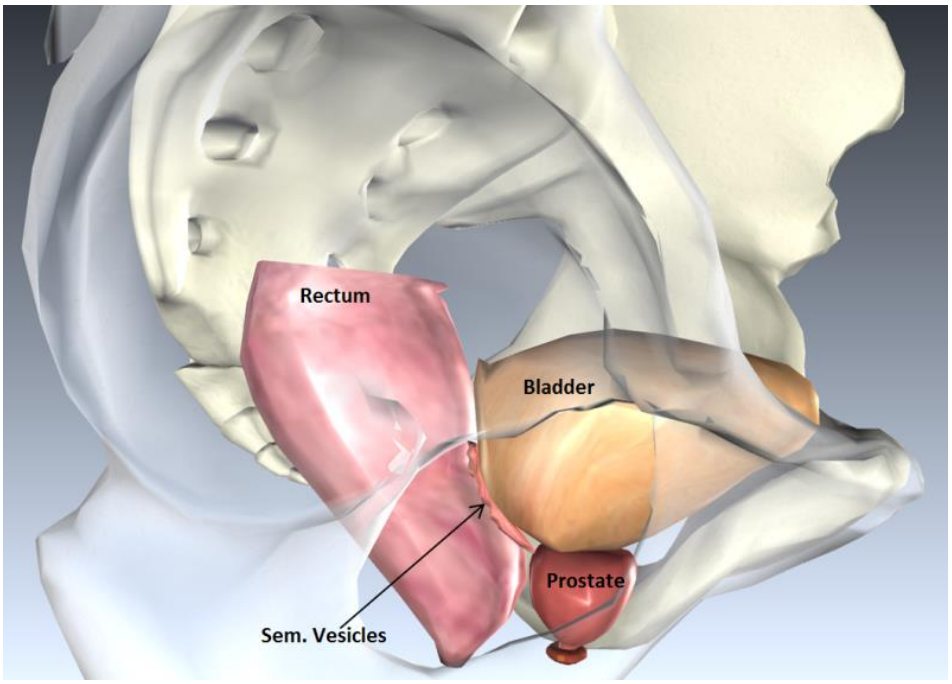
Visual analytics for web-based exploration of segmentation errors in pelvic structures



Introduction

One of the most common treatment techniques of prostate cancer is radiotherapy. In radiotherapy, tumorous tissues are irradiated with a high dose, while the adjacent healthy tissue is preserved. Therefore, high accuracy is required during treatment planning.

One of the preliminary steps of radiotherapy planning requires the segmentation of the prostate and the adjacent organs at risk (i.e. rectum, bladder, seminal vesicles). The model-based delineation of these organs is robust, but not perfect segmentation errors may have detrimental effects on the dosage planning and the final outcome of the procedure. If these errors cannot be minimized, it is at least desirable to convey this information to the clinicians that are involved in treatment planning. Additionally, it would be interesting to explore, whether segmentation errors are related to specific data features.

Project proposal

The project will focus on the development of a web-based visual analytics framework for the exploration of the segmentation errors of pelvic organs (prostate, bladder, rectum and seminal vesicles) in prostate cancer patients. Visual Analytics techniques can be used to gain insight in the relation between the various imaging information and allow a comprehensive exploration of the information space [1-3].

We propose that the application is based on WebGL, a JavaScript API that makes use of the GPU for rendering interactive 2D and 3D graphics within any compatible web browser. Other libraries such as Three.js and d3.js will also need to be employed.

Goal

The goal of this project is to design a comprehensive visualization for the interactive exploration of segmentation errors. Some of the questions we aspire to answer with this visualization are:

- How can we provide a better insight to the user on segmentation errors?
- Which are the underlying relationships, trends or patterns between different features (e.g. errors) of the segmented data?
- Are the data and their underlying features sensitive to the chosen method or to specific parameters of the segmentation?
- Which regions of the segmentation are more certain and which are uncertain?

Execution

The execution of the project comprises the following aspects:

- Literature study: Conduct a literature study on visualization and exploration methods currently or potentially used, to investigate how these methods can support the visual analysis and exploration of the segmentation errors (e.g. [1-3]).
- Wed-based design of the application: Design and implement an easy-to-understand and easy-to-use visualization for the interactive exploration of segmentation errors in the pelvic structures.
- Evaluation: Perform an evaluation to test the effectiveness and efficiency of the proposed method.

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References

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