Interactive Visual Analytics of Image-Centric Cohort Study Data

TBA

Abstract—Epidemiological population studies impose information about a set of subjects (a *cohort*) to characterize disease specific risk factors. Cohort studies comprise heterogenous data variables describing the medical condition as well as demographic and lifestyle factors of a subject. Using well established statistical methods the data is hypothesis driven analyzed to find statistically significant variable correlations ('*interactions*'). Modern cohort studies also incorporate medical image data. Analyzing these data requires image segmentation, extraction of key figures and shape based subject grouping.
We propose a Interactive Visual Analytics approach that enables epidemiologists to examine both image-based as well as sociodemographic and medical attribute data. It allows for both classical hypothesis validation approaches as well as hypothesis generation by incorporating data mining methods. Adaptive linked information visualization views and 3d-shape renderings are combined with epidemiological techniques. Similarity measures between data variables are used to compute interesting changes in variable interactions for the current variable selection. Shape based grouping of subjects is facilitated using hierarchical agglomerative clustering.

Index Terms—Interactive Visual Analytics, Epidemiology

1 Introduction

2 Medical and Technical Background

Image aquisition
- standardization of MR Scanners

2.1 Epidemiological Workflow

Bernhards Paper

2.2 The Spine Dataset

3 Prior and Related Work

- VMV Paper
- Analysis of data in the Rotterdam study
- VA in Epidemiology Part of Bernhards Paper - Commercial visual Analytics Systems

4 Interactive Visual Analytics in Cohort Study Data

According to Steffens Terminology in Interactive Visual Analysis of Perfusion Data

Object Space
- Medical Image Data / Spine Segmentations

Attribute Space
- SHIP-Variables
- Derived visualizations

? Where to incorporate Levels of IVA

4.1 Feature Localization

- Projection from Image Space to Attribute data. This is more difficult in our application, because we currently only brush on derived features.
- Clustering in Image Space yields Groups which can be analyzed using the attribute space

4.2 Local Investigation

- Selection of Information using Bar Charts, Scatterplots or Parallel Coordinates which projects the selection into the Object space
- this selection is for categorical data already given implicitly bei projecting the 3D-View onto the Bar Charts/Mosaik Plots!
- this aims to locale features of the data!
- Gain Information about SHIP-Variables by putting them into the context of each other. The Pivot Table allows for direct numerical analysis, while the information visualizations allow for better insight of the combination

4.3 Multivariate Analysis

- Selection of Elements in Scatterplots, Barcharts or Parallel Coordinates Views - observe how selection changes another view - this allows for multivariate analysis
- Becker, R.A., Cleveland, W.S.: Brushing scatterplots. Technometrics 29(2) (1987)
- Wang Baldonado, M.Q., Woodruff, A., Kuchinsky, A.: Guidelines for using multiple views in information visualization. In: AVI 00: Proceedings of the working conference on Ad- vanced visual interfaces, pp. 110119. ACM Press, New York, NY, USA (2000). DOI http://doi.acm.org/10.1145/345513.345271 - By brushing individual parameters or create new binnings of parameter it is possible to see how they change in coordinated views. This is already implemented in the Cargo framework
- by creating comparative 3d Visualizations it is possible to assess the influence of non-image parameters to the visual space.

5 Application

6 Summary and Conclusion

Acknowledgments

SHIP is part of the Community Medicine Research net of the University of Greifswald, Germany, which is funded by the Federal Ministry of Education and Research (grant no. 03ZIK012), the Ministry of Cultural Affairs as well as the Social Ministry of the Federal State of Mecklenburg-West Pomerania. Whole-body MR imaging was supported by a joint grant from Siemens Healthcare, Erlangen, Germany and the Federal State of Mecklenburg-Vorpommern. The University of Greifswald is a member of the Centre of Knowledge Interchange program of the Siemens AG. This work was supported by the DFG Priority Program 1335: Scalable Visual Analytics.

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Manuscript received 31 March 2013; accepted 1 August 2013; posted online 13 October 2013; mailed on 4 October 2013.
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