Grid-Enabled SEE++
A Grid-Based Medical Decision Support System for the Diagnosis and Treatment of Strabismus

http://www.risc.uni-linz.ac.at/research/parallel/projects/agrid/

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Abstract

“Grid-Enabled SEE++” is a software system that deals with the support of diagnosis and treatment of strabismus. Its goal is to adapt and to extend the original SEE++ in several steps and to develop an efficient grid-based tool for “Evidence Based Medicine”, which supports the surgeons to choose the optimal surgery techniques in case of the treatments of certain eye motility disorders. First, we have developed a grid-enabled version of the simulation of a medical examination, by which the pathology of the patient can be estimated. Based on this, we work on a pathology fitting algorithm that attempts to give sufficiently close estimations for the pathological reasons of the disorder. Furthermore, we started to develop a grid-enabled distributed database where both real and simulated pathological cases can be collected, sorted and evaluated for improving both the later pathology fitting calculations and the future medical treatments.

Terminology

· Strabismus is the common name given to usually persistent or regularly occurring misalignment of the eyes where eyes point in different directions such that a person may see double images.

· SEE++ is able to simulate a typical medical examination called Hess-Lancaster test, from which the reason for the pathological situation of the patient can be estimated.

· The outcome of the Hess-Lancaster test consists of two Gaze Patterns of blue points and of red points respectively (see the diagram in the middle of the GUI of SEE++ on Figure 1). The blue points represent the image seen by one eye and the red points the image seen by the simulated other eye. In a pathological situation there is a deviation between the blue and the red points.

· Pathology Fitting: It is possible to give the measured gaze pattern of a patient as input. In this case, SEE++ takes some default or estimated eye data and modifies a subset of them until the calculated gaze pattern of the simulated eye (red points) matches the measured gaze pattern (green points).

I. Web Service and WSRF based medical databases for SEE++

II. Grid-Enabled Hess-Lancaster Test. The Speedup is a factor of 14-17.

III. Preliminary Studies with the Pathology Fitting

Figure 1: The User Interface of the “SEE++ to Grid Bridge” (in front) and the GUI of the SEE++

Figure 2: The Architecture of “Grid-Enabled SEE++” based on Globus 4

Figure 3: Database Access Layer

Figure 4: Parallelization of the Gaze Pattern Calculation

Figure 5: Speedup and Efficiency Diagrams for Gaze Patterns Calculation with 45 points executed on the grid site alpha1.jku.austriangrid.at (64 Intel Itanium processors 1.4GHz)

Figure 6: Benchmark Results for Gaze Patterns with 45 points

Figure 7: The Outcome of the Pathology Fitting: Intended (blue), Measured (green) and Simulated (red) gaze patterns.

Figure 8: A Draft of the Pathology Fitting Algorithm

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