms of size of data sets and time. We use less memory and we have direct access to the leaves of the octree. Despite such promising achievements we expect major challenges in respect to changing properties of voxels. For example, to change a voxel from particle to non-particle.

These alterations may imply grouping or ungrouping of neighbors in the octree but its representation mismatch 3D spatial data neighborhood

Our current work aims to address the problems posed by dilate and erode operations. This operations needs some knowledge about spacial relations between voxeis, so we need extra data structures to fullfill these requirements.