PROJECT WORK MEDICAL IMAGE VISUALIZATION

The project work is an important component in the course in medical image visualization and constitutes the major part of the examination. Students are expected to work in pairs and spend about half the time devoted to this course (i.e., around 80 hours) on their project.

General information

Goals of the project

The main goal of the project is to design and develop a 3D visualization solution for a medical application. Students must select and adapt the most appropriate methods for medical image visualization for the selected application.

Contents

The project should include:

- 3D visualization
- surface reconstruction and rendering methods
- volume rendering methods
- interaction methods
- fused visualization of different modalities or features
- stereo rendering
- animation
- a GUI for the application

It should focus on a topic of relevance for medical applications of visualization and utilize 3D (or higher) medical image data.

Available data

The data should emanate from some medical imaging modality and preferably be in voxel data format.

At https://grand-challenge.org/challenges, you can get access to a large number of datasets, e.g., coronary vessels, brain tumors, cerebral aneurysms, or knee joint imaging. Although the purpose of each challenge is usually to solve some image analysis problem, you can usually get access to the imaging data without taking part in the competition announced. If you already have access to relevant data, e.g., for your master or bachelor thesis, or other courses, it is perfectly OK to use it. You may also ask people active in relevant research projects at MTH if they can offer you some such data.

Seminar (24th of November)

Before the first seminar, students should write a project proposal and submit it in Canvas one day before the seminar. In the seminar session, students will present their proposals. You will have to refine the project proposal with the feedback received during the session. After approval, you can start working on the implementation of the project.

To be included in the proposal

Design a use case for the project in a clinical environment:

- Describe the need of the visualization tool
- Define the future user(s) of the tool
- Propose a modified clinical pipeline in which your visualization tool will be included
- Include a very short impact analysis. (This must be completed in the final report.)

Motivate the selection of basic tools for the application:

- surface reconstruction & rendering methods
- volume rendering methods
- interaction methods

The application should also provide features for:

- fused visualization of different modalities or features
- stereo rendering
- animation

Seminar

Prepare an oral presentation of 10 min. The main goal of the presentation is to argue for the need for the application you will produce. You should also give some indications on the methods you will be using.

Things to consider:

- Do you have access to the data required for the project?
- Is the data already preprocessed for visualization?
- Get inspiration from chapters 11-21 of Preim & Botha's book
- For the design, you might use the tips discussed in Lecture 2 and Chapter 5of Preim & Botha's book

Final report (10th of January 2022)

Prepare a short report (max. 6 pages) and submit it in Canvas two days before the final presentation. The report should include:

- Motivation of the project
  - Describe the need of the visualization tool
  - Define the future user(s) of the tool
  - Define the additional information that the user will get from the tool. Remember, the project must be more than nice pictures!
  - Describe how the workflow might change for the user by using your tool
  - Describe any preprocessing/postprocessing needed for the tool. Remember that you can assume that you have the data preprocessed, but that has to be considered for its use in a real application.
  - Perform a very short impact analysis. Check Chapter 5 of Preim &Botha's book for this
- Description of the project
  - Describe the main functionalities of the tool
  - Describe the dataset you are using
  - Describe (in rather great detail) the methods used in the application, specifically: data preprocessing, rendering algorithms, fusion methods,interaction methods.
- Results of the project
  - Make a general summary of the findings
  - Give representative examples of visualizations
- Conclusions
  - Formulate a few conclusions that can be drawn from your work, preferably such that can be of use of future students or researchers
  - Discuss the usefulness of your software in a clinical context

It is a requirement that each group shares the project's source code with our teaching assistant (Fabian Sinzinger) using the repository KTH GitHub (https://intra.kth.se/en/it/programvara-o-system/system/kth-github). You will get more info at Lab 3.

Final presentation (12th Jan. 2022)

Prepare a 20 min presentation of your project that includes a live demo. The presentation should include a review of the purpose of the project, describe the available image data and the methods used, and the result presentation should include a live demo of the software. In order to enable stereo presentation, the seminar will be held in the visualization theater (Jonasson theatre) on floor 7 of the MTH building.

Good luck!

Rodrigo, Örjan & Fabian