BIOGRAPHICAL SKETCH

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NAME: Rehm, Gregory Boyd

eRA COMMONS USER NAME (credential, e.g., agency login): gbrehm

POSITION TITLE: Graduate Student, ORISE Fellow

EDUCATION/TRAINING (Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.)

INSTITUTION AND LOCATION	DEGREE (if applicable)	START DATE MM/YYYY	END DATE MM/YYYY	FIELD OF STUDY
Drew University	N/A	09/2005	05/2007	N/A
Georgia State University	BS	07/2008	05/2010	Mathematics
University of California Davis	MS	09/2015	12/2017	Computer Science
-	PhD (expected)	12/2017	12/2020	Computer Science

A. Personal Statement

I am currently seeking a Computer Science PhD with focus on clinical informatics and providing novel, data driven research for clinicians through collection, processing, and analysis of information from the intensive care unit (ICU). My past experiences as a professional software engineer have left me well-equipped to move into research in clinical informatics. After 3 successful years in industry I desired to return to academia to develop my interest in research. I completed my first major research project in the security field while working with a group at Argonne National Laboratory on improving email privacy. However, when I learned that Dr. Anderson and Dr. Adams were pushing for greater usage of technology to inform better standards of care in the ICU, I found the prospect of this work very compelling. Under guidance from Dr. Anderson and Dr. Adams I further improved my research capabilities and developed a platform for collecting, aggregating, and storing ventilator waveform data (VWD) from patients enrolled in our clinical study. As of the time of writing we have collected mechanical ventilation data for over 500 patients, including data from over 150 patients with acute respiratory distress disorder syndrome (ARDS), in total comprising over 34,000 hours of VWD. Using this data we have created novel heuristic and machine learning algorithms to robustly detect different forms of patient ventilator asynchrony and clinical artifact.

My personal research goals are to utilize the collected VWD, and using machine learning, determine whether there are characteristics in waveform data that can discriminate ARDS from other pathophysiologic conditions. This work could be of significant importance to the early detection of ARDS, which could prompt clinicians to deliver lifesaving therapies before the severity of the disease has worsened. The experience and cross-disciplinary knowledge that I will gain from this work will improve the science of how to perform rapid detection of ARDS, and will contribute to my goal of becoming a professor running at an academic medical center. In this role, I will continue to perform multidisciplinary team science at the crossroads or medicine, computer science, and informatics.

1. **Rehm GB**, Kuhn BK, Delplanque JP, Guo E, Lieng M, Nguyen, J., Anderson, N., Adams, J. Development of a Research Oriented System for Collecting Mechanical Waveform Data; *Journal of the American Medical Informatics Association*. 2017 Oct 28
2. Adams JY, Lieng M, Kuhn BK, **Rehm GB**, Guo E, Taylor S, Delplanque JP, Anderson N. Development and Validation of a Multi-Algorithm Analytic Platform to Detect Off-Target Mechanical Ventilation; Scientific Reports. 2017 Nov 3;7(1):14980

3. **Rehm GB**, Thompson M, Busenius B, Fowler J. (2016, Sept.) "Mobile Encryption Gateway (MEG) for Email Encryption; Proceedings of the 2016 Information Security Research and Education (INSuRE) Conference (INSuRECon-16). [On-line]. Available: https://sites.google.com/a/uah.edu/insurecon16/proceedings [November 22, 2017].

B. Positions and Honors

Employment

Activity	Start Date	End Date	Institution/Company	Location
TESOL Teacher	02/2011	09/2011	Aston English	Hefei, China
TESOL Teacher	10/2011	02/2012	Vancouver Language Center	Guadalajara, Mexico
Software Engineer	03/2012	07/2015	Location Labs	Emeryville, CA
Graduate Student Researcher	10/2015		UC Davis	Davis, CA
ORISE Fellow	07/2017		United States Air Force	Fairfield, CA

Honors

2009 Member, Golden Key Academic Honor Society

C. Contributions to Science

Information security, particularly email security has been a highly visible topic in the news since the 2016 USA Presidential Election. To ensure the security of email we must ensure that the email cannot be read by malicious actors while an email is in transit to its destination, or is in storage waiting to be read. To provide this assurance we must design an application to assist average computer users to successfully encrypt their emails using a cryptographic algorithm. However, many previous attempts to make cryptographically secure email applications user friendly and widely available have failed. For varied reasons, these applications have not reached widespread adoption. The most common issue associated with email encryption applications lies in the difficulty that novice users face when trying to effectively encrypt their email. Yet, even with special training, most average users are still not able to effectively encrypt their email.

My work in this area was intended to address usability deficiencies in email encryption systems. I also helped to create a software architecture that allows for a secure, end-to-end encrypted system that is email-client-agnostic, enabling users to keep their preferred email provider by installing an additional plugin for their browser or email application. I authored one publication in this subject and developed expertise in building systems to cryptographically secure data, and in designing software platforms that could resist intrusion attempts.

1. **Rehm GB**, Thompson M, Busenius B, Fowler J. (2016, Sept.) "Mobile Encryption Gateway (MEG) for Email Encryption; Proceedings of the 2016 Information Security Research and Education (INSuRE) Conference (INSuRECon-16). [On-line]. Available: https://sites.google.com/a/uah.edu/insurecon16/proceedings [November 22, 2017].

As part of an interdisciplinary lab focused on the application of informatics technologies in the intensive care unit, I have assisted Dr. Jason Adams (Health Informatics/Critical Care Medicine), and Dr. Nicholas Anderson (Chair of Health Informatics), for the past 2 years. Mechanical ventilation (MV) is a lifesaving intervention for patients with acute respiratory failure in the intensive care unit, but MV can be harmful and even fatal if delivered inappropriately. Synchronous interactions between patient and mechanical ventilator are thought to be important to ensuring patient

comfort and optimal clinical outcomes. However, asynchronous breathing may lead to the aforementioned deleterious outcomes.

My work has focused on developing the informatics infrastructure to collect data from mechanical ventilators in a scalable and reliable manner and to assist in the development of novel algorithms to detect pathologic patient-ventilator interactions. Over the past 2 years, I developed expertise in clinical informatics and machine learning, authoring one publication on our work, while assisting in an effort to create heuristic algorithms to identify patient. I currently have one publication pending on the topic of utilizing machine learning to detect injurious patient-ventilator asynchronies.

1. **Rehm GB**, Kuhn BK, Delplanque JP, Guo E, Lieng M, Nguyen, J., Anderson, N., Adams, J.. Development of a Research Oriented System for Collecting Mechanical Waveform Data; *Journal of the American Medical Informatics Association*. 2017 Oct 28
2. Adams JY, Lieng M, Kuhn BK, **Rehm GB**, Guo E, Taylor S, Delplanque JP, Anderson N. Development and Validation of a Multi-Algorithm Analytic Platform to Detect Off-Target Mechanical Ventilation; Scientific Reports. 2017 Nov 3;7(1):14980

D. Additional Information: Research Support and Scholastic Performance
Completed Research Support

UC Davis Clinical and Translational Science Center Chuah (PI) 07/01/2016 - 06/30/2017
Title: "Leveraging Big Data Analytics for Precision Medicine in Critical Care -- Development of Statistical & Machine Learning Methods for Preventing Acute Respiratory Failure Requiring Mechanical Ventilation"

Goal: The goal of this project was to develop machine learning-based analytics to improve the accuracy of classifying off-target mechanical ventilation and to enable prediction of important clinical state transitions such as clinical decompensation. In order to notify doctors to changes in patient state, we also intended to create a phone application that could remotely alert clinicians if a deterioration in patient state was detected.

Role: Graduate Student – I was responsible for developing machine learning models to detect patient ventilator asynchrony, and for developing the data analytics systems to detect clinical decompensation. I also developed a web server for processing streaming VWD so it could be processed and delivered to a phone application

Scholastic Performance

YEAR	SCIENCE COURSE TITLE	GRADE	YEAR	NON-SCIENCE COURSE TITLE	GRADE
	DREW UNIVERSITY				
2005	Principles of Chemistry I	B+	2005	China & The World	A-
2005	Calculus and Analytic Geometry II	A-	2005	History of the Islamic Middle East 600-1800	A-
2006	Principles of Chemistry II	B+	2006	Writing	A-
2005	Calculus and Analytic Geometry III	B+	2006	History of Modern Philosophy	B+
2006	Organic Chemistry I	B-	2006	Introduction to Sociology	B+
2006	Foundations of Higher Mathematics	D	2006	Elementary Modern Standard Arabic	B+
2007	Differential Equations	B+	2006	Elementary Modern Standard Arabic	B+
			2006	Arabic Conversation I	A-
			2006	Economic Principles: Microeconomics	A-
			2007	Intermediate Modern Standard Arabic	B
			2007	Arabic Conversation II	B+
			2007	American Government and Politics	A

YEAR	SCIENCE COURSE TITLE	GRADE	YEAR	NON-SCIENCE COURSE TITLE	GRADE
			2007	Economic Principles: Macroeconomics	A-
	GEORGIA STATE UNIVERSITY				
2008	Discrete Mathematics	A	2008	History of Motion Pictures	A
2008	Bridge to Higher Mathematics	A-	2008	Critical Thinking	B
2009	Introductory Linear Algebra	A	2008	The Global Economy	B+
2009	Optimization	A-	2008	English Composition II	B-
2009	Vector Calculus	A	2008	Comparative Culture	A-
2008	Modern Geometry	A	2008	Human Communication	B-
2009	Partial Differential Equations	A			
2009	Linear Algebra	A			
2009	Analysis I	B+			
2009	Mathematical Statistics I	B+			
2010	Modern Algebra I	A+			
2010	Numerical Analysis II	A			
2010	Analysis II	B			
2010	Senior Seminar	A-			
	UNIVERSITY OF CALIFORNIA DAVIS				
2015	Computational Methods & Synthetic Biology	A	2016	Elementary Chinese	A-
2015	Software Engineering	A			
2016	Security Research I	A			
2016	Operating Systems	A			
2016	Security Research II	A			
2016	Computer Architecture	A			
2016	Computer and Information Security	A			
2017	Programming Languages	A-			
2017	Analysis of Algorithms	B+			

Georgia State University courses are graded from on a 0 – 4.3 scale. A+ = 4.3, A = 4.0, A- = 3.7, B+ = 3.3, B = 3.0, B- = 2.7. At all undergraduate institutions attended a passing grade was regarded as C or higher. At UC Davis the Graduate Group in Computer Science considers a passing grade as B or higher.