JOHN R GOODALL

Senior Research Scientist: Data Science and Visualization Group

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Research Interests

Visual analytics, information visualization, human-computer interaction, computer-supported cooperative work (CSCW), software engineering, distributed systems, streaming analytics, cybersecurity, intelligence analysis, qualitative research methods.

Education

Ph.D.	2006	University of Maryland, Baltimore County (UMBC): Information Systems
M.S.	2003	University of Maryland, Baltimore County (UMBC): Information Systems
B.A.	1998	Binghamton University: History

Refereed Journal Publications

Jeremy E. Block, Shaghayegh Esmaeili, Eric D. Ragan, John R. Goodall, and G. David Richardson. "The Influence of Visual Provenance Representations on Strategies in a Collaborative Hand-off Data Analysis Scenario." IEEE Transactions on Visualization and Computer Graphics, 2022.

Chad A. Steed, John R. Goodall, Junghoon Chae, and Artem Trofimov. "CrossVis: A Visual Analytics System for Exploring Heterogeneous Multivariate Data with Applications to Materials and Climate Sciences." *Computers & Graphics 3*(200013), 2020.

John R. Goodall, Eric D. Ragan, Chad A. Steed, Joel W. Reed, G. David Richardson, Kelly M.T. Huffer, Robert A. Bridges, and Jason A. Laska. "Situ: Identifying and Explaining Suspicious Behavior in Networks." *IEEE Transactions on Visualization and Computer Graphics 25*(1), 2019, 204-214.

Bogdan Czejdo, Erik M. Ferragut, John R. Goodall, and Jason Laska. "Data warehouse for event streams violating rules." *Foundations of Computing and Decision Sciences 38*(2), 2013, 87–96.

Bogdan D. Czejdo, Erik M. Ferragut, John R. Goodall, and Jason Laska. "Network Intrusion Detection and Visualization Using Aggregations in a Cyber Security Data Warehouse." *International Journal of Communications, Network and System Sciences 5*(9a), Scientific Research Publishing Inc., 2012, 593–602.

John R. Goodall. "An Evaluation of Visual and Textual Network Analysis Tools." *Information Visualization 10*(2), SAGE Publications, 2011, 145-157.

John R. Goodall, Wayne G. Lutters, and Anita Komlodi. "Developing Expertise for Network Intrusion Detection." *Information Technology & People 22*(2), Emerald Group Publishing Limited, 2009, 92-108.

John R. Goodall, Wayne G. Lutters, and Anita Komlodi. "Supporting Intrusion Detection Work Practice." *Journal of Information System Security 5*(2), The Information Institute, 2009, 43-74.

Anita D. D'Amico, John R. Goodall, Daniel R. Tesone, and Jason K. Kopylec. "Visual Discovery in Computer Network Defense." *IEEE Computer Graphics & Applications 27*(5), IEEE Press, 2007, 20-27.

John R. Goodall, Wayne G. Lutters, Penny Rheingans, and Anita Komlodi. "Focusing on Context in Network Traffic Analysis." *IEEE Computer Graphics & Applications 26*(2), IEEE Press, 2006, 72-80.

Refereed Conference Publications

Eric Ragan, Andrew Pachuilo, John R. Goodall, and Felipe Bacim. "Preserving Contextual Awareness during Selection of Moving Targets in Animated Stream Visualizations." *Proceedings of International Conference on Advanced Visual Interfaces (AVI)*, 2020. (Honorable Mention Award)

Eric Ragan, Andrew Stamps, and John R. Goodall. "Empirical Study of Focus-Plus-Context and Aggregation Techniques for the Visualization of Streaming Data." *Proceedings of International Conference on Advanced Visual Interfaces (AVI)*, 2020.

Junghoon Chae, Chad A Steed, John R. Goodall, and Steven Hahn. "Dynamic Color Mapping with a Multi-scale Histogram: A Design Study with Physical Scientists." *Visualization and Data Analysis, Society for Imaging Sciences and Technology*, 2019, 680-1-680-13.

Robert A. Bridges, Kelly M. T. Huffer, Corinne L. Jones, Michael D. Iannacone, and John R. Goodall. "Cybersecurity Automated Information Extraction Techniques: Drawbacks of Current Methods, and Enhanced Extractors." *IEEE International Conference on Machine Learning and Applications (ICMLA)*, IEEE Press, 2017, 437-442.

Christopher H. Harshaw, Robert A. Bridges, Michael D. Iannacone, Joel W. Reed, and John R. Goodall. "GraphPrints: Towards a Graph Analytic Method for Network Anomaly Detection." *Proceedings of the 11th Annual Cyber and Information Security Research Conference (CISR)*. ACM International Conference Proceedings Series, 2016.

Eric D. Ragan, John R. Goodall, Albert Tung. "Evaluating How Level of Detail of Visual History Affects Process Memory." *Proceedings of the ACM Conference on Human Factors in Computing Systems (CHI)*, ACM Press, 2015, 2711-2720.

Corinne L. Jones, Robert A. Bridges, Kelly M. T. Huffer, and John R. Goodall. "Towards a Relation Extraction Framework for Cyber-Security Concepts." *Proceedings of the 10th Annual Cyber and Information Security Research Conference (CISR)*, ACM International Conference Proceedings Series, 2015.

Michael Iannacone, Shawn Bohn, Grant Nakamura, John Gerth, Kelly Huffer, Robert Bridges, Erik Ferragut, and John R. Goodall. "Developing an Ontology for Cyber Security Knowledge Graphs." *Proceedings of the 10th Annual Cyber and Information Security Research Conference (CISR)*, ACM International Conference Proceedings Series, 2015.

Eric Ragan and John R. Goodall. "Evaluation Methodology for Comparing Memory and Communication of Analytic Processes in Visual Analytics." *Proceedings of the Fifth Workshop on*

Beyond Time and Errors: Novel Evaluation Methods for Visualization (BELIV), ACM Press, 2014, 27-34.

Robert A. Bridges, Corinne L. Jones, Michael D. Iannacone, Kelly M. Testa, John R. Goodall. "Automatic Labeling for Entity Extraction in Cyber Security." *ASE Third International Conference on Cyber Security*, Academy of Science and Engineering (ASE), 2014.

Bogdan Czejdo, Michael D. Iannacone, Robert A. Bridges, Erik M. Ferragut, and John R. Goodall. "Integration of External Data Sources with Cyber Security Data Warehouse." *Proceedings of the 9th Annual Cyber and Information Security Research Conference*. ACM International Conference Proceedings Series, 2014, 49-52.

Nikki McNeil, Robert A. Bridges, Michael D. Iannacone, Bogdan Czejdo, Nicolas E. Perez, and John R. Goodall. "PACE: Pattern Accurate Computationally Efficient Bootstrapping for Timely Discovery of Cyber-Security Concepts." *International Conference on Machine Learning and Applications (ICMLA)*. IEEE Press, 2013, 60-65

Lane Harrison, Riley Spahn, Michael Iannacone, Evan Downing, and John R. Goodall. "NV: Nessus Vulnerability Visualization for the Web." *Proceedings of the Symposium on Visualization for Computer Security (VizSec)*, ACM International Conference Proceedings Series, 2012, 25-32.

John R. Goodall, Hassan Radwan and Lenny Halseth. "Visual Analysis of Code Security." *Proceedings of the Symposium on Visualization for Computer Security (VizSec)*, ACM International Conference Proceedings Series, 2010, 46-51.

Anita D'Amico, Laurin Buchanan, John R. Goodall and Paul Walczak. "Mission Impact of Cyber Events: Scenarios and Ontology to Express the Relationships Between Cyber Assets, Missions and Users." *Proceedings of the 5th International Conference on Information Warfare and Security (ICIW)*, Thomson Reuters ISI, 2010, 388-397.

John R. Goodall, Anita D. D'Amico and Jason K. Kopylec. "Camus: Automatically Mapping Cyber Assets to Missions and Users." *Proceedings of the Military Communications Conference (MILCOM)*, IEEE Press, 2009.

John R. Goodall. "Visualization is Better! A Comparative Evaluation." *Proceedings of the Workshop on Visualization for Computer Security (VizSec)*, IEEE Press, 2009, 57-68.

John R. Goodall and Mark Sowul. "VIAssist: Visual Analytics for Cyber Defense." *Proceedings of the IEEE International Conference on Technologies for Homeland Security (HST)*, IEEE Press, 2009, 143-150.

John R. Goodall and Daniel T. Tesone. "Visual Analytics for Network Flow Analysis." *Proceedings of the Cybersecurity Applications & Technology Conference For Homeland Security (CATCH)*, IEEE Press, 2009, 199-204.

Kenneth Prole, John R. Goodall, Anita D. D'Amico, and Jason K. Kopylec. "Wireless Cyber Assets Discovery Visualization." *Proceedings of the Workshop on Visualization for Computer Security (VizSec)*, Springer LNCS, 2008, 136-143.

Daniel T. Tesone and John R. Goodall. "Balancing Interactive Data Management of Massive Data with Situational Awareness through Smart Aggregation." *Proceedings of the IEEE Symposium on Visual Analytics Science and Technology (VAST)*, IEEE Press, 2007, 67-74.

John R. Tesone, Wayne G. Lutters, Penny Rheingans, and Anita Komlodi. "Preserving the Big Picture: Visual Network Traffic Analysis with TNV." *Proceedings of the Workshop on Visualization for Computer Security (VizSec)*, IEEE Press, 2005, 47-54.

Anita Komlodi, Penny Rheingans, Utkarsha Ayachit, John R. Goodall, and Amit Joshi. "A User-Centered Look at Glyph-Based Security Visualization." *Proceedings of the Workshop on Visualization for Computer Security (VizSec)*, IEEE Press, 2005, 21-28.

John R. Goodall. "User Requirements and Design of a Visualization for Intrusion Detection Analysis." *Proceedings of the IEEE SMC Information Assurance Workshop (IAW)*, IEEE Press, 2005, 394-401.

John R. Goodall, A. Ant Ozok, Wayne G. Lutters, Penny Rheingans, and Anita Komlodi. "A User-Centered Approach to Visualizing Network Traffic for Intrusion Detection." *Extended Abstracts of the ACM Conference on Human Factors in Computing Systems (CHI)*, ACM Press, 2005, 1403-1406.

John R. Goodall, Wayne G. Lutters, and Anita Komlodi. "I Know My Network: Collaboration and Expertise in Intrusion Detection." *Proceedings of the ACM Conference on Computer-Supported Cooperative Work (CSCW)*, ACM Press, 2004, 342-345.

John R. Goodall, Wayne G. Lutters, and Anita Komlodi. "The Work of Intrusion Detection: Rethinking the Role of Security Analysts." *Proceedings of the Americas Conference on Information Systems (AMCIS),* AIS Press, 2004, 1421-1427.

Anita Komlodi, John R. Goodall, and Wayne G. Lutters. "An Information Visualization Framework for Intrusion Detection." *Extended Abstracts of the ACM Conference on Human Factors in Computing Systems (CHI)*, ACM Press, 2004, 1743-1746.

Books

John R. Goodall, Gregory Conti, and Kwan-Liu Ma (eds.). *Visualization for Computer Security: 5th International Workshop, VizSec 2008*. Springer Lecture Notes in Computer Science Series, Berlin, 2008.

John R. Goodall, Gregory Conti, and Kwan-Liu Ma (eds.). *VizSec 2007: Proceedings of the Workshop on Visualization for Computer Security*. Springer, Berlin, 2008.

Book Chapters

John R. Goodall. "Introduction to Visualization for Computer Security." In John R. Goodall, Gregory Conti, and Kwan-Liu Ma (eds.), *VizSec 2007: Proceedings of the Workshop on Visualization for Computer Security*. Springer, Berlin, 2008, 1-17.

Jason K. Kopylec, Anita D. D'Amico, and John R. Goodall. "Visualizing Cascading Failures in Critical Cyber Infrastructure." In Eric Goetz and Sujeet Shenoi (eds.), *Critical Infrastructure Protection*. Springer, Boston, MA, 2007, 351-366.

Panels, Workshops and Presentations

Goodall, John R. Keynote Address: "Lessons learned from 17 years of VizSec research." IEEE Symposium on Visualization for Cyber Security (VizSec), in conjunction with IEEE VIS, October 27, 2021.

Eric Ragan, Mahsan Nourani, Emily Wall, Aritra Dasgupta, John Goodall, and Kris Cook. Organizing committee for TREX 2020: Workshop on TRust and EXpertise in Visual Analytics, in conjunction with IEEE VIS, October 25, 2020.

Robert A. Bridges, Maria A. Vincent, Kelly M. Huffer, John R. Goodall, Jessie D. Jamieson, and Zachary Burch. "Forming IDEAS Interactive Data Exploration & Analysis System." 4th Workshop on Security Information Workers, 2018.

Laurence Nichols and John R. Goodall. "Log Monitoring and Anomaly Detection at Scale at ORNL." NLIT Summit, May 23, 2018.

Chad Steed, Junghoon Chae, John Goodall, and Steven Hahn. "Improving Scientific Data Analysis Through Multi-touch Enabled Interactive Data Visualization With Applications to Neutron Science." Workshop on Immersive Analytics, 2017.

Laurence Nichols and John R. Goodall. "Situ: Discovering Suspicious Behavior." Elasticsearch Federal User Group meeting, August 16, 2017.

Andrew Pachuilo, Eric Ragan, and John R. Goodall. "Leveraging Interaction History for Intelligent Configuration of Multiple Coordinated Views in Visualization Tools," Logging Interactive Visualizations and Visualizing Interaction Logs Workshop, 2016.

John R. Goodall. "Situ: Discovering Suspicious Behavior in Cyber Security," Invited Talk. DHS S& T Cyber Security Division 2016 R&D Showcase, Washington, D.C., February 17, 2016.

John R. Goodall. "Stucco: Situation and Threat Understanding by Correlating Contextual Observations," Invited Talk. National (Dutch) Cyber Security Research Agenda Symposium, The Hague, Netherlands, June 2, 2014.

Lane Harrison, Jason Laska, Riley Spahn, Michael Iannacone, Evan Downing, Erik M. Ferragut and John R. Goodall. "situ: Situational Understanding and Discovery for Cyber Attacks". *IEEE Symposium on Visual Analytics Science and Technology Challenge Entry*, 2012.

Chad Steed, Thomas Potak, Robert Patton, John R. Goodall, Christopher Maness, and James Senter. "Interactive Visual Analysis of High Throughput Text Streams." Poster & Presentation. *2nd IEEE Workshop on Interactive Visual Text Analytics*, Seattle, WA, October 15, 2012.

John R. Goodall. "Visualization for Text Analysis," Keynote. *Text Mining 2011*, Mesa AZ, April 30, 2011.

John R. Goodall. "Visualization for Cyber Security," Panel: Visual analytics for the security sector. *Visual Analytics Community Consortium Meeting*, College Park MD, August 31-September 1, 2010.

John R. Goodall. "VIAssist: Visual Analytics for Cyber Defense," Panel: DHS Science & Technology Emerging Technologies. *GFIRST National Conference*, Atlanta GA, August 23-28, 2009.

John R. Goodall. "Information Visualization," Panel: Visualization for Cyber Security. *USSS Global Cyber Security Conference*, Washington DC, August 4-6, 2009.

John R. Goodall. and Jason K. Kopylec. "VIAssist: Visual Analytics for NetFlow Data," *FloCon*, Scottsdale AZ, January 12-15, 2009.

John R. Goodall. "Visualizing Network Traffic for Intrusion Detection," Doctoral Symposium, *Proceedings of the ACM Conference on Designing Interactive Systems (DIS)*, ACM Press, 2006, 363-364.

John R. Goodall, Anita Komlodi, and Wayne G. Lutters. "Information Visualization for Intrusion Detection Analysis: A Needs Assessment of Systems and Network Security Experts." *Workshop on Statistical and Machine Learning Techniques in Computer Intrusion Detection*, Fairfax VA, September 24-26, 2003.

Patents

Erik M. Ferragut, John R. Goodall, Michael D. Iannacone, Jason A. Laska, and Lane T. Harrison. "Real-time detection and classification of anomalous events in streaming data," U.S. Patent No. 9319421, Issued: April 19, 2016.

Dissertation

John R. Goodall. "Defending the Network: Visualizing Network Packets for Intrusion Detection Analysis," *Ph.D. Dissertation*, University of Maryland, Baltimore County (UMBC), 2006.

Professional Experience

2022-present	Oak Ridge National Laboratory - Cyber Resilience and Intelligence Div., Oak Ridge TN Senior Research Scientist, Data Science and Visualization Group
2020-2022	Oak Ridge National Laboratory - Cyber Resilience and Intelligence Div., Oak Ridge TN Group Lead, Augmented Analyst Intelligence Group
2010-2020	Oak Ridge National Laboratory - Computational Sciences & Engineering Div., Oak Ridge TN Research Scientist / Team Leader, Situation Awareness & Visual Analytics
2006-2010	Applied Visions Inc. - Secure Decisions division, Albany NY Research Scientist
2001-2006	University of Maryland, Baltimore County (UMBC), Baltimore MD Unix Systems Administrator
1998-2001	TVData Technologies, Glens Falls NY Unix Systems Administrator

Teaching Experience

2004-2006	University of Maryland, Baltimore County (UMBC), Baltimore MD Department of Information Systems Instructor, User interface design upper-level undergraduate course
2003/04/06	Student Supervisor, NSF Research for Undergraduates Experience

| 2005 | **Student Supervisor**, student group's senior project, industry grant |

Mentoring

Phillipe Austria, PhD Student, University of Nevada, Las Vegas, DOE Scholar, 2020

Kevin Womack, BS Student, Columbia University, GEM Consortium, 2019

Cody Butler, BS Student, Purdue University, GEM Consortium, 2019

Elizabeth Kurkowski, BS Student, Florida Institute of Technology, DOE Scholar, 2018

James Senter, Post-Bachelors, 2017-18

Maria Vincent, Post-Bachelors, 2015-16

Amy Fox, PhD Student, University of California-San Diego, HS-STEM program, 2016

Alyssa Pena, BS Student, Texas A&M University, HERE program, 2016

Andrew Pachuilo, BS Student, Tennessee Technical University, SULI program, 2015

Maria Vincent, BS Student, University of Tennessee-Knoxville, HERE program 2014

Andrew Stamps, PhD Student, Mississippi State University, HERE program, 2014

Steven Hardge, BS Student, Western Carolina University, HS-STEM program, 2014

Anish Athalye, BS Student, Massachusetts Institute of Technology, HERE program, 2013

Lane Harrison, PhD Student, University of North Carolina-Charlotte, HERE program, 2012

Evan Downing, BS Student, University of Tennessee-Knoxville, HERE program, 2012

Nathan Chapman, BS Student, State University of New York-Potsdam, HERE program, 2011

Professional Service

Conference Committee

2020	Organizing Committee, TREX: Workshop on TRust & EXpertise in Visual Analytics In conjunction with IEEE Vis Week
2008-2019	Steering Committee, VizSec Symposium on Visualization for Cyber Security
2013	Chair, VizSec Symposium on Visualization for Cyber Security In conjunction with IEEE Vis Week
2012	Publications Chair, VizSec Symposium on Visualization for Cyber Security In conjunction with IEEE Vis Week
2011	Co-Chair, Visual Analysis of Massive Data for Decision Support and Operational Management Minitrack, Hawaii International Conference for Systems Science
2010	Publications Chair, VizSec Symposium on Visualization for Cyber Security In conjunction with Recent Advances in Intrusion Detection (RAID)
2009	Co-Chair, VizSec Workshop on Visualization for Cyber Security In conjunction with IEEE Vis & IEEE InfoVis
2008	Chair, VizSec Workshop on Visualization for Cyber Security In conjunction with Recent Advances in Intrusion Detection (RAID)

| 2007 | Chair, VizSec Workshop on Visualization for Cyber Security |
| | In conjunction with IEEE Vis & IEEE InfoVis |

Program Committee

2021	IEEE VIS Full Papers Program Committee
2021	TREX: Workshop on TRust & EXpertise in Visual Analytics
	In conjunction with IEEE Vis Week
2020 – 21	IEEE Visualization for Cyber Security (VizSec)
2017 – 19	IEEE Symposium on Visual Analytics Science and Technology (VAST)
2016	IEEE Information Visualization Conference (InfoVis)
2015	IEEE Symposium on Visual Analytics Science and Technology (VAST)
2011 – 13	IEEE Information Visualization Conference (InfoVis)
2011	VizSec Symposium on Visualization for Cyber Security
2008 – 09	ACM Computer Human Interaction for the Management of Information Technology (CHIMIT)
2005	VizSec Workshop on Visualization for Computer Security
	In conjunction with IEEE Vis & InfoVis
2004	VizSec Workshop on Visualization & Data Mining for Cyber Security
	In conjunction with ACM Conf. on Computer and Communications Security

Conference Reviewing

2023	ACM Conference on Human Factors in Computing Systems (CHI)
2017	IEEE Scientific Visualization Conference (SciVis)
2008, 2011-12	IEEE Symposium on Visual Analytics Science and Technology (VAST)
2008, 2011	IEEE & Eurographics Symposium on Visualization (EuroVis)
2008, 2010	IEEE Information Visualization Conference (InfoVis)
2010	IEEE Visualization Conference (Vis)
2006	ACM Conference on Human Factors in Computing Systems (CHI)
2005	ACM Conference on Supporting Group Work (GROUP)
2005	IEEE Information Assurance Workshop (IAW)

Journal Reviewing

2009	International Journal of Human Computer Studies
2009	IEEE Security and Privacy
2009	IEEE Transactions on Information Forensics and Security
2005, 2009	IEEE Transactions on Visualization & Computer Graphics
2005	IEEE Computer Graphics and Applications

Proposal Reviewing

2016-2018	ORNL Laboratory Directed Research and Development (LDRD) Initiative Review Committee (IRC) for Cyber Security and Resilience Initiative
2015	National Science Foundation, Division of Information & Intelligent Systems (IIS)
2012	National Science Foundation, Division of Information & Intelligent Systems (IIS)

Technical Book Reviewing

2008	*Applied Security Visualization*, Raffael Marty. Addison Wesley
2007	*Security Data Visualization: Graphical Techniques for Network Analysis*, Greg Conti. No Starch Press

Other Reviewing

2019	National GEM Fellowship Application Review Panel
2014	DHS Center of Excellence in Visual and Data Analytics (CVADA) Review Panel

Honors & Awards

2021	ORNL Innovation Award (License)
2020	ORNL Innovation Award (Copyright)
2018	R&D 100 Finalist, Situ: streaming anomaly detection platform for cyber security
2018	ORNL Significant Event Award (SEA) for "Cyber operations and research collaboration at ORNL" (with John Gerber, Dave Richardson, Joel Reed, Lawrence Nichols III)
2018	ORNL Supplemental Performance Award (SPA)
2015	ORNL Supplemental Performance Award (SPA)
2012	ORNL Supplemental Performance Award (SPA)
1994-1998	Morris Gitlitz Memorial Academic Scholar, Binghamton University

Open-Source Software

Mercury	Scalable packet capture and indexing tool Released under the Apache 2.0 License.	https://github.com/jgoodall/mercury
Stucco	A Cyber Intelligence Platform Released under the MIT License.	http://stucco.github.io/
TNV	Computer network traffic visualization tool Released under the MIT License.	http://tnv.sourceforge.net/