IEEE VisWeek Workshop on
Visual Analytics in Health Care 2010

David Gotz
IBM T.J. Watson Research Center
19 Skyline Drive
Hawthorne, NY 10532

dgotz@us.ibm.com

Jimeng Sun
IBM T.J. Watson Research Center
19 Skyline Drive
Hawthorne, NY 10532

jimeng@us.ibm.com

1. EXECUTIVE SUMMARY

Around the world, tremendous sums of money and time are being spent modernizing the health care ecosystem to improve outcomes and reduce cost. One of the critical hypotheses behind many of these efforts is that the collection of electronic data, such as longitudinal electronic health records (EHRs), will enable tools that provide actionable insights about a patient's condition required to make more intelligent medical decisions. This data-driven vision promises to improve care in facilities ranging from emergency rooms to general practitioner offices.

However, these goals are hampered by many fundamental challenges: overwhelming amounts of data, siloed information repositories with non-standard semi-structured and multi-modal data streams, time-limited practitioners with great domain knowledge but often little statistical training, and large semantic gaps between the raw data that is collected and the information needs of people who are delivering care or conducting effectiveness studies. Solutions to these challenges will require multi-disciplinary visual analytics solutions that combine efforts across the several intersecting research communities: data mining, visualization and visual analytics, medicine, and medical informatics.

The Workshop on Visual Analytics in Health Care was held to help build the community of scientists required to address these challenges. The one day workshop took place on October 24, 2010 and was organized as part of IEEE VisWeek in Salt Lake City, Utah, USA. The program included keynote speakers, technical presentations of novel research, and a student poster session that allowed for informal discussions between workshop attendees.

2. KEYNOTE SPEAKERS

The workshop included two distinguished keynote speakers who addressed both the great opportunities for progress as well as the tremendous challenges that stand in the way. The first speaker was Dr. L. Miguel Encarnação, Director of Consumer Technology Innovation at Humana Inc. and Adjunct Professor of Computer Engineering and Computer Science at the University of Louisville. As an executive at a Fortune 100 company with over 11.5 million customers in the United States, Dr. Encarnação gave a candid overview of the challenges associated with the current healthcare system and practical ways in which visual analytics technology can make a difference. However, he also cautioned that many basic challenges exist even beyond technology ranging from privacy, life styles to the financial incentives. In any technology is to be widely adopted and impact the healthcare ecosystem for the better, these issues must be considered.

The workshop's afternoon sessions were opened by a second keynote talk delivered by Dr. Ben Shneiderman, Professor of Computer Science at the University of Maryland and Founding Director of the University's Human-Computer Interaction Lab. Prof. Shneiderman gave a wonderful talk highlighting several of the successful projects that have emerged from his group's lab. These include the groundbreaking LifeLines work as well more recent systems such as LifeFlow. Perhaps most importantly, Prof. Shneiderman also made a passionate case for more researchers to explore visualization technologies in the context of healthcare, stating that it is one of the areas where we can make the largest impact. He also challenged healthcare insurers/providers to adopt open standards that would allow for far faster progress on technological innovation.

3. TECHNICAL PRESENTATIONS

The workshop program includes seven technical papers and four student posters covering a wide variety of healthcare topics. These ranged from fraud detection in billing to visual analysis frameworks for emergency room clinicians.

3.1 Papers

Following a peer-review process where each submission was reviewed by three experts, seven outstanding research papers selected for inclusion in the workshop's technical program. The accepted papers were submitted by both industry and academic labs, and they covered a broad range of activities. At the workshop, authors from each paper were given 30 minutes for an oral presentation before the floor was opened up to the audience for questions. We are happy to report that a lively discussion took place after most of the paper presentations thanks to a highly engaged and passionate audience.

The papers presented at the workshop were as follows:

- **Qyz: A Platform for Visual Analysis of Error, Abuse, and Fraud in Medical Bills.** Noah Pepper, Homer Strong and Kevin Lynagh

- **Left Ventricle Tracking in CMR Images for Measuring Myocardial Extracellular Volume Fraction.** Hua Zhong, Tim Wong, Christopher G. Meier, Stephen M. Testa, Willima Ceyrolles, Joshua Levenson and Erik Schelbert

- **Integrated Visual Analysis for Heterogeneous Datasets in Cohort Studies.** Martijn Steenwijk, Julien Milles, Mark A. van Buchem, Johan H.C. Reiber and Charl P. Botha

- **Scenario Design for Evaluation of Visual Analytics Tools to Support Pandemic Preparedness and Response.** Shawn Konecni, Georges Grinstein, Loura Costello and Heather Byrne

- **A Visual Analytics Framework for Emergency Room Clinical Encounters.** Zhiyuan Zhang, Arunesh Mittal, Supriya Garg, Alexander E. Dimitriyadi, IV Ramakrishnan, Rong Zhao, Asa Viccellio and Klaus Mueller
- **Spatial Scan Statistics on the GPGPU**. Stephen G. Larew, Ross Maciejewski, Insoo Woo and David Ebert
- **Practical Visualization of Multivariate Time Series Data in a Neonatal ICU.** Christoph U. Lehmann, Patricia Ordóñez Rozo, Jim Fackler and Kathryn Holmes

3.2 Student Posters

In addition to the technical paper program, the workshop included four student posters that were presented during an after-lunch coffee and dessert reception. The reception, sponsored by IBM Research, was designed to highlight the research being conducted by some of the field's emerging leaders and to provide an opportunity for networking between workshop participants. IBM Research also generously awarded each of the student poster presenters a $500 travel award to help them attend the workshop.

4. CONCLUSIONS

While the Workshop on Visual Analytics in Health Care was a success, it only marks the beginning. As electronic healthcare data proliferates and medical science advances, the challenges faced by healthcare workers continue to grow. For this reason, the 2010 workshop is envisioned as only the first of many with more to come in the years ahead.

For more information about the workshop or to download electronic copies of the presented papers, please visit the workshop's web site: http://research.ihost.com/vahc2010/

About the authors:

David Gotz is a Research Staff Member at IBM's T.J. Watson Research Center in New York. He has been at IBM since 2005 after receiving his Ph.D. in computer science from the University of North Carolina at Chapel Hill. His research focuses on visual analytics, visualization, intelligent user interfaces, graphics, and multimedia systems. At IBM Research, he is part of the Healthcare Transformation Research Group.

Jimeng Sun is a Research Staff Member at IBM's T.J. Watson Research Center in New York. He has been at IBM since 2007 after receiving his Ph.D. in computer science from Carnegie Mellon University. His research focuses on data mining, especially large-scale data analysis in high dimensional data. At IBM Research, he is part of the Healthcare Transformation Research Group.