

THE 9TH WORKSHOP ON VISUAL ANALYTICS IN HEALTHCARE

VAHC 2018



NOVEMBER 3, 2018
SAN FRANCISCO
AMIA Pre-symposium Workshop

VAHC 2018 (9th workshop on Visual Analytics in Healthcare)

	Time	Title	Author(s)
Morning Session I	Introduction & Keynote		
	07:30 - 08:30	Preparation (posters up)	All poster presenters
	08:30 - 08:35	Welcome and Introduction	Jeremy Warner, Annie Chen, and Danny Wu
	08:35 - 09:20	Keynote <i>“NLM and Visual Analytics: A Partnership for Discovery and Engagement”</i>	Patti Brennan Director of NLM
	Technical Paper Presentations #1 (Chair: Carolyn Petersen)		
	09:20 - 09:40	Paper 1: Reference Range Number Line Format Preferred by African American Adults for Display of Asthma Control Status	Adriana Arcia and Maureen George
	09:40 - 10:00	Paper 2: Visual Cohort Queries for High-Dimensional Data: A Design Study	Wanchen Zhao, David Borland, Arlene Chung, and David Gotz
Poster/Break	10:00 - 10:30	Coffee break & Poster presentation	
Morning Session II	Technical Paper Presentations #2 (Chair: Carolyn Petersen)		
	10:30 - 10:50	Paper 3: Ontology-Based Interactive Visualization of Patient-Generated Research Questions	David Borland, Laura Christopherson, and Charles Schmitt
	10:50 - 11:10	Paper 4: Composer: Visual Cohort Analysis of Patient Outcomes	Jennifer Rogers, Nicholas Spina, Ashley Neese, Rachel Hess, Darrel Brodke, and Alexander Lex
	11:10 - 11:30	Paper 5: A Case Study on Visual Analytics for Optimizing Drug Duplicate Alerts in a Medication Clinical Decision Support System	Jaehoon Lee, Wendi Record, and Nathan Hulse
	11:30 - 11:50	Paper 6: Finding the Humanity in Healthcare Data: Visualization for Communicating Health	Benjamin Watson
Break	12:00 - 1:00	Lunch break (lunch is on your own)	
Afternoon Session I	Design Challenge (Chair: John Manning)		
	13:00 - 13:15	Team 1: Jointly Visualizing Patient-Generated and Clinic Blood Pressure Readings	Swaminathan Kandaswamy, Jenna Marquard, and Barry Saver
	13:15 - 13:30	Team 2: Design Concept of an Information System for the Intuitive Assessment of Laboratory Findings	Alexander Oeser, Jan Gaebel, Juliane Müller, and Stefan Franke
	13:30 - 13:45	Team 3: Mapping and Visualizing Demographic Information in Structured and Unstructured Clinical Data	Clair Kronk and Danny Wu
	13:45 - 14:00	Team 4: Visual Evidence: Increasing Usability of Systematic Reviews in Health Systems Guidelines Development	Connor Smith, Rebecca Jungbauer, and Annette Totten

VAHC 2018 (9th workshop on Visual Analytics in Healthcare)

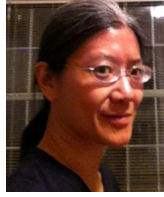
	Time	Title	Author(s)
Afternoon Session I	Design Challenge, cont. (Chair: John Manning)		
	Time	Title	Author(s) and Presenter(s)
	14:00 - 14:15	Team 5: Diabetes Mobile Care: Visualization and Prediction of Data from Multiple Mobile Health Technologies	Ryan Shaw, Qing Yang, Daniel Hatch, Ellie Wood, and Meilin Jiang
	14:15 - 14:30	Team 6: A Matrix Visualization system to Identify Factors Affecting Mortality Rate	Ayushi Gupta, Veera Raghavendra Chikka, and Kamalakar Karlapalem
Poster/Break	14:30 - 15:00	Coffee break & Poster presentation	
Afternoon Session II	Ignite-style System Demonstrations (Chair: Annie Chen)		
	15:00 - 15:07	Demo 1: Identifying and Tracking Unapproved Joint Commission Abbreviations in the EHR using Tableau at UAB	Daniel Heisler, Abrar Qadri, Richard Pockman, Lori Silva and Geoff Gordon
	15:07 - 15:14	Demo 2: Optimizing PQRS metrics and CMS Incentive Payments using Dashboards	Daniel Heisler, Danny Potts, Lauren Mayes, Subhash Reddy, Muhammad Khan, Geoff Gordon, and Randy Tims
	15:14 - 15:21	Demo 3: Signaling Sepsis: Novel Data Collection of Diagnostic Mental Models	Kristen Miller, Joseph Blumenthal, Laura Schubel, Robin Littlejohn, Muge Capan, Ryan Arnold, Kendall McKenzie, Ella Franklin, F. Jacob Seagull, Ken Catchpole, and Russell Branaghan
	15:21 - 15:28	Demo 4: CoCA: Visualizing Complex Cases	Daniel Gruen, Panagiotis Karampournotis, Ahana Sheshandri, Noor Fairoza, and Amar Das
	15:28 - 15:35	Demo 5: A Clinical Visual Analytics Tool for Checking Conformance of Treatment Program	Veera Raghavendra Chikka and Kamalakar Karlapalem
	15:35 - 15:42	Demo 6: Longitudinal Visual Analytics for Unpacking the Cancer Journey	Zhou Yuan, Sean Finan, Jeremy Warner, Guergana Savova, and Harry Hochheiser
	Closing (Chair: Jeremy Warner)		
	15:45 - 16:00	Design Challenge Winners Announcement	John Manning & The Judges
	16:00 - 16:20	Workshop Feedback	
	16:20 - 16:30	End of Workshop	

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Organizing Committee



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Co-chair
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Carolinas Health Care



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NICoE, Walter Reed National Military
Medical Center



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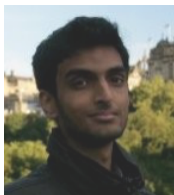
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Swaminathan Kandaswamy
PhD Candidate
Student committee member
UMASS Amherst

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Keynote

08:35 – 09:20



Dr. Patricia Flatley Brennan

Director of National Library of Medicine

Title: NLM and Visual Analytics: A Partnership for Discovery and Engagement

Dr. Brennan is the director of the National Library of Medicine (NLM). Before joining NLM, she is the Lillian L. Moehlman Bascom Professor, School of Nursing and College of Engineering at the University of Wisconsin-Madison. Dr. Brennan also leads the [Living Environments Laboratory](#) at the [Wisconsin Institute for Discovery](#), which develops new ways for effective visualization of high dimensional data. A recipient of many awards, Dr. Brennan is a past-President of the American Medical Informatics Association, a member of the National Academy of Medicine (formerly the Institute of Medicine), and a fellow of the American College of Medical Informatics, the American Academy of Nursing, and the New York Academy of Medicine.

- [NIH News Releases 2016](#)

VAHC 2018 (9th workshop on Visual Analytics in Healthcare)

Technical Paper Presentations #1

09:20 – 10:00

Paper 1: Reference Range Number Line Format Preferred by African American Adults for Display of Asthma Control Status

Adriana Arcia, PhD, RN¹, Maureen George, PhD, RN, AE-C, FAAN¹

¹Columbia University School of Nursing, New York, NY, US

Abstract: *Optimal asthma self-management requires an accurate understanding of one's asthma control status. Tailored infographics are a promising way of conveying status information but little is known about which formats are effective at supporting comprehension while also being appealing to African American adults. In this focus group study, we compared two formats to display Asthma Control Questionnaire (ACQ) scores: a stoplight graphic and a reference range number line (RRNL). Both formats supported comprehension but the RRNL was strongly preferred for its informativeness and for cueing participants to consider the self-management strategies they should undertake to improve their asthma control. The RRNL format may have broad appeal and can be adapted to numerous clinical variables for patient-facing displays, as in patient portals. However, until viewers are familiar with the format, use as a communication tool in the context of a clinical visit is recommended to forestall undue alarm over abnormal/out-of-range values.*

Paper 2: Visual Cohort Queries for High-Dimensional Data: A Design Study

Wanchen Zhao, MSIS¹, David Borland, PhD², Arlene E. Chung^{3,4}, MD, MHA MMCI, David Gotz, PhD^{1,3}

¹School of Information and Library Science, ²RENCI, ³Carolina Health Informatics Program, ⁴School of Medicine, University of North Carolina, Chapel Hill, NC, USA

Abstract: *The large collections of electronic health data gathered by modern health institutions are increasingly being leveraged as a source of real-world evidence within population health studies. Cohort selection is a critical first step in these studies. However, querying for patient data within complex medical databases can be challenging due to two key concepts: (1) the high-dimensionality of medical data, and (2) the temporal nature of many queries (e.g., "patients with a specific medical procedure within X days after diagnosis"). Visual interfaces which enable non-technical experts to define queries of this type are available in systems such as the widely used i2b2 platform. However, using such tools to retrieve a satisfactory cohort for a given study remains difficult, typically requiring users to employ an iterative cohort refinement process using multiple queries. This paper reports results from a formative design study aimed at gaining a better understanding of the iterative query process, identifying challenges faced by users as they define cohorts, and gathering feedback on a preliminary design for a novel interactive visual query interface.*

Technical Paper Presentations #2

10:30 – 11:50

Paper 3: Ontology-Based Interactive Visualization of Patient-Generated Research Questions

David Borland, PhD¹, Laura Christopherson, PhD¹, Charles Schmitt, PhD²

¹RENCI, University of North Carolina at Chapel Hill, Chapel Hill, NC, USA; ²National Institute of Environmental Health Sciences, Durham, NC, USA

Abstract: *Crohn's disease and colitis are chronic conditions that affect every facet of patients' lives (e.g., social interaction, family, work, diet, and sleep). Thus, treatment consists largely of disease management. The University of North Carolina at Chapel Hill chapter of the Crohn's and Colitis Foundation-IBD Partners-has created an interactive website that, in addition to providing helpful information and disease management tools, provides a discussion forum for patients to talk about their experiences and suggest new lines of research into Crohn's disease and colitis. In order to help researchers and physicians better understand how patients think about their conditions and what research questions these patients would like the researchers to pursue, we have created an interactive visualization tool that incorporates an ontology describing the major themes and topics in the discussion forum. The tool employs linked views of (a) the ontology, (b) a research topic overview clustered by relevant ontology terms, and (c) a detailed view of the discussion forum content. In this paper we describe the creation of the ontology, discuss visualizations and interactions enabled by the visualization tool, provide an example scenario using the tool, and discuss limitations and future work based on feedback from potential users.*

VAHC 2018 (9th workshop on Visual Analytics in Healthcare)

Paper 4: Composer: Visual Cohort Analysis of Patient Outcomes

Jennifer Rogers¹, Nicholas Spina¹, Ashley Neese¹, Rachel Hess¹, Darrel Brodke¹, Alexander Lex¹

¹University of Utah, Salt Lake City, UT

Abstract: *Visual cohort analysis utilizing electronic health record (EHR) data has become an important tool in clinical assessment of patient outcomes. In this paper, we introduce Composer, a visual analysis tool for orthopaedic surgeons to compare changes in physical functions of a patient cohort following various spinal procedures. The goal of our project is to help researchers analyze outcomes of procedures and facilitate informed decision-making about treatment options between patient and clinician. With Composer, analysts can dynamically define a patient cohort using demographic information, clinical parameters, and events in patient medical histories and then analyze patient-reported outcome scores for the cohort over time, as well as compare it to other cohorts. We describe a usage scenario for use of the tool in a clinical setting.*

Paper 5: A Case Study on Visual Analytics for Optimizing Drug Duplicate Alerts in a Medication Clinical Decision Support System

Jaehoon Lee, PhD^{1,2}, Wendi L. Record, PharmD¹, Nathan C. Hulse, PhD^{1,2}

¹Intermountain Healthcare, Salt Lake City, UT; ²University of Utah, Salt Lake City, UT

Abstract: In this study, we proposed and implemented a visual analytics approach to reduce drug duplicate alerts in a medication clinical decision support system running in our local hospitals. Our approach includes 1) development of a dashboard to provide interactive visualization of time-driven alert data, 2) statistical analysis of effectiveness of duplicate alerts based on behavioral change of physicians by alerts, and 3) process monitoring that enables detection of abnormal patterns in alert generation over time. Based on the tools, we have reduced drug duplicate alerts by removing clinically insignificant alerts (nuisance alert), eliminating duplication between different positions and applications, and detecting broken functions in the decision support system. The results from proof-of-concept implementation shows that the proposed approach could reduce duplicate alerts with increase of alert effectiveness measures: overridden rate and provider behavior change rate.

Paper 6: Finding the Humanity in Healthcare Data: Visualization for Communicating Health

Benjamin A. Watson, PhD¹

¹North Carolina State University, Raleigh, NC, USA

“Wherever the art of Medicine is loved, there is also a love of Humanity” — Hippocrates

Abstract: *Provider-patient communication is crucial in healthcare, and has been overlooked and even harmed in the rush to digitize medicine. Visualization can deliver the meaning of medical data clearly, revitalizing the provider-patient relationship. As evidence of this potential, we review visualization’s historic and rapidly growing communicative role, both broadly and in healthcare. We conclude with several questions that merit further research.*

VAHC 2018 (9th workshop on Visual Analytics in Healthcare)

Design Challenge

13:00 – 14:30

Team 1: Jointly Visualizing Patient-Generated and Clinic Blood Pressure Readings

Swaminathan Kandaswamy¹, Jenna Marquard¹, and Barry Saver²

¹University of Massachusetts, Amherst; ²Swedish Medical Center

Abstract: *Including patient-generated data in the EHR holds significant promise for improving clinical decision making, but some are voicing concerns about the reliability and meaningfulness of the data. By making thoughtful visualization design decisions, we have created a dashboard that allows clinicians to jointly view longitudinal patient-generated and clinic blood pressure data, in a way that supports the reliability and meaningfulness of the data. This approach could be extended to other types of patient-generated data.*

Team 2: Design Concept of an Information System for the Intuitive Assessment of Laboratory Findings

Alexander Oeser¹, Jan Gaebel¹, Juliane Mueller¹, Stefan Franke¹

¹Innovation Center Computer Assisted Surgery, University of Leipzig, Leipzig, Germany

Abstract: *The clinical landscape of IT systems is characterized by a diverse set of specialized applications. Apart from embedded hardware-specific solutions that are tailored for one specific use-case, hospital information systems (HIS) include a much broader feature-set and aim to support various aspects of daily clinical routine. However, based on their wide scope, those systems often lack a dedicated optimization of information representation, e.g. by proper implementation of visualization. This results in an excessive use of plain key-value pairs that need to be processed and evaluated by the respective user. The implementation of visualization is able to address those issues by allowing quick and easy access to data and the contained information. We have developed a design-oriented concept for an evaluation system for laboratory findings using different charting methods as well as an intuitive navigation throughout the interface.*

Team 3: Mapping and Visualizing Demographic Information in Structured and Unstructured Clinical Data

Clair A. Kronk, BSc¹, Danny T. Y. Wu, PhD, MSI¹

¹Department of Biomedical Informatics, University of Cincinnati, Cincinnati, Ohio

Abstract: *Demographic information—race, age, gender, etc.—is becoming increasingly vital in medical care in the context of social determinants of health (SDOHs). However, not many electronic health record (EHR) systems include systematic methods of collecting, managing, and utilizing such information. Here, we present a way to glean SDOH data from clinical notes and present it in an aesthetically pleasing manner. In our application, Intersect, we allow identification and visualization of values such as gender identity, sex assigned at birth, sexual orientation, family status, and ethnicity. This allows researchers to pan through clinical notes to create viable test populations and identify potential risk factors.*

Team 4: Visual Evidence: Increasing Usability of Systematic Reviews in Health Systems Guidelines Development

Connor J. Smith, BS¹, Rebecca Jungbauer, DrPH¹, and Annette Totten, PhD

¹Pacific Northwest Evidence-based Practice Center, Department of Medical Informatics and Clinical Epidemiology, OHSU, Portland, OR

Abstract: *Integration of evidence from systematic reviews is an essential step in the development of clinical guidelines. Due to the complex nature of the content and presentation of some systematic reviews, committees tasked with developing evidence-based guidelines may struggle to take full advantage of the available data. Current practice for reporting is a static text report with a structure that is highly fixed and often impedes investigation of selected results or subgroups. Thus, there exists a need for an alternate report modality that facilitates the “slicing and dicing” of results to match different end-users’ queries. We developed a dynamic visualization of data from a completed systematic review using the commercial product Tableau and assess its potential to permit customized inquiries. The use of interactive, accessible data may aid decision makers in developing evidence-based practice changes.*

VAHC 2018 (9th workshop on Visual Analytics in Healthcare)

Team 5: Diabetes Mobile Care: Visualization and Prediction of Data from Multiple Mobile Health Technologies

Ryan J Shaw, PhD, RN¹, Qing Yang, PhD¹, Daniel Hatch, PhD¹, Ellie Wood¹, Meilin Jiang, BS¹

¹Duke University

Background: Patients with type II diabetes mellitus (T2DM) and their care providers are burdened with monitoring complex health data to manage the illness effectively. Patients with T2DM and their providers must monitor blood glucose and HbA1c, laboratory values, weight, medication adherence, and lifestyle behaviors for successful disease management. Because T2DM is an illness that requires daily management, the majority of care must be performed by patients themselves. Mobile health (mHealth) technologies have the potential to revolutionize self-management and personalized care for T2DM patients by reducing the risk of escalations through constant data monitoring via smartphone apps and other mobile technologies.

The addition of mHealth technologies increases the amount of complex health data that patients and providers have to synthesize and interpret meaningfully. User-centered visualizations simplify the interpretation process by presenting information in an accessible way. However, when assessing a typical electronic health record, basic patient data is rarely visualized. Particularly, there is a lack of intensive longitudinal data akin to the data generated by mobile health devices.

Team 6: A Matrix Visualization system to Identify Factors Affecting Mortality Rate

Ayushi Gupta¹, Veera Raghavendra Chikka¹ and Kamalakar Karlapalem¹

¹International Institute of Information Technology, Hyderabad, Telangana, India

Abstract: In this paper, we present a system that visualizes the effect of parameters (such as demographic features, physical features, and medications) on mortality rate using two-dimensional matrix visualization. We take a list of conditional statements as input. These conditional statements divide the patients cohort into different sets. Size of a set is proportional to the number of patients. Comparing the size of two sets under the same constraints (conditional statements) but different expiry flag helps the user in understanding the effect of parameters on the mortality rate. We demonstrate the usefulness of our approach on a publicly available database - MIMIC-III. Our results show that the developed system can be used to validate and visualize the parameters affecting the mortality rate.

Design Challenge Judges:



Adriana Arcia, PhD, RN (Assistant Professor of Nursing at Columbia University): Dr. Arcia's research focuses on consumer health informatics, patient education, low health literacy as a health disparity, information visualization, women's preferences and decision making about childbirth, normal physiologic childbirth, and planned home birth. More here: <http://nursing.columbia.edu/profile/aarcia>.



Harry Hochheiser, PhD (Associate Professor of Biomedical Informatics at the University of Pittsburgh): Dr. Hochheiser's research covers a range of topics, including human-computer interaction, information visualization, bioinformatics, universal usability, security, privacy, and public policy implications of computing systems. More here: <https://www.dbmi.pitt.edu/person/harry-hochheiser-phd>.



David Kreda, BA (SMART Project Translation Advisor, <https://smarthealthit.org>): Mr. Kreda has worked extensively with electronic medical record systems, medical informatics research, app design, medical data quality and interoperability. In his earlier career in quantitative finance, risk management/trading systems, on-line trading systems, and workflow systems, he had wide-ranging roles in business management and business start-ups.



Lucila Ohno-Machado, MD, PhD, MBA (Professor of Medicine and Chair of Biomedical Informatics at the University of California, San Diego): Dr. Ohno-Machado is the outgoing editor-in-chief of JAMIA, where she has served since 2010. At UCSD, she is associate dean for informatics and technology and has experience leading multidisciplinary projects at the intersections of biomedicine and quantitative sciences. Her research group focuses on biomedical pattern recognition from large data sets, statistical learning, and privacy technology.

VAHC 2018 (9th workshop on Visual Analytics in Healthcare)

Ignite-style System Demonstrations

15:00 – 15:42

Demo 1: Identifying and Tracking Unapproved Joint Commission Abbreviations in the EHR using Tableau at UAB

Daniel Heisler, MBA¹, Abrar Qadri¹, Lori Silva, RN, MSHI¹, Richard Pockman¹

¹University of Alabama at Birmingham

Abstract: During a previous Joint Commission visit to the University of Alabama at Birmingham, the surveyors noticed the prevalence of incorrect abbreviations used in clinical documentation by UAB physicians. Most of these occurrences were within free text notes in the Cerner Electronic Health Record (EHR). As this is non-discrete data, mining these infractions proves very difficult. The UAB Enterprise Data Warehouse (EDW) team developed a solution to identify incorrect abbreviations with the intention of decreasing their future presence in the EHR. Using a combination of Java, Oracle, and Tableau, the EDW team developed an analytics dashboard for users to identify physicians that are violating abbreviation standards as well as the analytics around the different components of the EHR that could be optimized in order to prevent future violations. The result is an interactive Tableau dashboard that displays trends in incorrect abbreviations, providers, and components (notes and forms) of the EHR that are prone to abbreviation violations. This demo will consist of walking through the Tableau dashboard and talking about its effectiveness within the organization.

Demo 2: Optimizing PQRS metrics and CMS Incentive Payments using Dashboards

Daniel Heisler, MBA¹, Danny Potts, MBA¹, Lauren Mayes¹, Subhash Reddy¹,
Muhammad Khan¹, Geoff Gordon, MSEE¹

¹University of Alabama at Birmingham

Abstract: The Physician Quality Reporting System (PQRS) is a reporting program encouraging physicians and group practices to report on a series of selected measures defined by the Center for Medicare and Medicaid Services (CMS). The goal of this program is to improve care across the spectrum of ambulatory services. This program also offers financial incentives in the form of payment adjustments based upon participation and a scoring algorithm. UAB was a participant in the Group Practice Reporting Option (GPRO) under PQRS until the recent transition to the Merit-based Incentive Payment System (MIPS). The UAB Enterprise Data Warehouse Team (EDW) was asked to create a PQRS dashboard that has attributed to positive payment adjustments from CMS including incentive payments and was related to process improvement activities across the ambulatory setting for improved patient outcomes. In addition to the PQRS dashboard the EDW team was also asked to create an Ambulatory Quality Performance Dashboard with additional measures not directly related to PQRS.

Additional information related to PQRS can be found here: <https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/PQRS/index.html>

This dashboard was created using Tableau with data loading nightly from a variety of data sources in order for physicians to review and monitor to improve quality of patient care. The Ambulatory Quality Performance Dashboard is loaded monthly with additional measures for physician review and compliance.

Demo 3: Signaling Sepsis: Novel Data Collection of Diagnostic Mental Models

Kristen E. Miller, DrPH, CPPS¹, Joseph Blumenthal¹, Laura Schubel¹, Robin Littlejohn, MS¹, Muge Capan, PhD², Ryan Arnold, MD, MS³, Kendall McKenzie⁴, Ella Franklin, RN¹, F. Jacob Seagull, PhD⁵, Ken Catchpole, PhD⁶, Russell Branaghan, PhD⁷

¹National Center for Human Factors in Healthcare, MedStar Health, Washington DC, USA; ²Lebow College of Business, Drexel University, Philadelphia, Pennsylvania, USA; ³Department of Emergency Medicine, Drexel University School of Medicine, Philadelphia, Pennsylvania, USA; ⁴Dept. of Industrial & Systems Engineering, North Carolina State University, Raleigh, NC, USA; ⁵Department of Learning Health Sciences, University of Michigan, Ann Arbor, MI, USA; ⁶Clinical Practice and Human Factors, Medical University of South Carolina; ⁷Arizona State University, Mesa AZ USA

Introduction: A patient arrives in the Emergency Department and then there is questioning, tests are ordered, and a diagnosis is established; a treatment plan is set in place and upon following medical recommendations, the patient's condition improves. That is a common, albeit ideal, course of events. In healthcare, however, this process

VAHC 2018 (9th workshop on Visual Analytics in Healthcare)

is complex and requires knowledge of the evidence-base, human cognition, pattern matching, and clinical reasoning. Diagnosis has important implications for patient care, research, and policy.

Diagnosis has been described as both a process and a classification scheme, or a “pre-existing set of categories agreed upon by the medical profession to designate a specific condition”. When a diagnosis is accurate and made in a timely manner, a patient has the best opportunity for a positive health outcome because clinical decision making will be tailored to a correct understanding of the patient’s health problem. Little is known about how evidence-based knowledge is integrated into clinician mental models that often underlie human decision-making. A fuzzy cognitive map is a cognitive map within which the relations between the elements (e.g. concepts, events, project resources) of a “mental landscape” can be used to compute the “strength of impact” of these elements. Fuzzy-logic cognitive mapping has potential to measure and assess perceptions of sepsis diagnosis both individually and collectively. Taking a human systems engineering approach, the objective of this demonstration is to present a novel data collection tool, leveraging visual analytics as a means to knowledge discovery.

Demo 4: CoCA: Visualizing Complex Cases

¹Laura Schubel, ¹Robin Littlejohn, ¹Joseph Blumenthal, ²Ryan Arnold, ²Muge Capan, ¹Ella Franklin, ³Jacob Seagull, ⁴Ken Catchpole and ¹Kristen Miller

¹MedStar Health; ²Drexel University; ³Department of Learning Health Sciences, University of Michigan; ⁴Clinical Practice and Human Factors, Medical University of South Carolina

Abstract: *We demonstrate work to date on CoCA (Complex Case Assistant), an interactive visualization tool aimed at helping practitioners maintain awareness of the multiple conditions and medications that could be involved in symptoms experienced by their complex patients. The visualization combines information from multiple sources and services, including patient information from their EMR or ingested textual summary, a database of disease-symptom relationships, data from FDA.gov containing drug effects and contraindications, population statistics, and Natural Language Processing (NLP) and Entity Extraction services to enable integration across sources*

Demo 5: A Clinical Visual Analytics Tool for Checking Conformance of Treatment Program

Veera Raghavendra Chikka¹, Kamalakar Karlapalem¹

¹International Institute of Information Technology, Hyderabad, India

Abstract: *Digitalization of healthcare allowed enormous generation of patient records in recent decades. Each patient record contains a treatment program undergone in his/her visit to hospital. It is often unknown whether the treatment program is in accordance with the standard treatment. Checking the conformance would help the quality assurance for the treatment provided. It also helps in resolving the conflicts with patient for treatment program agreement. In this paper, we give a computational representation for the free-text patient record and check the conformance of the treatment program with the standard treatment guidelines. These guidelines are extracted from the publicly available websources, such as, WebMd, Mayo Clinic, and John Hopkins. For each disease, the corresponding treatment guidelines are represented in the form of workflow specification.*

Demo 6: Longitudinal Visual Analytics for Unpacking the Cancer Journey

Zhou Yuan¹, Sean Finan², Jeremy Warner³, Guergana Savova², Harry Hochheiser¹

¹University of Pittsburgh, Pittsburgh, PA, USA; ²Boston Children’s Hospital, Boston, MA, USA; ³Vanderbilt University, Nashville, TN, USA

Abstract: *Retrospective cancer research requires identification of patients matching both categorical and temporal inclusion criteria, often based on factors exclusively available in clinical notes. Although natural language processing approaches for inferring higher-level concepts have shown promise for bringing structure to clinical texts, interpreting results is often challenging, involving the need to move between abstracted representations and constituent text elements. We discuss qualitative inquiry into user tasks and goals, data elements and models resulting in an innovative natural language processing pipeline and a visual analytics tool designed to facilitate interpretation of patient summaries and identification of cohorts for retrospective research.*

VAHC 2018 (9th workshop on Visual Analytics in Healthcare)

Poster Sessions

10:00 – 10:30 and 14:30 – 15:00

Poster 1: A Pan-Cancer Authorship Network Analysis

Tiffany Wu¹, Elizabeth Sigworth², Xuanyi Li², Samuel Rubinstein², and Jeremy Warner, MD, MS²

¹Mount Holyoke College, South Hadley, MA; ²Vanderbilt University, Nashville, TN

Introduction: Progress in the field of hematology/oncology is mediated primarily through the publication of practice-changing clinical trials. Individual researchers typically specialize in their research and publish in one subfield. We established measures of an author's impact as well as the diversity of their publications across cancer subfields to generate a weighted network, which provides a novel method for visualizing an author's significance and offers insight into the links between researchers across this rapidly evolving field.

Poster 2: P3 — Partition, Pivot, and Prune: Aggregated Semantic Graphs for Analyzing Medical Terminologies

Sigfried Gold, MFA, MA¹, Harry Hochheiser, PhD², Richard D. Boyce, PhD², Niklas Elmqvist, PhD¹

¹University of Maryland, College Park, MD, USA; ²University of Pittsburgh, PA, USA

Motivation: A controlled medical terminology is a systematically organized and machine-readable collection of medical concepts, terms, and codes used to record clinical information, such as observations, diagnoses, treatments, pharmaceuticals, and tests. These terminologies—ICD-10-CM, LOINC, RxNorm, SNOMED-CT—are central to electronic health records (EHRs) for computer-supported recording of clinical patient data, and have become a cornerstone of health system interoperability. As a result, medical terminologies are not only employed during the practice of care by clinicians, but they are also used by clinical researchers to define in silico virtual cohorts from large EHR databases for the purpose of conducting retrospective studies. However, difficulties in forming queries across multiple, complex medical terminologies present substantial barriers to achieving complete and accurate cohort definitions. Comprehensive terminology systems, like the UMLS Metathesaurus or the OHDSI vocabulary system, bring together multiple, overlapping, sometimes redundant vocabularies, along with crosswalks between them, into collections for general analytic use. Users of a comprehensive terminology system must navigate a forbiddingly large and complex space of terms and relationships to form virtual cohorts. Existing approaches to this problem either force the user to rely on their own knowledge or on published cohort definitions, or to manually traverse the hierarchy using rudimentary search and filter operations based on textual and tabular interfaces. Although visual approaches such as node-link diagrams have been tried for semantic navigation, they have generally been abandoned due to visual clutter. Our goal is to provide clinical researchers with better support for navigating the entire space of terms and relationships.

Poster 3: Signaling Sepsis: Conveying severity through novel alert design

Laura Schubel¹, Robin Littlejohn, MS¹, Joseph Blumenthal¹, Ryan Arnold, MD, MS², Muge Capan, PhD³, Ella Franklin, RN¹, F. Jacob Seagull, PhD⁴, Ken Catchpole, PhD⁵, Kristen E. Miller, DrPH, CPPS¹

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Problem Addressed: The current structure of electronic health record (EHR) systems allows clinical providers to access patient data and make impactful point of care decisions based on their significance. There are a wide range of patient alerts in the EHR that act as clinical decision support (CDS), aimed to assist in the early recognition of patient disorders; however, there are serious shortcomings in existing health information technology for alerting providers in a meaningful way. 1-3 Sepsis, a spectrum of organ dysfunction induced by infection⁴ with increasing incidence, 5-6 provides a unique lens in which we can further modify and evaluate CDS alerts. Clinicians subconsciously forecast each patient's clinical course with every decision they make. Because of this, clinicians are in need of improved EHR alerts to assist in early recognition of sepsis to combat high mortality rates. Currently, time pressure, competing demands, and ambiguous alert design reduce a user's opportunity to detect signals in the face of "noise" and may lead to inadvertent confirmation bias.³⁻⁴ As a result, CDS developers, designers, and users aspire to improve alert management to achieve better acceptance rates and improved care delivery. The objective of our work is to leverage visualization techniques and human factors principals to design novel CDS interfaces of validated sepsis scores to support outcome forecasting and prediction.

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Poster 4: Usability Testing of an Interactive Surgical Dashboard in a Large Congenital Heart Disease Center

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Abstract: *Large sets of clinical data present an enormous opportunity to support clinical decision making and to improve care quality, but cannot be fully utilized without interactive data visualization and dashboards. In this study, we conducted a formal usability testing to validate the design of a new interactive surgical outcomes dashboard to demonstrate its effectiveness and to seek opportunities for improvement.*