

Diplomarbeitspräsentation



Comparative Visual Analytics in a Cohort of Breast Cancer Patients

Masterstudium: Medizinische Informatik

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Introduction

The most common cancer among the female population in the economically developed world is breast cancer. To significantly reduce the mortality among affected women an early diagnosis is essential, and also treatment strategies need to be selected carefully. Clinical researchers working on the selection of chemotherapy treatment need to *analyze the progress of the disease* during and after treatment and to *understand how different groups of patients respond* to selected treatments. Currently this is a difficult task because of the multitude of involved (imaging and non-imaging) data, for which adequate visualizations are required. The aim of this work is to *help clinical researchers, who are working on the analysis of the progress of chemotherapy, to understand and explore the multitude of data they have.* To this end, the following three tasks were realized in a web-based framework:

- 1. Functionality for single patient follow-up studies (intra-patient study)
- 2. Functionality to compare two different patients (pairwise inter-patient study)
- 3. Functionality to compare groups of patients (groupwise inter-patient study)

In the examples below, we demonstrate only the latter, as it can be considered an overset of the other two tasks.

Methodology

As an initial step, some preprocessing procedures had to be done, e.g. registration, segmentation and calculation of tumor probability maps. The nonimaging demographic data had to be structured by their relation to the patient, the treatment or the tumor to enable easier querying of the data.





For the selection of the subjects-to-be explored, i.e. a single patient, two patients or two groups, we designed an interactive *selection wheel*, which is dynamically generated according to certain criteria chosen and arranged individually by the user.

The figure is showing a possible selection
wheel, which visualizes the available patients
divided into groups of common properties.
The correlating divisions are highlighted in
similar colors showing their commonality to
each other.

Results

Comparing visualization of tumor segmentation imaging data of two groups of patients, using tumor control probability maps overlaid on a standardized breast.

left: *Boxplots* to visualize and compare tumor volume and longest diameter progress

right:

Radar chart to visualize and compare multivariate nonimaging data of the groups of patients

This screenshot shows an example of



Spotmatrix to visualize nonimaging demographic data both compared to each other and compared to the cohort

Force-directed graph to show relations of non-imaging data and compare quantity of each property within the selected groups Using this framework clinical researchers are able to visually explore and analyze the multitude of both imaging and non-imaging data of a patient and compare patients wihin a cohort, which was not possible before with any available exploratory tools.

the third task groupwise inter-patient study to compare two selected groups of patients to each other by their imaging and non-imaging demographic data. All visualizations are also available in the other two tasks with some minor changes.

All visualizations are interactive. The user has the opportunity to explore the imaging data and has access to further information in the charts following the concept of multiple linked views.

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