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Grid-enabled SEE++, A Grid-Based Medical Decision Support System for Eye Muscle Surgery

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JKU/RISC currently develops in cooperation with Upper Austrian Research (UAR) the SEE-GRID software system. SEE-GRID is based on the SEE++ software for the biomechanical 3D simulation of the human eye and its muscles. SEE++ simulates the common eye muscle surgery techniques in a graphic interactive way that is familiar to an experienced surgeon. SEE++ is world-wide the most advanced software for this purpose; it is used by various hospitals and medical doctors for surgery training and planning,

SEE++ deals with the support of diagnosis and treatment of strabismus, which is the common name given to usually persistent or regularly occuring misalignment of the eyes. Strabismus is a visual defect in which eyes point in different directions. A person suffering from it may see double images due to misaligned eyes. SEE++ is able to simulate the result of the Hess-Lancaster test, from which the pathological reason of strabismus can be estimated. The outcome of such an examination is two gaze patterns of blue points and of red points respectively. The blue points represent the image seen by one eye and the red pointsthe image seen by the simulated other eye, but in a pathological situation there is a deviation between the blue and the red points.

In SEE++, a third gaze pattern, a measured one (with green points) of a patient can be given 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. This procedure is called pathology fitting. The current algorithm is time consuming and gives only a more or less precise estimation for the pathology of the patient. Doctors

want to see quickly the
results from such a decision support system, but for
reaching adequate response times
it is not sufficient to use only local computational power.

The goal of SEE-GRID is to adapt and to extend SEE++ in
several steps and to develop
an efficient grid-based tool for Evidence Based Medicine,
which supports the surgeons
to choose the best surgery techniques in case of the
treatments of different
syndromes of strabismus. We approach this goal in three phases:

- We have implemented a parallel and grid-enabled version of
  the Hess-Lancaster test
  simulation (it is based on the Globus Toolkit at present).
- We are currently developing a grid-based medical database
  described for storing and
  sorting patient data with gaze patterns and eye data.
- We plan to make a gLite compatible version of SEE-GRID and
  then further develop it
  on the basis of the higher services of the EGEE-II
  middleware (comparedwith the
  low-level services of the Globus Toolkit).
- We will work on a parallel grid-enabled pathology fitter
  algorithm.

References:

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