

2011 Workshop on Visual Analytics in Healthcare: Understanding the Physician Perspective

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ABSTRACT

This paper presents a review and summary of the 2011 Workshop on Visual Analytics in Healthcare (VAHC 2011). This was the second annual VAHC workshop and it was held in late October in conjunction with the IEEE VisWeek Conference. The primary goal of the VAHC workshop is to bring together researchers and clinicians to discuss the areas in healthcare that can benefit the most from advances in visualization and analytic systems. This review summarizes the event and provides information on how to access the electronic proceedings. In addition, we seek volunteers who are interested in helping to organize future VAHC workshops.

Keywords

Workshop, Visualization, Informatics, Analytics, Healthcare

1. INTRODUCTION

As hospital organizations, clinics, and private practice offices move to electronic medical records and embrace new health information technology (HIT), the amount of data available to clinicians continues to grow at a rate not seen before. The vast amount of clinical data often captured for every patient poses a challenging task for clinicians trying to make sense of the patient's condition and understand the patient's medical history.

Visualization and visual analytics show great potential as methods to analyze, filter, and illustrate many of the diverse data used in clinical practice. Today, (a) physicians and clinical practitioners are faced with the challenging task of analyzing large amount of unstructured, multi-modal, and longitudinal data to effectively diagnose and monitor the progression of a particular disease; (b) patients are confronted with the difficult task of understanding the correlations between many clinical values relevant to their health; and (c) healthcare organizations are faced with the problem of improving the overall operational efficiency and performance of the institution while maintaining the quality of patient care and safety.

Visualization and visual analytics can potentially provide great benefits to each of these three core areas of healthcare. However, to be successful, the resulting visualization must be able to meet the physician's requirements and be useful for both patients and physicians.

Despite the continuous use of scientific visualization and visual analytics in medical applications, the lack of communication between engineers and physicians has meant that only basic visualization and analytics techniques are currently employed in clinical practice. The goal of this workshop was to gather together leading physicians and clinical practitioners to share with the visualization community their need for specific visualization tools and discuss the areas in healthcare where additional visualization techniques are needed.

The 2011 Workshop on Visual Analytics in Healthcare (VAHC) - Understanding the Physician Perspective [1] was held in conjunction with the IEEE VisWeek Conference [2] on October 23, 2011 in Providence, RI. The workshop provided a unique and valuable opportunity in which participants were able to meet, talk, and showcase their visualization techniques to leading physicians and receive feedback about how their tools can be adapted for use in clinical practice. In addition, throughout the one-day workshop, physicians provided detailed information about areas in healthcare where additional visualization techniques are needed.

The program included three keynote presentations from leading physicians that understand the clinical workflow and also know the significant benefits visual analytic systems can bring to healthcare settings. Furthermore, nine technical papers, four poster presentations, and eight demos were presented throughout the day. In addition, the workshop also included a panel featuring four clinicians.

2. KEYNOTE SPEAKERS

The workshop featured three leading clinicians from the top healthcare organizations in the United States including Harvard Medical School, Keiser Permanente, and John Hopkins University. Each of the featured speakers has extensive experience with healthcare organizations, the clinical workflow, and the steps needed to integrate new health IT into clinical settings.

The first speaker was Dr. Jeffrey L. Schnipper MD, M.P.H. Dr. Schnipper is an Assistant Professor of Medicine at Harvard Medical School, an Associate Physician at Brigham and Women's Hospital (BWH), and the Director of Clinical Research for the BWH Hospitalist Service. During his talk, Dr. Schnipper discussed the importance of medication safety and reconciliation. He discussed how visual analytics has the potential to reduce the number of adverse drug events (ADEs), which currently happens

among 5 - 40% of hospitalized patients and 12-17% post-discharge subjects. He discussed how visual analytics can help with challenges such as changes in medications, rushed events such as emergencies, and inadequate follow-up.

The second speaker was Dr. Joe Terdiman, MD, PhD from Kaiser Permanente. Dr. Terdiman is a research scientist at the Kaiser Permanente Northern California Division of Research and an assistant professor in the School of Optometry at the University of California, Berkeley. Dr. Terdiman is the principal investigator of The Kaiser Permanente National Research Database. During his presentation Dr. Terdiman talked about the extensive amount of clinical data that Kaiser has and how visual analytic tools have the potential to help. Kaiser, the nation's largest nonprofit health plan, has over 8.8 million active members in eight states. His pilot research database consists of 3.2 million active patients and 13 million past members. The database has been designed with consistent, standardized data definitions, terminology and coding. He underscored the necessity of visual analytics frameworks that can allow the clinicians to explore such large collections of clinical information and enable the discovery of new insights about the condition of a patient.

The third keynote speaker was Dr. Paul Nagy, PhD. Dr. Nagy is the Director of Quality at the Russell H. Morgan department of Radiology at Johns Hopkins University. In 2010, Dr. Nagy became the chair of the American Board of Imaging Informatics. Dr. Nagy discussed the importance of using visualization tools to improve the overall clinical workflow. In his presentation he discussed a web-based system he designed to monitor, study, and explore the utilization of radiology imaging rooms. He demonstrated how visualization techniques can be used to monitor the queue of patients, understand what's causing delays, filter the data by equipment failures, technicians, radiologists, nurses, etc... Overall, he demonstrated how clinical informatics can benefit from visualization systems and how visual analytic systems can reduce the cost associated with clinical care.

3. TECHNICAL PRESENTATIONS

The workshop consisted of nine technical papers, four poster presentations, and eight demos. To more effectively disseminate the importance of visual analytics in healthcare setting, VAHC 2011 made the proceedings open access and available through the website www.visualanalyticshealthcare.org.

3.1 Paper Presentations

- Lauro Lins, Marta Heilbrun, Juliana Freire and Claudio Silva, "VisCareTrails: Visualizing Trails in the Electronic Health Record with Timed Word Trees, a Pancreas Cancer Use Case"
- Zhiyuan Zhang, Faisal Ahmed, Arunesh Mittal, Iv Ramakrishnan, Rong Zhao, Asa Viccellio and Klaus Mueller, "AnamneVis: A Framework for the Visualization of Patient History and Medical Diagnostics Chains"
- Kostas Pantazos, "Engaging Clinicians in the Visualization Design Process - Is It Possible?"
- Krist Wongsuphasawat and David Gotz, "Outflow: Visualizing Patients Flow by Symptoms and Outcome"
- Jim DeLeo and James J Cimino, "Clinical Applications of Start Glyphs and Ideas about Crowdsourcing Data Visualization Software"
- Edward Worbis, Raghu Machiraju, Christopher Bartlett and William Ray, "Visual Interactive Quality Assurance of Personalized Medicine Data and Treatment Subtype Assignment"
- Michael J Cairelli and Thomas C. Rindfleisch, "Hierarchical Summarization of Concepts for Visual Discovery Browsing - a Pilot Study"
- Brian Drohan, Curran Kelleher, Georges Grinstein and Kevin Hughes, "Assessing Risks for Families with Inherited Cancers"
- Samar Al-Hajj, Richard Arias, and Brian Fisher, "Interactive Visualization for Understanding and Analyzing Medical Data"

3.2 Poster Presentations

- Patrick Gillich, "Trauma Analysis through Data-Driven Medical Injury Visualization"
- Shareef Dabdoub, Brian Vanderbrink, Sheryl Justice and William Ray, "Quantitating pathogenic biofilm architecture in biopsied tissue"
- Jason Mclaughlin, Qian You, Shiaofen Fang and Jake Y. Chen, "TAO: Terrain Analytic Operators for Expert-Guided Data Mining Applications"
- Halimat Alabi, David Worling and Bruce Gooch, "The (Inter)face of Kalm"

3.3 Demo Presentations

- Anne Wright and Ray Yun, "BodyTrack: Open Source Tools for Health Empowerment through Self-Tracking"
- Lauro Lins, Marta Heilbrun, Juliana Freire, and Claudio Silva, "VisCareTrails: Visualizing Trails in the Electronic Health Record with Timed Word Trees, a Pancreas Cancer Use Case"
- Fransisca Vina Zerlina, Bum chul Kwon, Sung-Hee Kim, Karen S. Yehle, Kimberly S. Plake, Sibylle Kranz, Lane M. Yahiro, and Ji Soo Yi, "Food For The Heart: Visualizing Nutritional Contents for Food Items for Patients with Coronary Heart Disease"
- Jens Kruger and Thomas Fogal, "ImageVis3D Mobile in Clinical Use"
- Zhiyuan Zhang, Faisal Ahmed, Arunesh Mittal, IV Ramakrishnan, Rong Zhao, Asa Viccellio, and Klaus Mueller, "AnamneVis: A Framework for the Visualization of Patient History and Medical Diagnostics Chains"
- Krist Wongsuphasawat, "LifeFlow: Understanding Millions of Event Sequences in a Million Pixels"
- Michael J. Cairelli and Thomas C. Rindfleisch, "Hierarchical Summarization of Concepts for Visual Discovery Browsing"

- Jian Chen, Haipeng Cai, Alexander P. Auchus, "InBox: In-situ Multiple-Selection and Multiple-View Exploration of Diffusion Tensor MRI Visualization"

3.4 Panel: Clinicians@VisWeek

With the goal of starting a conversation between computer scientists and clinicians, the workshop also included a panel of four clinicians that provided specific information about how visualization systems can be incorporated into clinical settings. The panel featured the three keynote speakers and Dr. Marta Heilbrun, MD, MS from the University of Utah. Dr. Heilbrun brought to the panel the radiology point of view and how data visualization systems can also be included within the radiology workflow.

Some of the keypoints discussed during the panel were the cultural gap between IT and medicine and the importance of understanding that gap when working with clinicians. The panelists agree that the clinical data will always have a significant amount of uncertainty and noise. Overall, they prefer web-based tools given that they can be incorporated into the clinical workflow easier than software applications that need specialized libraries and computers.

The clinicians highlighted the importance of software tools that can be incorporated into the clinical workflow. A panelist mentioned that medical practitioners often believe that software applications that are not incorporated into the clinical workflow should not be used when analyzing the history and medical information of a given patient. Instead, many clinicians believe that such tools should only be used for research purposes.

Furthermore, when designing tools, clinicians agreed that it is important to quickly iterate through revisions and understand that most physicians do not respect the concept of beta applications. Finally, when creating the next visualization and analytic tools the panelists agreed that it is also important to consider patients, not just clinicians.

4. Conclusion

As described in this review, VAHC 2011 provided a valuable opportunity for technologists to gather with clinicians and share their work. In its second year, the VAHC workshop served as a successful forum for the discussion of both new solutions and

remaining challenges. The wide variety of content, ranging from panels to papers to live interactive demonstrations, served as the starting point for many conversations that we hope will lead to future innovations in this important area of research.

Looking to the future, we believe that the VAHC workshop will continue to provide a valuable forum for sharing new and emerging research results. We are therefore already at work planning the next VAHC workshop. We invite any clinicians or technologists in the SIGHIT research community that are interested in helping to organize future events to contact us through the workshop website www.visualanalyticshealthcare.org. In addition, we value any comments or suggestions from the community on past or future workshops.

5. REFERENCES

- [1] Visual Analytics in Healthcare, link: www.visualanalyticshealthcare.org
- [2] IEEE VisWeek, link: www.visweek.org

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Jesus J Caban is a Research Scientist at the National Intrepid Center of Excellence at the Naval Medical Center in Bethesda, MD. He's also a guest researcher at the Clinical Center at the National Institutes of Health. His research focuses on multimodal data analysis, visualization systems, image processing, and machine learning. In 2009, he obtained a Ph.D. in computer science from the University of Maryland, UMBC and a Masters degree from the University of Kentucky in 2005.

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