Research Director and Associate Professor
School of Computing and AI, Fulton Schools of Engineering, Arizona State University

Paulo Shakarian, Ph.D.
School of Computing and AI
Fulton Schools of Engineering
Arizona State University
699 S. Mill Ave.
Tempe, AZ 85281
pshak02@asu.edu

Paulo Shakarian, Ph.D. is a tenured Associate Professor in the School of Computing and AI at the Fulton Schools of Engineering at Arizona State University. He also holds the additional position as Research Director for the School of Computing and AI at ASU. He specializes in the fusion of symbolic artificial intelligence and machine learning – publishing numerous scientific books and papers. Shakarian was named a "KDD Rising Star," received the Air Force Young Investigator award, received multiple "best paper" awards and has been featured in major news media outlets such as CNN and The Economist. Paulo has been funded by various organizations including IARPA (HAYSTAC, CAUSE, ICARUS), ARO (4x), ONR (5x), AF/AFOSR (2x), and DARPA as well as various industry partners. Paulo also co-founded a startup company that used machine learning to predict future exploits; the company was acquired after raising $8 million in venture capital and having obtained over 80 customers. Paulo also founded and manages the Neuro Symbolic Channel on YouTube which has over 2,000 subscribers. Earlier in his career, Paulo was an officer in the U.S. Army where he served two combat tours in Iraq, earning a Bronze Star and the Army Commendation Medal for Valor. During his military career, Paulo also served as a DARPA Fellow and as an advisor to IARPA. He holds a Ph.D. and M.S. in computer science from the University of Maryland, College Park, and a B.S. in computer science from West Point.

PROFESSIONAL EXPERIENCE:

2024-Present	Research Director, School for Computing and Augmented Intelligence, Arizona State University, Tempe, AZ
2020-Present	Associate Professor (w. tenure), Arizona State University, Tempe AZ
2014-2020	Assistant Professor, Arizona State University, Tempe AZ • Fulton Entrepreneurial Professor, co-founded startup company applying machine learning to cybersecurity use-case (acquired) • Served as a rotating Fellow at New America Foundation (2017)
2011-2014	Assistant Professor, U.S. Military Academy, West Point NY, 2011-2014
2008-2011	Graduate Research Assistant, University of Maryland, College Park, MD, 2008-2011
2007	Military Fellow, DARPA Service Chiefs' Fellows Program
2002-2014	Commissioned Officer, U.S. Army • Combat tour with First Infantry Division to Baghdad, Iraq (13 months), (2006-2007) • Combat tour with First Armor Division to Baghdad, Iraq (14 months), (2003-2004) • Military Intelligence Carrer and Basic courses (2002, 2008)

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EDUCATION:
University of Maryland College Park, Computer Science, Ph.D., 2011
University of Maryland College Park, Computer Science, Master of Science, 2009
U.S. Military Academy, Computer Science, Bachelor of Science, 2002

SECURITY INFROMATION:
Citizenship: US
Current clearance: SECRET
Previous clearance: TS-SCI (expired after I left the military)

AWARDS AND ACCOLADES:

- Best-paper or presentation awards
  - Editor's Choice Article (Cover article), Big Data and Cognitive Computing, "Argumentation-based Query Answering under Uncertainty with Application to Cybersecurity," 2022.
  - Best Presentation, IEEE CCWC 2020 for "Inductive and Deductive Reasoning to Assist in Cyber-Attack Prediction"
  - Best Paper, IEEE ICDIS-2019 for "An End-to-End Framework to Identify Pathogenic Social Media Accounts on Twitter"
  - Best Paper, IEEE ICDIS-2018 for "Mining Key-Hackers on Darkweb Forums"
  - Best Paper, IEEE ASONAM-2016 (FOSINT-SI track) for "Argumentation Models for Cyber Attribution"
- Other accolades for scientific papers
  - One of 100 scientists selected for DARPA AI Forward 2023
  - Paper "Darknet and deepnet mining for proactive cybersecurity threat intelligence" was the second most cited article of the IEEE ISI conference in its 14 year history (2023)
  - Paper "A review of evolutionary graph theory with applications to game theory" was the most cited article of the Elsevier journal *BioSystems* (2017)
  - MIT Technology Review "Best of 2013" (2013) for "A Scalable Heuristic for Viral Marketing Under the Tipping Model"
    - selected as one of 12 academic papers uploaded to arXiv in 2013 - selected from across all scientific disciplines
  - Best paper nomination, KDD 2015 for "Early Identification of Violent Criminal Gang Members"
  - Best paper nomination, ASONAM 2013 for "Large Social Networks can be Targeted for Viral Marketing with Small Seed Sets"
- Competitive Grant Awards:
  - AFOSR Young Investigator Award (2015)
    - One of 59 funded proposals (over 200 proposals submitted)
  - Co-Principal Investigator for a DoD Minerva award (2015)
    - One of 11 teams awarded the grant (297 proposals submitted)
  - Defense University Research Instrumentation Program (DURIP) award (2016)
    - One of 176 funded proposals (622 submitted)

- Awards relating to entrepreneurship
  - Finalist, Skysong Venture Challenge, 2023 ($25,000 investment award for company BAT, LLC)
  - State of Arizona EmergeAZ grant 2021 ($50K prize for Cyber Reconnaissance, Inc.)
  - Winner, Trumpf Venture Challenge, 2019 ($1M investment for Cyber Reconnaissance, Inc.)
  - Finalist, CISO choice awards (2020)
  - Finalist for the Arizona Technology Council's "Best Startup" award (2017)
  - Finalist for PwC's Most Promising Company award (2017)
  - Winner, Defense Innovation Technology Challenge (2017)
  - Semi-Finalist, *Cisco Innovation Grand Challenge* (2016)
  - I-Corps grant award (2016)
- Other Awards and Fellowships:
  - Named a KDD Rising Stars by Microsoft Research Asia (2016)
  - DARPA Service Chiefs' Fellowship (2007)
    - selected as one of four military officers from FORCECOM
  - ASU Leadership Academy (2016)
    - Selected through a nomination process
  - Winner, Lorenz e-Science 2019 (co-author with Vincent Lengkeek, Roy Lindelauf, Arnout van de Rijt, and V.S. Subrahmanian)
  - Selected for Innovation Showcase at TechConnect 2016 for invention "Improved Malware Detection Technology".
- Military Awards
  - Several awards for military service not related to scientific or academic contributions including the Bronze Star (2007), the Army Commendation Medal for Valor (2007), and the Combat Action Badge (2005)
  - Meritorious Service Medal (2014)
    - awarded by West Point "For exceptionally meritorious service as an Assistant Professor in the Dept. of Electrical Engineering and Computer Science."

CURRENT GRANT AWARDS:

- Principle Investigator for MCAI (Metacognitive Composable AI), DARPA $238K, 2024-2025.
- Co-PI for CONNECT, DARPA, $180K of a $684K award, 2024-2025 (award pending contract negotiation).
- Principle Investigator for "Reasoning about Machine Learning," ARO, $500K (single investigator), 2023-2025.
- Principle Investigator for "Reasoning about Global Supply Networks," ONR, $559K (single investigator), 2023-2026.
- Principle Investigator for "Transferable Agent Learning using Neuro Symbolic Methods," MADE Science and Technology Center, co-funded by the Arizona New Economic Initiative and SSCI, $156K (2 years), 2023-2024.

- Principle Investigator for "Seeding System1-System2 Strengthening of AI with Application to Disaster Decision Support," ASU internal funding, $150K (1 year), 2024-2025

PREVIOUS GRANT AWARDS:

- Large grant ($100K+) as PI:
  - Principle Investigator (ASU team, sub to Leidos) for "Hidden ActivitY Signal and Trajectory Anomaly Characterization (HAYSTAC)," IARPA, $238K, 2023-2024.
  - Principal Investigator for "Understanding Social Influence without Markov Assumptions," ARO Single Investigator Program, $469K, 2015-2018.
  - Principal Investigator for "Reasoning about Cyber-Attribution," ONR, $400K, 2015-2018.
  - Principal Investigator for "Toward Anti-Inhibitory Influence of Online Social Networks," USAFOSR (Young Investigator Award) $354K, 2015-2018.
  - Principal Investigator for "Viral Marketing for Social Networks" USAF A2II, $100K, 2013-2014
  - Principal Investigator for "Combinatorial and Scalable Initiation in Complex Networks," ARO Single Investigator Program, project 2GDATXR042, $249K, 2012-2014.
  - Principle Investigator (of sub-prime to both USC ISI and Leidos) for IARPA CAUSE Phase II program, $472K (portion for sub), 2018-2019.
  - Principle Investigator (of sub-prime to USC ISI) for IARPA CAUSE Phase I program, $623K (portion to sub), 2016-2018.
- Large grants as Co-PI or senior personnel:
  - Co-Principal Investigator for "New Analytics for Measuring and Countering Social Influence and Persuasion of Extremist Groups" DoD (Minerva), $1.2M (total, over multiple investigators), 2015-2018.
  - Senior Personnel, "Crisis and Collective Problem-Solving on the Darkweb: Understanding Crisis Inform," ARO, $121K, 2019-2023.
  - Senior Personnel, "Next Generation Energy Technologies and Systems for Civilian and Military Applications," ONR, $260K, 2016-2019.
  - Senior Personnel "NEPTUNE," ONR, $210K, 2015-2018.
- Small Grants:
  - Principle Investigator for "Perceptual Introspection," Cox Communications, $50K, (1 year) 2023-2024.
  - Principle Investigator for "Workshop on Metacognitive Prediction of AI Behavior," Army Research Office, $30K (2023).
  - Principle Investigator (ASU team, sub to Charles River Analytics) for "Explainable AI for Complex Decision Making for Command and Control in MDO (STTR)," Army Research Office, $73K (Phase I, ASU portion, 2023).
  - Principle Investigator, State of Arizona EmergeAZ grant $50K, 2021.
  - Senior Personnel, "Ideological Techniques and Operational Procedures: Analyzing the Tactics of Propaganda and Disinformation," $49K (total award $497K), DoS, 2018-2019.

- Principle Investigator for "Commercialization of Social Influence Algorithms for Information Operations", DoD @ I-Corps grant, $70K, 2016-2017.
- Principle Investigator for "High-memory workstations in support of cyber-socio research," ARO DURIP, $52K, 2016.
- Principle Investigator for "Undergraduate and High School Network Science Education," ARO, $6K, 2016.
- Principal Investigator for "Arabic-Language Extremist Darknet Study," ASU Global Security Initiative (GSI), $80K, 2016.
- Principal Investigator for "Behavioral Analysis of Hacking Groups," ASU Global Security Initiative (GSI), $74K, 2015.
- Principal Investigator, DARPA UROP program, R.0004972.001, $21K, 2013-2014
- Consultant (to the Program Manager), "Integrated Cognitive-Neuroscience Architectures for Understanding Sensemaking (ICArUS)" IARPA, 2012-2014.
- Principal Investigator for "Landowner-Red (LOR)," DoD project N4175613MP50287, $50K, 2013.
- Principal Investigator for "Searching Huge Attribute and Relational Knowledgebases (SHARK)," DoD project N4175613MP50285, $50K, 2013.
- Principal Investigator for "Allocation of Special Forces Resources in a COIN Environment," DoD project F1AF262025G001, $23K, 2012.

KEYNOTE AND PLENARY PRESENTATIONS:

2023 P. Shakarian, *The New Challenges of Artificial Intelligence*, **Keynote** talk at *Cactuscon-11*, Mesa, AZ, Jan. 27, 2023.

2020 P. Shakarian, *Getting Ahead Of Hackers: Predicting The Next Exploit And Ramifications For The Software Supply Chain*, **Keynote** talk at SIP-CPS Symposium 2020 on Cross-Ministerial Strategic Innovation Promotion Program (SIP), Japan, Nov. 2020.

2019 P. Shakarian, *Proactive Cybersecurity*, IEEE ICDIS-2019, **Keynote** speaker

2017 P. Shakarian, *Leveraging Actionable Cyber Threat Intelligence from the Darkweb using Machine Learning*, StateFarm #doITdifferently, Dec. 2017, invited **keynote**.

2016 P. Shakarian, The Cyber Battlefield: Now and the Near Future. Combatting Terrorism Technical Support Office (CTTSO) Threat Day, Washington, D.C., Jan. 2016, invited **keynote**.

2016 P. Shakarian, Reducing Risk in the Face of Adaptive Threats in Cyberspace, *IEEE ISI 2016*, ***plenary*** talk, Sep. 2016.

TUTORIALS (REVIEWED):

2023 P. Shakarian, G.I. Simari, C. Baral, *B. Xi., L. Pokala*, Advances in Neuro Symbolic Reasoning, AAAI Tutorial, Washington, D.C., Feb., 2023.

2016 P. Shakarian, Diffusion in Social Networks. AAAI Tutorial, Phoenix, AZ, Feb., 2016.

2015 P. Shakarian, Diffusion in Social Networks. IJCAI Tutorial, July, 2015.

SELECTED INVITED TALKS:

2023 Invited Panelist at *IEEE TransAI*, Sep. 25, 2023.
2023 P. Shakarian, *Learning and Reasoning: Pathways to Artificial General Intelligence*, Invited talk at Machine Learning Day, ASU West Campus, Apr. 14, 2023.
2022 P. Shakarian, *Cybersecurity Applications of Artificial Intelligence,* Simposio Argentino de Inteligencia Artificial, Argentina, Oct. 26, 2022
2022 P. Shakarian, *Generalized Annotated Logic and an Equivalent Neural Architecture*, Invited talk at Hughes Research Labs (HRL), Malibu, CA, Aug. 10, 2022.
2022 P. Shakarian, *Annotated Logic and Neuro Symbolic Reasoning*, Invited talk at BBN, Cambridge, MA, July 14, 2022.
2021 P. Shakarian, *Toward Proactive Appsec thru Machine Learning augmented CI/CD*, Invited talk at Florida Institute of Technology, Sep. 2021.
2021 P. Shakarian, *Proactive Cybersecurity: The Case for Artificial Intelligence*, Invited talk at CalPoly Pomona, July 2021.
2021 P. Shakarian, *Primer on Artificial Intelligence and Machine Learning for Cybersecurity*, Invited talk at NYU, Feb. 2021.
2019 P. Shakarian, *Proactive Cybersecurity: The Case for Artificial Intelligence*, Invited talk at NYU, Oct. 2019
2019 P. Shakarian, *Can Artificial Intelligence Replace Threat Intelligence*, panel chair, SINET, New York, NY, June 2019.
2019 P. Shakarian, *Cyber Reconnaissance,* Invited talk at DARPA, Feb. 2019.
2018 V. Paliath, P. Shakarian, *Defending Against Chained Cyber-attacks By Adversarial Agents: An Optimization Approach*, InForms, Nov. 2018.
2018 P. Shakarian, *When Patching 'Critical' Vulnerabilities Doesn't Cut It*, ISC(2) Congress, Oct. 2018.
2018 P. Shakarian, *Staying ahead of cyber attacks*, ASU KED Talk, Oct. 2018.
2018 P. Shakarian, C. DeVar, Jennifer Martin, A*voiding Cyber Attacks by Understanding Hacker Communities*, National Association of State Treasurers Annual Conference, invited panel, Sep. 2018.
2018 P. Shakarian, et al., *Cybersecurity Solutions/Trends.* Panel discussion, Arizona Tech Council 2018 Cybersecurity Summit, May 2018.
2018 P. Shakarian, et al., *The IoT, Cybersecurity, and GDPR: What's keeping CISOs up at night?* Panel discussion, RSA (sponsored by A10 networks)
2018 P. Shakarian, *Countering Cyber Threats with Machine Learning and Darkweb Threat Intelligence*, Future of Global Aerospace Market, 2018
2018 P. Shakarian, *Panel on DoD Research,* ASU Fulton Schools of Engineering, Jan. 2018.
2017 S. Geftic, R. Ayoub, P. Shakarian, Cutting Through the FUD Factor – the Reality of Machine Learning, ISC(2) ThinkTank (sponsored by Sophos), webinar, November 2017. 271 viewers. (invited panel)
2017 M. Almukaynizi, P. Shakarian, *Online Vulnerabilities and Exploits, CactusCon,* September, 2017.
2017 P. Shakarian (invited panelist for panel moderated by Rep. Tom O'Halleran), ASU Congressional Conference on Cybersecurity, August 2017.
2017 P. Shakarian, Threat Intelligence, ISC(2) Phoenix chapter meeting, August 2017.

2017 S. Merchant, P. Shakarian, Scaling Up Network Security - Shifting Control Back to the Defenders, ISC(2) ThinkTank (sponsored by Gigamon), webinar, August 2017. 285 viewers. (invited panel)

2017 R. Leong, R. Los, P. Shakarian, Machine Learning and Malware: What You Need to Know, ISC(2) ThinkTank (sponsored by McAfee), webinar, April 2017. 448 viewers. (invited panel)

2016 P. Shakarian, Scaling to the Adversary: Machine Learning Driven Mining of Threat Intel from the Darkweb, POC Security Conference, Seoul, Korea, Nov., 2016 (invited talk).

2016 P. Shakarian, Toward a Threat-Centric Paradigm, *Army Cyber Talks*, New York, NY, Sep. 2016.

2016 P. Shakarian, Data-Driven Modeling and Reasoning About Cyber Adversaries, Invited talk at Kings College, London, UK, June 2016.

2016 P. Shakarian, Influence and Inhibition in Information Cascades, *EU RISE Workshop, Prague*, Czech Republic, June 2016.

2016 P. Shakarian, Cybersecurity Initiative Business – Policy Roundtable #11: The Darkweb with New America Fellow Dr. Paulo Shakarian, *New America Foundation*, Washington D.C., June 2016.

2016 P. Shakarian, Leveraging Game Theory and Machine Learning for Proactive Cyber Threat Intelligence, *CactusCon*, May, 2016

2016 P. Shakarian, Contemporary Cyber Threat Intelligence From the Deep and Dark Web. Invited lecture to Microsoft IT Security, Apr. 2016.

2016 P. Shakarian, Pre-reconnaissance Cyber Security Understanding Cyber Threats Before They Strike. SERENE-RISC, Vancouver, Canada, Apr. 2016 (Invited lecture).

2016 P. Shakarian, Diffusion in Social Networks. *NIMBioS*, Knoxville, TN, Apr. 2016 (Invited lecture).

2015 P. Shakarian, The Cyber Battlefield: Now and the Near Future. Invited talks, ISC2, Phoenix Chapter, Phoenix, AZ, Oct. 2015

2015 P. Shakarian, New Analytics for Cyber Security. Invited Presentation for the Information Systems Security Association (ISSA) Phoenix Chapter, Tempe, Arizona, July 2015.

2015 P. Shakarian, Malware Task Identification: A Data Driven Approach. Invited Presentation to Microsoft, Redmond, Washington, June 2015.

2015 P. Shakarian, Predictive Mining in Social Systems. Invited Presentation at the University of Southern California (Information Sciences Institute), Marina Del Rey, California, June 2015.

2015 P. Shakarian, The Cyber Battlefield: Now and the Near Future. Invited Presentation DHS/START/MINERVA/SMA Technical Lecture Series, June 2015.

2015 P. Shakarian, The Cyber Battlefield: Now and the Near Future. Invited Presentation to the Danish Defense College, Copenhagen, Denmark, May 2015.

2015 P. Shakarian, Malware Task Identification. *CyberWest*, Phoenix, AZ, March, 2015.

2015 P. Shakarian, *E. Nunes*, Automatic identification of malware tasks. *CactusCon-15*, Tempe, AZ, March, 2015.

2014 P. Shakarian, Preparing for the New Threat Environment. Presentation to the U.S. Army Intelligence Center of Excellence, Ft. Huachuca, AZ, Dec. 2014.

2014 P. Shakarian, Cyber-Warfare. *ASU 4th Annual International Humanitarian Law Workshop*, Oct. 2014.

2014 P. Shakarian, Cascades in Complex Networks. Invited Presentation at the University of Notre Dame, Feb. 2014.
2014 P. Shakarian, Cyber-Warfare: A Primer. Presentation to the Danish Defense College, Copenhagen, Denmark May 2014.
2014 P. Shakarian, Mining Complex Networks to Leverage Cascading Processes. *AAAI Spring Symposium 2014* (invited lecture), Stanford, CA, March 2014.
2014 P. Shakarian, The "Science of Cyber" and the Next Generation of Security Tools. *ShmooCon 2014,* Washington, D.C., Jan. 2014 (19.23% acceptance rate).
2013 P. Shakarian, Understanding the Cyber Adversary. *Cyber Security Finance Forum*, Washington, D.C., Oct. 2013.

BOOKS AUTHORED (STUDENT CO-AUTHORS ARE IN ITALICS):

2023 **P. Shakarian,** G.I. Simari, C. Baral, *B. Xi, L. Pokala,* Neuro Symbolic Reasoning and Learning, Springer-Nature.
2021 *E. Marin, M. Almukaynizi, S. Sarkar, E. Nunes,* J. Shakarian, **P. Shakarian,** Exploring Malicious Hacker Communities: Toward Proactive Cyber Defence, Cambridge University Press (April 2021).
2021 *H. Alvari, E. Shabani,* **P. Shakarian,** Identification of Pathogenic Social Media Accounts: From Data to Intelligence to Prediction, Springer (Feb, 2021).
2018 *E. Nunes,* **P. Shakarian,** G. I. Simari, A. Ruef, *Artificial Intelligence Tools for Cyber Attribution,* Springer (Feb., 2018).
2017 *J. Robertson, A. Diab, E. Marin, E. Nunes, V. Paliath,* J. Shakarian, **P. Shakarian,** *Darkweb Cyber Threat Intelligence Mining,* Cambridge University Press (March, 2017). Translated into Kazakh.
2015 **P. Shakarian,** *A. Aleali, A. Bhatnagar, R. Guo, E. Shaabani*, *Diffusion in Social Networks*, Springer (Sep., 2015).
2013 **P. Shakarian**, J. Shakarian, A.Ruef, *Introduction to Cyber Warfare: A Multidisciplinary Approach*, Elsevier/Syngress, June 2013. 9 out of 10 rating on *Slashdot*. Translated into Chinese.
2011 **P. Shakarian**, V.S. Subrahmanian, *Geospatial Abduction: Principles and Practice*, hardcover, Springer, November 2011.

BOOK EDITED:

2024 H. Wei, **P. Shakarian** (eds.), *Metacognitive Artificial Intelligence.* Cambridge University Press (in press) 2024.
2015 S. Jajodia, **P. Shakarian**, V.S. Subrahmanian, V. Swarup, C. Wang (eds.), *Cyber Warfare: Building the Scientific Foundation*, Springer, May 2015. Translated into Chinese.

BOOK CHAPTERS (STUDENT CO-AUTHORS ARE IN ITALICS):

2024 *B. Xi,* **P. Shakarian,** Metacognitive AI through Error Detection and Correction Rules, Metacognitive Artificial Intelligence, ed. H. Wei, P. Shakarian, Cambridge University

Press.

2024 *N. Ngu*, **P. Shakarian,** *A. Koyyalamudi, L. Mareedu*, Metacognitive Insights into ChatGPT's Arithmetic Reasoning, Metacognitive Artificial Intelligence, ed. H. Wei, P. Shakarian, Cambridge University Press.

2020 *M. Almukaynizi, E. Marin, M. Shah, E. Nunes*, G. I. Simari, **P. Shakarian**, A Logic Programming Approach to Predict Enterprise-Targeted Cyberattack, Data Science in Cybersecurity and Cyberthreat Intelligence, eds. L. F. Sikos, K.K. R. Choo, Springer.

2020 *E. Nunes, C. Buto*, **P. Shakarian,** C. Lebiere, S. Bennati, R. Thomson, Cognitively-Inspired Inference for Malware Task Identification, in *Open Source Intelligence and Cyber Crime*, Springer.

2018 *V. Paliath*, **P. Shakarian,** Defending Against Chained Cyber-Attacks by Adversarial Agents, *in Guide to Vulnerability Analysis for Computer Networks and Systems*, eds. S. Parkinson, A. Crampton, R. Hill, Springer.

2018 *M. Almukaynizi, E. Nunes, K. Dharaiya, M. Senguttuvan,* J. Shakarian, **P. Shakarian,** Patch Before Exploited: An Approach to Identify Targeted Software Vulnerabilities, in *Intelligent Systems Reference Library: AI in Cybersecurity*, ed. L. F. Sikos, Springer.

2016 J. Shakarian, A. Gunn, **P. Shakarian,** Exploring Malicious Hacker Forums, in *Cyber Deception: Building the Scientific Foundation*, eds. S. Jajodia, V.S. Subrahmanian, V. Swarup, C. Wang, Springer.

2016 *E. Nunes, N. Kulkarni*, **P. Shakarian,** A Ruef, J. Little, Cyber-Deception and Attribution in Capture-the-Flag Exercises, (extended version) in *Cyber Deception: Building the Scientific Foundation*, eds. S. Jajodia, V.S. Subrahmanian, V. Swarup, C. Wang, Springer.

2015 **P. Shakarian,** *N. Kulkarni*, M. Albanese, S. Jajodia, Keeping Intruders at Bay: A Graph-Theoretic Approach to Reducing the Probability of Successful Network Intrusions, in *E-Business and Telecommunications*, eds. M. S. Obaidat, A. Holzinger, J. Filipe, Springer.

2015 **P. Shakarian,** M. Martin, J. Bertetto, *B. Fischl, J. Hannigan, G. Hernandez, E. Kenney, J. Lademan, D. Paulo, C. Young.* Criminal Social Network Intelligence Analysis with the GANG Software. In *Illuminating Dark Networks: The Study of Clandestine Groups and Organizations*, ed. L. M. Gerdes, Cambridge University Press.

2015 **P. Shakarian**, G. I. Simari, *G. Moores*, S. Parsons. Cyber Attribution: An Argumentation-Based Approach. In *Cyber Warfare: Building the Scientific Foundation*, eds. Sushil Jajodia et al, Springer.

2011 **P. Shakarian**, V.S. Subrahmanian. Region-based Geospatial Abduction with Counter-IED Applications. In *Counterterrorism and Open Source Intelligence*, ed. U. Kock Wiil, Springer.

PUBLICATIONS IN REFEREED JOURNALS (STUDENT CO-AUTHORS ARE IN ITALICS):

2022 M. A. Leiva, A. J. García, **P. Shakarian**, G. I. Simari, Argumentation-based Query Answering under Uncertainty with Application to Cybersecurity, *Big Data and Cognitive Computing*, 6(91). Article featured on the cover of the journal, received Editor's Choice Award.

2021 R. Zhang, J. Lukasczyk, F. Wang, D. Ebert, **P. Shakarian**, E.A. Mack, R. Maciejewski, Exploring Geographic Hotspots Using Topological Data Analysis, *Transactions in GIS*, (accepted, 2021).

2020 *S. Sarkar*, **P. Shakarian,** D. Sanchez, M. Armenta, K. Lakkaraju, Use of a controlled experiment and computational models to measure the impact of sequential peer exposures on decision making, *PLoS ONE* 15(7).

2020 *E. Marin, R. Guo*, **P. Shakarian**, Measuring Time-Constrained Influence to Predict Adoption in Online Social Networks, *ACM Transactions on Social Computing*, 3(3), 2020.

2019 *S. Sarkar, M. Almukaynizi*, J. Shakarian, **P. Shakarian,** Mining user interaction patterns in the darkweb to predict enterprise cyber incidents, *Social Network Analysis and Mining*, 9(1), 2019.

2019 *S. Sarkar*, R. Guo, **P. Shakarian,** Using network motifs to characterize temporal network evolution leading to diffusion inhibition, *Social Network Analysis and Mining*, 9(1), 2019.

2018 **P. Shakarian**, Darkweb Cyber Threat Intelligence: From Data to Intelligence to Prediction, *Information*, 2018.

2017 *S. Sarkar, R. Guo*, **P. Shakarian**, Understanding and forecasting lifecycle events in information cascades, *Social Network Analysis and Mining*, 2017.

2017 *H. Alvari*, **P. Shakarian**, J. Snyder, Semi-Supervised Learning for Detecting Human Trafficking, *Springer Security Informatics*, 6:1, May 2017.

2016 **P. Shakarian,** G. I. Simari, *G. Moores. D. Paulo*, S. Parsons, M. Falappa, *A. Aleali*, Belief Revision in Structured Probabilistic Argumentation: Model and Application to Cyber Security, *Springer Annals of Mathematics and Artificial Intelligence* 78(3), Dec. 2016.

2016 *R. Guo, E. Shaabani, A. Bhatnagar*, **P. Shakarian,** Toward Early and Order-of-Magnitude Cascade Prediction in Social Networks, *Social Network Analysis and Mining*, 6(1), 2016. DOI 10.1007/s13278-016-0372-7

2016 *J. Robertson, A. Diab, E. Marin, E. Nunes, V. Paliath*, J. Shakarian, **P. Shakarian,** Darkweb Mining and Game Theory for Enhanced Cyber Threat Intelligence, *Cyber Defense Review* 1(2), fall 2016.

2016 G. I. Simari, **P. Shakarian,** M. Falappa, A Quantitative Approach to Belief Revision in Structured Probabilistic Argumentation, *Springer Annals of Mathematics and Artificial Intelligence* 76(3), April, 2016.

2015 **P. Shakarian,** A Multidisciplinary Survey of Social Network Diffusion Models, *IEEE Intelligent Informatics Bulletin*, 16(1), Dec. 2015.

2014 *G. Moores*, **P. Shakarian,** B. Macdonald, N. Howard. Finding Near-Optimal Groups of Epidemic Spreaders in a Complex Network. *PLoS ONE* 9(4).

2013 **P. Shakarian,** *S. Eyre, D. Paulo*. A Scalable Heuristic for Viral Marketing Under the Tipping Model. *Social Network Analysis and Mining.* Springer 3(4). "Best of 2013" by *MIT Technology Review*. Source code available: https://github.com/viralTipping/viralTipping

2013 **P. Shakarian,** P. Roos, *G. Moores*. A Novel Analytical Method for Evolutionary Graph Theory Problems. *BioSystems*. 111(2).

2013 D. Callahan, **P. Shakarian,** *J. Nielsen*, A.N. Johnson. Shaping Operations to Attack Robust Terror Networks. *ASE Human Journal* 1(1).

2013 **P. Shakarian**, M. Broecheler, V.S. Subrahmanian, C. Molinaro. Using Generalized Annotated Programs to Solve Social Network Diffusion Optimization Problems. *ACM Transactions on Computational Logic.* 14(2) 2013.

2012 **P. Shakarian**, J.K. Wickiser, Similar Pathogen Targets in *Arabidopsis thaliana* and *Homo sapiens* Protein Networks. *PLoS ONE* 7(9).

2012 **P. Shakarian**, P. Roos, A. Johnson. A Review of Evolutionary Graph Theory with Applications to Game Theory. *BioSystems* 107(2). #1 cited article of the journal from 2012-2017.

2012 **P. Shakarian**, J.P. Dickerson, V.S. Subrahmanian. Adversarial Geospatial Abduction Problems. *ACM Transactions on Intelligent Systems and Technology* 3(2), 2012.

2012 **P. Shakarian**, G. I. Simari, V.S. Subrahmanian. Annotated Probabilistic Temporal Logic: Approximate Fixpoint Implementation. *ACM Transactions on Computational Logic* 13(2).

2011 **P. Shakarian**, V.S. Subrahmanian, M.L. Sapino. GAPs: Geospatial Abduction Problems. *ACM Transactions on Intelligent Systems and Technology* 3(1).

2011 **P. Shakarian**, A. Parker, G.I. Simari, V.S. Subrahmanian. Annotated Probabilistic Temporal Logic. *ACM Transactions on Computational Logic* 12(2).

2011 **P. Shakarian**. The 2008 Russian Cyber-Campaign against Georgia. *Military Review* 91(6).

2011 **P. Shakarian**, C. Otstott. What is old is New: Counter-IED by Disrupting the Weapons Supply. *Military Review* 91(4).

PUBLICATIONS IN REFEREED CONFERENCE AND WORKSHOP PROCEEDINGS (STUDENT CO-AUTHORS ARE IN ITALICS):

2024 *J. S. Kricheli, K. Voa, A. Datta, S. Ozgur,* **P. Shakarian**, Error Detection and Constraint Recovery in Hierarchical Multi-Label Classification without Prior Knowledge, *33rd ACM International Conference on Information and Knowledge Management (CIKM-24)* (2024). 27% acceptance rate, A-rated conference.

2024 *A. M. S. Chowdhury*, **P. Shakarian**, G.I. Simari, Abduction of Domain Relationships from Data for VQA, *40th Intl. Conference on Logic Programming* (ICLP-24). A-rated conference.

2024 *D. Bavikadi, D. Aditya, D. Parkar,* **P. Shakarian,** G. Mueller, C. Parvis, G. Simari, Geospatial Trajectory Generation via Efficient Abduction: Deployment for Independent Testing, *40th Intl. Conference on Logic Programming* (ICLP-24). A-rated conference.

2024 H. Wei, **P. Shakarian,** C. Lebiere, B. Draper, N. Krishnaswamy, S. Nirenburg, Metacognitive AI: Framework and the Case for a Neurosymbolic Approach. *18th International Conference on Neural-Symbolic Learning and Reasoning* (NeSy), 2024.

2024 *K. Mukherji, D. Parkar, L. Pokala, D. Aditya,* **P. Shakarian**, C. Dorman. Scalable Semantic Non-Markovian Simulation Proxy for Reinforcement Learning, *18th IEEE International Conference on Semantic Computing* (IEEE ICSC), 2024.

2024 *N. Ngu, N. Lee,* **P. Shakarian**. Diversity Measures: Domain-Independent Proxies for Failure in Language Model Queries, *18th IEEE International Conference on Semantic Computing* (IEEE ICSC), 2024.

2023 *D. A. Furman, S. A. Malvicini,* M. V. Martinez, **P. Shakarian,** G. I. Simari, *Y. O. Soto,* A Neuro-symbolic Approach to Argument Comparison in Structured Argumentation, *7th Workshop on Advances in Argumentation in Artificial Intelligence (AI3)* (Nov. 2023).

2023 *D. Aditya, K. Mukherji, S. Balasubramanian, A. Chaudhary*, **P. Shakarian**, PyReason: Software for Open World Temporal Logic, *AAAI Spring Symposium* (Mar. 2023). (CEUR-WS)

2023 **P. Shakarian,** *A. Koyyalamudi, N. Ngu, L. Mareedu,* An Independent Evaluation of ChatGPT on Mathematical Word Problems (MWP), *AAAI Spring Symposium* (Mar. 2023). (CEUR-WS)

2022 **P. Shakarian**, G.I. Simari, Extensions to Generalized Annotated Logic and an Equivalent Neural Architecture, *IEEE TransAI*, 2022.

2021 M. A. Leiva, A. Garcia, G. Simari, **P. Shakarian**, Probabilistic Defeasible Logic Programming: Towards Explainable and Tractable Query Answering, *Intl. Conference on Logic Programming* (ICLP-21). A-rated conference.

2020 *E. Marin, M. Almukaynizi*, **P. Shakarian,** Inductive and Deductive Reasoning to Assist in Cyber-Attack Prediction, *2020 IEEE 10th Annual Computing and Communication Workshop and Conference (CCWC)*, (Jan., 2020). Best Presentation.

2020 *H. Alvari,* G. Beigi, *S. Sarkar,* S. Ruston, S. Corman, H. Davulcu, **P. Shakarian,** A Feature-Driven Approach for Identifying Pathogenic Social Media Accounts, 2020 *IEEE International Conference on Data Intelligence and Security* (ICDIS-20).

2019 *E. Marin, M. Almukaynizi*, **P. Shakarian**, Reasoning About Future Cyber-Attacks Through Socio-Technical Hacking Information, *2019 IEEE International Conference on Tools with Artificial Intelligence* (ICTAI-2019) (Nov. 2019).

2019 M. A. Leiva, G. I. Simari, G. Simari, **P. Shakarian**, Cyber Threat Analysis with Structured Probabilistic Argumentation, AIIA-2019.

2019 *S. Sarkar, A. Aleali*, **P. Shakarian**, M. Armenta, D. Sanchez, K. Lakkaraju, Impact of Social Influence on Adoption Behavior: An Online Controlled Experimental Evaluation, *ASONAM '19: Proceedings of the 2019 IEEE/ACM International Conference on Advances in Social Networks Analysis and Mining* (Aug. 2019). 15% acceptance rate.

2019 *M. Almukaynizi, M. Shah*, **P. Shakarian**, A Hybrid KRR-ML Approach to Predict Malicious Email Campaigns, *ASONAM '19: Proceedings of the 2019 IEEE/ACM International Conference on Advances in Social Networks Analysis and Mining* (Aug. 2019).

2019 *V. Paliath*, **P. Shakarian**, Reasoning about Sequential Cyberattacks, *ASONAM '19: Proceedings of the 2019 IEEE/ACM International Conference on Advances in Social Networks Analysis and Mining* (Aug. 2019).

2019 *E. Shaabani*, A. Sadeghi-Mobarakehy, *H. Alvari*, **P. Shakarian**, An End-to-End Framework to Identify Pathogenic Social Media Accounts on Twitter, *IEEE International Conference on Data Intelligence and Security* (ICDIS-19) (June 2019). Best paper.

2019 *H. Alvari,* **P. Shakarian**, Hawkes Process for Understanding the Influence of Pathogenic Social Media Accounts, *IEEE International Conference on Data Intelligence and Security* (ICDIS-19) (June 2019).

2019 *H. Alvari, S. Sarkar*, **P. Shakarian**, Detection of Violent Extremists in Social Media, *IEEE International Conference on Data Intelligence and Security* (ICDIS-19) (June 2019).

2019 *H. Alvari, E. Shaabani, S. Sarkar,* G. Beigi, **P. Shakarian,** Less is More: Semi-Supervised Causal Inference for Detecting Pathogenic Users in Social Media, *Cybersafety 2019* (workshop co-located at WWW 2019) (May 2019).

2019 *S. Sarkar, H. Alvari,* **P. Shakarian,** Leveraging Motifs to Model the Temporal Dynamics of Diffusion Networks, *MSM 2019* (workshop co-located at WWW 2019) (May 2019).

2018 *E. Marin, M. Almukaynizi, E. Nunes,* J. Shakarian, **P. Shakarian,** Predicting Hacker Adoption on Darkweb Forums using Sequential Rule Mining, *11th IEEE International Conference on Social Computing* (SocialCom 2018) (Dec. 2018).

2018 *M. Almukaynizi, V. Paliath, M. Shah, M. Shah,* **P. Shakarian**, Finding Cryptocurrency Attack Indicators Using Temporal Logic and Darkweb Data, *2018 IEEE Conference on Intelligence and Security Informatics* (ISI-18) (Nov. 2018).

2018 *M. Almukaynizi, E. Marin, E. Nunes,* **P. Shakarian**, G. I. Simari, D. Kapoor, T. Siedlecki**,** DARKMENTION: A Deployed System to Predict Enterprise-Targeted External Cyberattacks, *2018 IEEE Conference on Intelligence and Security Informatics* (ISI-18) (Nov. 2018).

2018 *H. Alvari, E. Shaabani,* **P. Shakarian,** Early Identification of Pathogenic Social Media Accounts, *2018 IEEE Conference on Intelligence and Security Informatics* (ISI-18) (Nov. 2018).

2018 *S. Sarkar, M. Almukaynizi,* J. Shakarian, **P. Shakarian,** Predicting enterprise cyber incidents using social network analysis on the darkweb hacker forums, *2018 International Conference on Cyber Conflict* (CyCon-US) (Nov. 2018).

2018 *E. Nunes,* **P. Shakarian,** G. I. Simari, At-Risk System Identification via Analysis of Discussions on the Darkweb, *2018 IEEE Symposium on Electronic Crime Research* (eCRIME 2018) (May, 2018).

2018 *E. Shaabani, R. Guo,* **P. Shakarian,** Detecting Pathogenic Social Media Accounts without Content or Network Structure, *IEEE International Conference on Data Intelligence and Security* (ICDIS-18) (April 2018). Best Poster.

2018 *A. Aleali, M. Dadfarnia,* **P. Shakarian,** Finding Novel Event Relationships in Temporal Data, *IEEE International Conference on Data Intelligence and Security* (ICDIS-18) (April 2018).

2018 *E. Marin, M. Almukaynizi, E. Nunes,* **P. Shakarian,** Community Finding of Malware and Exploit Vendors on Darkweb Marketplaces**,** *IEEE International Conference on Data Intelligence and Security* (ICDIS-18) (April 2018).

2018 *E. Marin,* J. Shakarian, **P. Shakarian,** Mining Key-Hackers on Darkweb Forums**,** *IEEE International Conference on Data Intelligence and Security* (ICDIS-18) (April 2018). Best Paper.

2018 *R. Guo, H. Alvari,* **P. Shakarian,** Strongly Hierarchical Factorization Machines and ANOVA Kernel Regression, *SIAM International Conference of Data Mining* (SDM18) (May 2018). 23.2% acceptance rate. A-rated conference.

2018 N. Tavabi, P. Goyal, *M. Almukaynizi*, **P. Shakarian,** K. Lerman, DarkEmbed: Exploit Prediction with Neural Language Models, *Proceedings of the Thirty-Second AAAI Conference on Artificial Intelligence (AAAI-18)* (Feb. 2018). A-rated conference.

2017 A. Sapienza, A. Bessi, *S. Damodaran,* **P. Shakarian**, K. Lerman, E. Ferrara, Early Warnings of Cyber Threats in Online Discussions, ICDM Workshop proceedings and

presentation at the Data Mining for Cyber Security Workshop (DMCS'2017) (Nov. 2017).

2017 *M. Almukaynizi, A. Grimm, E. Nunes,* J. Shakarian, **P. Shakarian**, Predicting Cyber Threats through Hacker Social Networks in Darkweb and Deepweb Forums, *ACM Computational Social Science* (CSS-2017) (Oct. 2017).

2017 *M. Almukaynizi, E. Nunes, K. Dharaiya, M. Senguttuvan,* J. Shakarian, **P. Shakarian**, Proactive Identification of Exploits in the Wild Through Vulnerability Mentions Online, *2017 International Conference on Cyber Conflict* (CyCon-US) (Nov. 2017).

2017 *E. Marin, R. Guo,* **P. Shakarian**, Temporal Analysis of Influence to Predict User's Adoption in Online Social Networks, *International Conference on Social Computing, Behavioral-Cultural Modeling & Prediction and Behavior Representation in Modeling and Simulation (SBP-BRiMS) 2017* (July, 2017).

2017 H. K. Kwon, *J. H. Priniski, S. Sarkar,* J. Shakarian, **P. Shakarian,** Crisis and Collective Problem Solving in Dark Web: An Exploration of a Black Hat Forum, *2017 International Conference on Social Media and Society* (SMSociety) (July, 2017).

2017 A. Ruef, *E. Nunes,* **P. Shakarian,** G. Simari, Measuring Cyber Attribution In Games, *2017 IEEE Symposium on Electronic Crime Research* (eCRIME 2017) (Apr. 2017).

2016 *R. Guo,* **P. Shakarian,** A Comparison of Methods for Cascade Prediction, *2016 IEEE/ACM International Conference on Advances in Social Networks Analysis and Mining* (ASONAM-2016) (Aug. 2016).

2016 *E. Nunes,* **P. Shakarian,** G. Simari, A. Ruef, Argumentation Models for Cyber Attribution, *ASONAM '16: Proceedings of the 2016 IEEE/ACM International Conference on Advances in Social Networks Analysis and Mining* (Aug. 2016). Best Paper.

2016 *E. Shaabani, H. Alvari,* **P. Shakarian,** J. Snyder, MIST: Missing Person Intelligence Synthesis Toolkit, *25th ACM International Conference on Information and Knowledge Management (CIKM-16)* (Oct. 2016). 19.8% acceptance rate. A-rated conference.

2016 *E. Nunes, A. Diab,* Andrew Gunn, *E. Marin, V. Mishra, V. Paliath, J. Robertson,* J. Shakarian, *A. Thart*, **P. Shakarian,** Darknet and Deepnet Mining for Proactive Cybersecurity Threat Intelligence, *2016 IEEE Conference on Intelligence and Security Informatics* (ISI-16) (Sep. 2016). Featured in *MIT Technology Review* and *Forbes.*

2016 *E. Marin, A. Diab,* **P. Shakarian,** Product Offerings in Malicious Hacker Markets, *2016 IEEE Conference on Intelligence and Security Informatics* (ISI-16) (Sep. 2016). Featured in *Softpedia.*

2016 *H. Alvari,* **P. Shakarian,** J. Snyder, A Non-Parametric Learning Approach to Identify Online Human Trafficking, *2016 IEEE Conference on Intelligence and Security Informatics* (ISI-16) (Sep. 2016).

2016 *V. Paliath,* **P. Shakarian,** Modeling Cyber-attacks on Industrial Control Systems, *2016 IEEE Conference on Intelligence and Security Informatics* Doctorial Consortium (ISI-16) (Sep. 2016).

2016 *R. Guo,* **P. Shakarian**, A Comparison of Methods for Cascade Prediction, *2016 IEEE/ACM International Conference on Advances in Social Networks Analysis and Mining*(ASONAM-2016) (Aug. 2016)

2016 *N. Kumar, R. Guo, A. Aleali,* **P. Shakarian,** An Empirical Evaluation of Social Influence Metrics, *ASONAM Workshop on Social Influence* (Aug. 2016).

2016 *J.J. Robertson, V. Paliath*, J. Shakarian, *A. Thart*, **P. Shakarian,** Data Driven Game Theoretic Cyber Threat Mitigation, *Proceedings of the Thirtieth AAAI Conference on Artificial Intelligence (AAAI-16)* (Feb. 2016). A-rated conference.

2016 *E. Nunes*, **P. Shakarian,** G. I. Simari, Toward Argumentation-Based Cyber Attribution, *AAAI-16 Workshop on Artificial Intelligence and Cyber Security* (Feb. 2016).

2016 **P. Shakarian,** J. Shakarian, Socio-Cultural Modeling for Cyber Threat Actors, *AAAI-16 Workshop on Artificial Intelligence and Cyber Security* (Feb. 2016).

2015 *E. Shaabani, A. Aleali*, **P. Shakarian,** J. Bertetto, Early Identification of Violent Criminal Gang Members, *21st ACM SIGKDD Conference on Knowledge, Discovery, and Data Mining (KDD)* (Aug. 2015). [Video] Nominated for best paper; Featured on *Data Skeptic.* A-rated conference.

2015 *A. Stanton, A. Thart, A. Jain, P. Vyas, A. Chatterjee*, **P. Shakarian**, Mining for Causal Relationships: A Data-Driven Study of the Islamic State, *21st ACM SIGKDD Conference on Knowledge, Discovery, and Data Mining (KDD)* (Aug. 2015). [Video] Featured as *BBC Technology*'s lead story; also featured in the *Huffington Post*, *Business Insider*, and the Australian news media. A-rated conference.

2015 *R. Guo, E. Shaabani, A. Bhatnagar*, **P. Shakarian,** Toward Order-of-Magnitude Cascade Prediction, *2015 IEEE/ACM International Conference on Advances in Social Networks Analysis and Mining* (ASONAM-2015) (Aug. 2015). 11% acceptance rate.

2015 X. Chen, S. Candan, M. L. Sapino, **P. Shakarian,** KSGM: Keynode-driven Scalable Graph Matching, *24th ACM International Conference on Information and Knowledge Management (CIKM-15)* (Oct. 2015). 18% acceptance rate. A-rated conference.

2015 *E. Nunes, N. Kulkarni*, **P. Shakarian,** A Ruef, J. Little, Cyber-Deception and Attribution in Capture-the-Flag Exercises, *ASONAM '15: Proceedings of the 2015 IEEE/ACM International Conference on Advances in Social Networks Analysis and Mining* (Aug. 2015).

2015 *E. Nunes, C. Buto*, **P. Shakarian,** C. Lebiere, S. Bennati, R. Thomson, H. Jaenisch, Malware Task Identification: A Data Driven Approach, *ASONAM '15: Proceedings of the 2015 IEEE/ACM International Conference on Advances in Social Networks Analysis and Mining* (Aug. 2015). Related invention "Improved Malware Detection Technology" selected for Innovation Showcase at TechConnect 2016.

2015 R. Thomson, C, Lebiere, S. Bennati, **P. Shakarian**, *E. Nunes*. Malware Identification Using Cognitively-Inspired Inference. *24th Conference on Behavior Representation in Modeling and Simulation (BRiMS-15)* (April, 2015).

2015 C. Lebiere, S. Bennati, R. Thomson, **P. Shakarian**, *E. Nunes*. Functional Cognitive Models of Malware Identification. *13th International Conference on Cognitive Modeling (ICCM-15)* (April, 2015).

2014 **P. Shakarian,** *J. Salmento*, W. Pulleyblank, J. Bertetto. Reducing Gang Violence through Network Influence Based Targeting of Social Programs. *20th ACM SIGKDD Conference on Knowledge, Discovery, and Data Mining (KDD)* (Aug. 2014). 22% acceptance rate. A-rated conference.

2014 **P. Shakarian,** *D. Paulo*, M. Albanese, S. Jajodia. Keeping Intruders at Large: A Graph-Theoretic Approach to Reducing the Probability of Successful Network Intrusions. *11th Intl. Conf. on Security and Cryptography (SECRYPT)* (Aug. 2014). 9% acceptance rate. Selected for inclusion in a subsequent edited volume.

2014 **P. Shakarian,** G. Simari, *G. Moores*, S. Parsons, M. Falappa. An Argumentation Based Framework to Address the Attribution Problem in Cyber Warfare. *Cyber Security 2014* (May 2014).

2014 **P. Shakarian,** H. Lei, R. Lindelauf. Power Grid Defense Against Malicious Cascading Failure. *13th Intl. Conf. on Autonomous Agents and Multiagent Systems* (AAMAS-14) (May 2014). 23.8% acceptance rate. Featured in *Foreign Policy* (online). A-rated conference.

2014 **P. Shakarian,** G. Simari, M. Falappa. Belief Revision in Structured Probabilistic Argumentation. *Foundations of Information and Knowledge Systems 2014 (FoIKS 2014)* (Mar. 2014). 26.9% acceptance rate. Selected for journal version (42% of accepted papers).

2014 *J. Hannigan*, S. Matthews, J. Wickiser and **P. Shakarian.** A Network-Based Approach for Identifying Cancer Causing Pathogens. *ACM SE 2014* (Mar. 2014). Poster version was selected as "Best Student Poster" at ACM Tapia 2014.

2014 **P. Shakarian,** L. Gerdes, H. Lei. Circle-Based Tipping Cascades in Social Networks. *WSDM 2014 Workshop on Diffusion Networks and Cascade Analytics* (Feb. 2014).

2013 *J. Hannigan*, *G. Hernandez*, R. Medina, P. Roos, **P. Shakarian.** Mining for Spatially-Near Communities in Geo-Located Social Networks. *AAAI Fall Symposium* (Nov. 2013).

2013 *D. Paulo*, *B. Fischl*, T. Markow, M. Martin, **P. Shakarian**. Social Network Intelligence Analysis to Combat Street Gang Violence. *ASONAM '13: Proceedings of the 2013 IEEE/ACM International Conference on Advances in Social Networks Analysis and Mining* (Aug. 2013). Featured in the Jan. 2014 print edition of *Popular Science.*

2013 **P. Shakarian,** P. Roos, D. Callahan, *C. Kirk*. Mining for Geographically Disperse Communities in Social Networks by Leveraging Distance Modularity. *19th ACM SIGKDD Conference on Knowledge, Discovery, and Data Mining* (KDD) (Aug. 2013). 17% acceptance rate. A-rated conference.

2013 **P. Shakarian,** G.I. Simari, D. Callahan. Reasoning about Complex Networks: A Logic Programming Approach. *29th Intl. Conference on Logic Programming* (ICLP-13) (Aug. 2013). A-rated conference.

2013 **P. Shakarian,** G.I. Simari, R. Schroeder. MANCaLog: A Logic for Multi-Attribute Network Cascades. *12th Intl. Conf. on Autonomous Agents and Multiagent Systems* (AAMAS-13) (May 2013). A-rated conference.

2013 **P. Shakarian,** V.S. Subrahmanian. Geospatial Optimization Problems. *IEEE Network Science Workshop* (April 2013).

2012 D. Callahan, **P. Shakarian,** *J. Nielsen*, A.N. Johnson. Shaping Operations to Attack Robust Terror Networks. *Social Informatics 2012* (Dec. 2012). 11.5% acceptance rate, selected for journal publication (top 3% of papers); featured in WIRED (online); presented to senior staffers from the House Permanent Select Committee on Intelligence (HPSC-I) at the U.S. Capitol; presented at the Central Intelligence Agency.

2012 **P. Shakarian**, D. Paulo. Large Social Networks can be Targeted for Viral Marketing with Small Seed Sets. *2012 IEEE/ACM International Conference on Advances in Social Networks Analysis and Mining* (ASONAM-2012) (Aug. 2012). 16% acceptance rate, Nominated for best paper and invited for journal publication. MIT Technology Review "Best of 2013."

2012 M. Albanese, A. De Benedictis, S. Jajodia, **P. Shakarian**. A Probabilistic Framework for the Localization of Attackers in MANETs. *17th European Symposium on Research in Computer Security* (ESORICS 2012) (Sep. 2012). 21% acceptance rate. A-rated conference.

2011 **P. Shakarian**, P. Roos. Fast and Deterministic Computation of Fixation Probability in Evolutionary Graphs. *6th International Conference on Computational Intelligence and Bioinformatics* (CIB-11) (Nov. 2011).

2011 G. Johnson, **P. Shakarian**, N. Gupta, A. Agrawala. Towards Shrink-Wrapped Security: Practically Incorporating Context into Security Services. *Intl. Symposium on Frontiers in Ambient and Mobile Systems* (FAMS-2011) (Sep. 2011).

2011 **P. Shakarian**, M. K. Nagel, B. E. Schuetzle, V.S. Subrahmanian. Abductive Inference for Combat: Using SCARE-S2 to Find High-Value Targets in Afghanistan. *23rd Innovative Applications of Artificial Intelligence* (IAAI-11, held in conjunction with AAAI) (Aug. 2011). Featured in *The Economist* in April, 2012.

2010 M. Broecheler, **P. Shakarian**, V.S. Subrahmanian. A Scalable Framework for Modeling Competitive Diffusion in Social Networks. *2nd IEEE International Conference on Social Computing* (SocialCom-10) (symposium section) (Aug. 2012)

2010 **P. Shakarian**, V.S. Subrahmanian, M.L. Sapino. Using Generalized Annotated Programs to Solve Social Network Optimization Problems. *26th Intl. Conference on Logic Programming* (ICLP-10) (Jul. 2010). A-rated conference.

2009 **P. Shakarian**, V.S. Subrahmanian, M.L. Sapino. SCARE: A Case Study with Baghdad. *3rd Intl. Conference on Computational Cultural Dynamics* (ICCCD-09) (Dec. 2009). Featured in the *Baltimore Sun* and the online edition of *Popular Science* in Dec., 2009.

SELECTED PREPRINTS AND SUBMISSIONS:

2024 *D. Bavikadi*, *A. Agarwal*, *S. Ganta*, Y. Chung, L. Song, J. Qiu, **P. Shakarian**, Machine Learning Driven Biomarker Selection for Medical Diagnosis, submitted (journal paper), available on arXiv: https://arxiv.org/abs/2405.10345

2024 J. Parades, M. Falappa, **P. Shakarian**, M. Martinez, G. I. Simari, Combining Existential Rules with Network Diffusion Processes for Automated Generation of Hypotheses. submitted (journal paper).

2024 *N. Lee, N. Ngu, H. Sahdev, P. Motaganahalli, A. Chowdhury, B. Xi,* **P. Shakarian**, Metal Price Spike Prediction via a Neurosymbolic Ensemble Approach, In prep.

2024 *B. Xi, K. Scaria, D. Bavikadi,* **P. Shakarian.** Rule-Based Error Detection and Correction to Operationalize Movement Trajectory Classification. Submitted and available on arXiv: https://arxiv.org/abs/2308.14250

2024 *N. Ngu, N. Lee*, **P. Shakarian**. Diversity Measures: Domain-Independent Proxies for Failure in Language Model Queries, journal version, submitted.

OTHER PUBLICATIONS (SOME NOT PEER-REVIEWED, STUDENT CO-AUTHORS IN ITALICS):

2021 **P. Shakarian,** North Korea targeted cybersecurity researchers using a blend of hacking and espionage, The Conversation, Feb. 2021.

2020 **P. Shakarian,** The Sunburst hack was massive and devastating – 5 observations from a cybersecurity expert, The Conversation, Dec. 2020.

2017 **P. Shakarian,** The Enemy has a Voice, *New America Cybersecurity Initiative* (policy paper), 2017. Featured in *National Defense Magazine*, in Apr., 2017.
2016 **P. Shakarian,** Combating the Dangers of Big Data Analysis, *NGA Pathfinder*, 14(2), 2016.
2015 A. Kott, D. Alberts, A. Zalman, **P. Shakarian**, F. Maymi, C. Wang, G. Qu. Visualizing the Tactical Ground Battlefield in the Year 2050: Workshop Report. *U.S. Army Research Laboratory*, ARL-SR-0327, June 201 5.
2015 J. Shakarian, **P. Shakarian,** A. Ruef. Cyber Attacks and Public Embarrassment: A Survey of Some Notable Hacks. *Elsevier SciTechConnect*, January, 2015.
2013 **P. Shakarian**, J. Shakarian, A. Ruef, The Dragon and the Computer: Why Intellectual Property Theft is Compatible with Chinese Cyber-Warfare Doctrine. *Elsevier SciTechConnect*, July, 2013.
2012 *S. Eyre, R. Rotte, T. Taggart*, C. Chewar, A. Johnson, P. Roos, **P. Shakarian**. Using RASCAL to Find Key Villages in Afghanistan. *Small Wars Journal.*
2011 **P. Shakarian**. Stuxnet: Cyberwar Revolution in Military Affairs. *Small Wars Journal.*
2008 **P. Shakarian**. The Future of Analytical Tools: Prediction in a Counterinsurgency Fight. *Military Intelligence Professional Bulletin* 34(8).
2008 **P. Shakarian**. Precision Employment. *CTC Quarterly Bulletin, Center for Army Lessons Learned (CALL)* 8(18).
2007 **P. Shakarian**. Stand and Fight: Lessons for the Transition Mission in Iraq. *Armor Magazine.*
2007 **P. Shakarian**. Beyond Mentoring: Leveraging Indigenous Intelligence Assets through Reporting. *CTC Quarterly Bulletin, Center for Army Lessons Learned (CALL)* 7(32).
2005 T. Higgins, **P. Shakarian**, R. E. Ferguson. No Stone Unturned: A Thorough Search for Tactical Intelligence. *American Intelligence Journal* 23.

ARTICLES TRANSLATED INTO OTHER LANGUAGES:

2013 **P. Shakarian**, J. Shakarian, A. Ruef. El Dragón y la Computadora: Por qué el Robo de la Propiedad Intelectual es Compatible con la Doctrina China de la Guerra Cibernética. *Air and Space Power Journal, Edicion en Espanol,* 3rd quarter, 2013.
2013 **P. Shakarian.** 震网——掀起网空战争军事革命. *Air and Space Power Journa l-Chinese*, 1Q 2013.
2012 **P. Shakarian**. Stuxnet: Revolucion de la Ciberguerra en los Asuntos Militares. *Air and Space Power Journal, Edicion en Espanol* 24(3).

PATENTS ISSUED:

1. US11892897 (Feb. 6, 2024) Systems and methods for prioritizing software vulnerabilities for patching
    a. ASU invention M18-009P
    b. Published in US, EU, and Israel
2. US11693972B2 (Jul. 4, 2023) Systems and methods for an at-risk system identification via analysis of online hacker community discussions
    a. ASU invention M19-268P

3. US11552976B2 (Jan. 10, 2023) Systems and methods for social network analysis on dark web forums to predict enterprise cyber incidents
    a. ASU invention M19-002P
4. US11520900B2 (Dec. 6, 2022) Systems and Methods for a Text Mining Approach for the Prediction of Exploited Software Vulnerabilities
    a. ASU invention M18-247P
    b. Currently licensed
5. US11336673B2 (May 17, 2022) Systems and Methods for Third Party Risk Assessment
    a. ASU invention M18-175P
6. US11275900B2 (Mar. 15, 2022) Systems and methods for automatically assigning one or more labels to discussion topics shown in online forums on the dark web
    a. ASU invention M18-191P
7. US11126679B2 (Sep. 21, 2021) Systems and methods for detecting pathogenic social media accounts without content or network structure
    a. PCT application WO2019157335A1
    b. ASU invention M18-147P
8. US10437945B2 (Oct. 8, 2019) Systems and methods for order-of-magnitude viral cascade prediction in social networks
    a. ASU invention M15-222P
9. US10313385B2 (Jun. 4, 2019) Systems and methods for data driven game theoretic cyber threat mitigation
    a. ASU invention M16-040P
10. US10176438B2 (Jan. 8, 2019) Systems and Methods for Data Driven Malware Task Identification
    a. ASU invention M15-167P

PUBLISHED PATENT APPLICATIONS (NOT YET ISSUED):

1. US20200036743A1 (Jan. 30, 2020) Systems and methods for predicting the likelihood of cyber-threats leveraging intelligence associated with hacker communities
    a. ASU invention M18-234P
    b. Currently licensed
2. WO2020236960A1 (Nov. 26, 2020) Systems and methods for calculating aggregation risk and systemic risk across a population of organizations
    a. Published in US and UK

REGISTERED COPYRIGHT

- Intelligent darkweb crawling infrastructure for cyber threat intelligence collection (2016)
    a. ASU invention M16-090P
    b. Software copyright

ASU INVENTION DISCLOSURES NOT ASSOCIATED WITH A PUBLISHED PATENT OR COPYRIGHT.

- M24-118P: PyReason: Open World Temporal Logic
  - U.S. Provisional patent 63/549,314 (Feb. 2, 2024) "Systems and Methods for Open World Temporal Logic"
- M23-101: Systems and methods for identification of trade indicators
  - U.S. Provisional patent 63/511,149 (June 29, 2023) "Systems and Methods for Identification of Trade Indicators"
  - Also submitted for copyright registration of source code
  - Currently under exclusive option to license
- M23-184P: System and method for predicting the accuracy of a machine learning model on solving math problems
  - U.S. Non-Provisional patent application filed May 24, 2024
  - U.S. Provisional patent 63/509,237 (June 20, 2023) "Large Language Model Screening System and Methods Thereof"

CURRENT DOCTORAL STUDENTS (CHAIR)

- Divyagna Bavikadi (Ph.D., Computer Science, ASU) (Fall 2022- present)
- Kaustuv Mukherji (Ph.D., Computer Science, ASU) (Fall 2022- present)
- Al Mehdi Saadat Chowdhury (Ph.D., Computer Science, ASU) (Fall 2023 - present)
- Yijin Yang (Ph.D., Computer Science, ASU) (Fall 2023 - present)
- Joshua Shay Kricheli (Ph.D., Computer Science, ASU) (Fall 2023 - present)
- Jaikrishna Patil (Ph.D., Computer Science, ASU) (Fall 2023 - present)

CURRENT MS THESIS STUDENTS (CHAIR)

- Aniruddha Datta (M.S., Computer Science) (Spring 2023-Present)
- Noel Ngu (M.S., Computer Science) (Spring 2024-Present)
- Ezra Lee (M.S., Computer Science, Spring 2024-Present)

GRADUATED DOCTORAL STUDENTS (CHAIR)

- Eric Nunes (Ph.D., Computer Engineering, ASU, successfully defended in 2018, graduated in 2019, now at Palantir)
  - *Reasoning about Cyber Threat Actors*
- Elham Shaabani (Ph.D., Computer Science, ASU, successfully defended in 2019, graduated in 2019, now at Microsoft (LinkedIn))
  - *Data Driven Inference in Populations of Agents*
- Mohammed Almukaynizi (Ph.D., Computer Science, successfully defended in 2019, graduated in 2019, now an Assistant Professor King Saud University)
  - *Proactive Identification of Cybersecurity Threats using Online Sources*
- Hamid Alvari (Ph.D., Computer Science, successfully defended in 2020, graduated in 2020, currently researcher at Google DeepMind)
  - *Understanding Propagation of Malicious Information Online*
- Soumajyoti Sarkar (Ph.D., Computer Science, successfully defended in 2020, graduated in 2020, currently a scientist at Amazon AWS)

  - *Measuring the Impact of Social Network Interactions*
- Ericsson Marin (Ph.D., Computer Science, ASU, successfully defended in 2020, graduated in 2020, currently an Assistant Professor at CalPoly Pomona)
  - *A Hacker-Centric Perspective to Empower Cyber Defense*

FORMER STUDENTS HOLDING ACADEMIC POSITIONS

- Mohammed Almukaynizi, King Saud University (Assistant Professor)
- Ericsson Marin, CalPoly (Assistant Professor)
- Geoffrey Moores, West Point (Lecturer)
- Joseph Salmento, West Point (Lecturer)

GRADUATED STUDENTS (MS THESIS ADVISOR - CHAIR)

- Brian Vincent (M.S., Computer Science) graduated in 2018
  - *Understanding Hacking-as-a-Service Markets*
- Krishna Dharaiya (M.S., Computer Science) graduated in 2018
  - *Identifying Financial Fraud on the Darkweb*
- Revanth Patil (MS, Computer Science) graduated in 2018
  - *Multi-class and Multi-label classification of Darkweb Data*
- Nikhil Kumar (MS, Computer Science) graduated in the summer of 2016
  - *An Empirical Evaluation of Social Influence Metrics*

OTHER ASU UNDERGRADUATE AND GRADUATE MENTORSHIP:

- UNDERGRADUATE HONORS THESIS:
  - Brandon Tsai (B.S., Computer Science, current student)
  - Roman Smith (B.S., Computer Science, graduated in 2023)
  - Colton Payne (B.S., Computer Science, graduated in 2023)
  - Iden Alba (B.S., Computer Science, ASU, graduated in 2018)
  - Andrew Polican (B.S., Computer Science, ASU, graduated in 2018)
  - James Hutchins (B.S., Computer Science, ASU, graduated in 2017)
  - John Robertson (B.S., Computer Science, ASU, graduated in 2016)
- ASU Master's Opportunity for Research in Engineering (MORE)
  - Aniruddha Datta (MS, Computer Science)
- Master's Capstone Project
  - Gilles-armel Aye (MS, Systems Engineering, Robotics and Autonomous Systems)
- ASU Fulton Undergraduate Research Initiative (FURI):
  - Noel Ngu, Fall 2023
  - Bryan Lee, Summer 2022
  - Cody Iwertz, Fall 2017
  - Nidhal Selmi, Spring 2017
  - John Robertson, Fall 2015, Spring 2016
  - James Hutchins, Fall 2016
  - Riyan Setiadji, Spring 2015
  - Amanda Thart, Fall 2015

  - Adam Tse, Spring 2015, Fall 2015
  - Spencer Offenberger, Spring 2015, Fall 2015
- ASU Grand Challenge Scholar Program (GCSP) Research Stipend
  - Rohan Nair, Spring 2023
  - Cody Iwertz, Fall 2016
- Army Research Office Undergraduate Research Program
  - John Robertson (2016)
- ASU Barrett Honors contract
  - Sai Punit Arani (2023)
  - Taehoon Kwon (2023)
  - Harikrishna Kommineni (2023)

EDITORIAL BOARD MEMBERSHIPS:

- Editorial board member, *Springer Social Network Analysis and Mining* (2021-2022)
- Editorial board member, *Cyber Defense Review* (2017-2022)
- Guest editor, *Neurosymbolic Artificial Intelligence* (Special Issue on Neuro-Symbolic AI and Domain Specific Conceptual Modelling) (2024).
- Guest editor, *Information* (special issue "Social Influence") (2020)
- Guest editor, *Information* (special issue "Darkweb Cyber Threat Intelligence Mining") (2018)
- Guest editor, Springer *Social Network Analysis and Mining* (special issue "Diffusion of Influence and Information in Social Networks") (2016)

CONFERENCE ORGANIZING ACTIVITY:

- Organizing committee, ""Empowering Machine Learning and Large Language Models with Domain and Commonsense Knowledge (AAAI-MAKE 2024)", part of the AAAI Spring Symposium, 2024.
- Co-Chair, "International Workshop on Hybrid AI Machine Learning Systems (AIMS)," co-located at CAISE, 2024.
  - CAISE is an "A" rated conference by https://www.core.edu.au
- Chair, "Workshop on Metacognitive Prediction of AI Behavior," sponsored by Army Research Office, held in Scottsdale, AZ, 2023.
- Co-Chair, *Workshop on Social Influence (SI)* (held in conjunction with ASONAM) 2014, 2016-2021
  - This workshop is still held annually as of 2023
- General Chair, FOSINT-SI 2021-2022
- Co-Chair, FOSINT-SI, 2019-2020
- Program Committee Co-Chair, IEEE *International Conference on Data Intelligence and Security (ICDIS)*, 2020.
- Co-Chair, *Artificial Intelligence and Cybersecurity* (Lorenz eScience winner), 2019
- Co-Chair, *ARO Workshop on Cyber Warfare: Building the Scientific Foundation*, 2014

PROFESSIONAL ADVISORY BOARDS:

- Member, Arizona Technology Council Artificial Intelligence Committee (2023-present)
- Member, Arizona Cyber Team, Emerging Technologies subgroup (2018-2021)
- Member, Arizona Technology Council Committee of Cybersecurity (2018-2021)

OTHER EXTERNAL SERVICE:

- PC member, NeSy 2024 (Int'l. Conf. on Neural-Symbolic Learning and Reasoning)
- PC member, KR 2024
- Springer book reviewer for "Applications of Neuro-Symbolic Artificial Intelligence," 2023
- Cambridge University Press book reviewer for "Knowledge-infused Learning: Knowledge-powered NeuroSymbolic AI for Explainability, Interpretability, and Safety," 2023
- PC member, AAAI-2016, 2023, 2024, 2025
- PC Member for KDD Workshop on Artificial Intelligence-Enabled Cybersecurity Analytics (2024)
- PC member for European Conference on Logics in Artificial Intelligence (JELIA) 2023
- PC member for Knowledge-Guided Machine Learning at ECML/PKDD 2023
- Reviewer for book "Neuro-Symbolic AI" (Packt Publishing) 2023
- AAMAS Senior Program Committee, AAMAS (2018-2019)
- PC member, ASONAM (2019)
- PC member, IJCAI (2018, 2019)
- PC member, FOSINT-SI (co-located with ASONAM) (2014-2017)
- PC member, KDD (2015, 2016)
- PC member, AAMAS (2015, 2016)
- Journal Reviewer Duties
    - Reviewer for Intl. Journal of Approximate Reasoning (2023) (Q1)
    - Reviewer for Neurosymbolic Artificial Intelligence (2023)
    - Reviewer for ACM Digital Threats (2022)
    - Reviewer for Elsevier Computers and Security (2021) (Q1)
    - Reviewer for Springer-Nature Scientific Reports (2018) (Q1)
    - Reviewer for journal IEEE Transaction on Big Data (2017) (Q1)
    - Reviewer for Cambridge *Knowledge Engineering Review* (2016) (Q1)
    - Reviewer for *Proceedings of the Royal Society A* (PRSA) (2013, 2015) (Q1)
    - Reviewer for ACM journal *Transactions of Knowledge Discovery from Data* (TKDD) (2012) (Q1)
- Funding Agency Reviewer Duties
    - Reviewer for Department of Energy (DOE) grant proposals (2024)
    - Reviewer for Army Research Office (ARO) grant proposals (2012-2013, 2015-2018, 2023)
    - Reviewer for National Science Foundation (NSF) grant proposals (2022)
    - Reviewer for Air Force Office of Scientific Research (AFOSR) grant proposals (2017)
    - Reviewer for DARPA proposals (2014)

ASU PROGRAM ENDORSEMENTS:

- Computer Science PhD (Endorsed to Chair)
- Data Science, Analytics and Engineering PhD (Endorsed to Chair)
- Electrical Engineering PhD (Endorsed to Chair)

UNIVERSITY SERVICE:

- SCHOOL-LEVEL:
  - Chair of SCAI Faculty Entrepreneurship Innovation Venture Education (SCAI-FIVE) 2022-Present
  - Committee Member, Personnel Committee, 2023-Present
  - Committee Member, Smart Data Engineering Search, 2022-2023
  - Committee Member, Admissions Committee, CIDSE (ASU) 2014-2016
  - Faculty Advisor, West Point UPE (Computer Science Honor Society) Chapter, 2011-2014
  - Faculty Advisor, Department Scholarship Program, West Point, 2011-2014
  - Department Academic Counselor (Computer Science), West Point, 2011- 2014
- COLLEGE-LEVEL:
  - SCAI Research Director for FSE VDRI (2023-present)
  - SCAI Representative for the FSE Dean's Research Advisory Council (RAC), 2022-2023
  - Reviewer for GCSP scholarship applications (2023, 2024)
  - Reviewer for FURI scholarship applications (2023)
  - Judge for the Fulton Entrepreneurial Professorship (2023)
  - Judge for the New Economic Initiative entrepreneurial post doc position (2022)
  - Mentor, Fulton Undergraduate Research Initiative (FURI) (ASU) 2015-Present
  - Head Faculty Advisor, Fulton Student Veterans Organization (ASU) 2019-2021
  - Faculty Advisor, Fulton Student Veterans Organization (ASU) 2016-2019
- UNIVERSITY-LEVEL:
  - Reviewer, limited submission grant proposals for Knowledge Enterprise (KE) (2023-Present)
  - Interviewer for applicants for senior position at ASURE including director (2023)
  - Honors Faculty, Barrett, The Honors College, 2015-Present
  - Affiliate Faculty, Institute for Social Science Research, 2017-Present
  - Affiliate Faculty, Center for Cybersecurity and Digital Forensics, 2015-Present
  - Affiliate Faculty, Center for Assured and Scalable Data Engineering, 2015-Present
  - Affiliate Faculty, Center for the Future of War, 2014-Present
  - Affiliate Faculty, West Point Network Science Center, 2011-2014

DIVERSITY, EQUITY, AND INCLUSION ACTIVITIES:

- Taught 18 classes on diversity, equity, and inclusion as part of instruction for ASU 101

- Served as a senior personnel leading research efforts as part of the ONR NEPTUN program (2015-2019) that involved veteran outreach and training. My research group both recruited veteran participants and conducted professional training for veterans as part of the program.
- Served as an advisor, ad eventually head faculty advisor for the Fulton Student Veteran's organization from 2016-2021.

SAMPLE LECTURES:

- Various lectures on the "Neuro Symbolic" YouTube channel we created (2022-present) https://www.youtube.com/@neurosymbolic
- ASU KED Talk: Staying ahead of cyber attacks (2018) https://www.youtube.com/watch?v=B-H2kaQNVNw&t=335s
- ISC2/McAfee: Malware and Machine Learning: What you need to know (2017) https://www.brighttalk.com/webcast/5385/254753
- Army Cyber Talks: Toward a Threat-Centric Paradigm (2016) https://www.youtube.com/watch?v=TFeFR_Jldcw
- New America Panel: Understanding the Future of Cyber Threat Intelligence (2016) http://www.ustream.tv/recorded/88353440
- Mining for Causal Relationships: A Data-Driven Study of the Islamic State (KDD 2015) https://www.youtube.com/watch?v=CNU5Ovs-L-g
- The "Science of Cyber" and the Next Generation of Security Tools (ShmooCon 2014) https://archive.org/details/ShmooCon2014_Science_of_Cyber_and_Next_Gen_Security_Tools https://www.youtube.com/watch?v=btvwhY-eMEw

COURSES TAUGHT:

- **Arizona State (Fall 2014-Present):**
  - Undergraduate:
    - CSE 475: Foundations of Machine Learning
      - Spring, 2024 (195 undergraduates), ASU I-Course (online)
      - Fall, 2023 (205 undergraduates), ASU I-Course (online)
      - Fall, 2023 (25 undergraduates), ASU Online
      - Spring, 2023 (175 undergraduates), hybrid version
      - Fall, 2022 (132 undergraduate), hybrid version
    - CSE471: Introduction to Artificial Intelligence
      - Fall, 2024 (175 undergraduates), Roll-out of redesigned online version of CSE471
      - Spring, 2015 (43 undergraduate)
    - CSE 494: Artificial Intelligence for Cybersecurity
      - Spring, 2019 (15 undergraduate)
    - ASU 101: The ASU Experience

        - Multiple semesters from 2022-Present
    - Graduate:
        - CSE 598: Perceptual Reasoning and Symbol Grounding
            - Fall, 2023 (40 graduate)
        - CSE 591: Neuro Symbolic Reasoning
            - Fall, 2022 (22 graduate)
        - CSE 591: Security Informatics
            - Spring, 2016 (14 graduate)
        - CSE 598: Introduction to Artificial Intelligence (Graduate version)
            - Spring 2015 (7 graduate)
        - CSE 573: Semantic Web Mining
            - Fall, 2015 (57 graduate)
        - CSE 591: Diffusion in Social Networks
            - Fall 2014, 25 total students (all graduate)

- **West Point Fall 2011 – Spring 2014:**
  (all undergraduate, West Point lectures are limited to 18 students per section, though multiple sections are often taught – each section is provided its own lecture for each lesson, **West Point provides no TA/GA support for any courses**)
    - IT300: Fundamentals of Programming
      (taught to non-computer science majors as all students at West Point are required to take an "engineering sequence" if not majoring in an engineering)
        - Fall, 2012 - 36 total students, 2 sections
    - CS486: Artificial Intelligence
        - Fall 2013, 6 students
        - Fall 2012, 5 students
    - IT305: Theory and Practice of Military IT Systems
      (mandatory course for all non-computer science majors)
        - Spring 2014, 36 students, 2 sections
        - Spring 2013, 54 students, 3 sections
        - Spring 2012, 54 students, 3 sections
        - Fall 2011, 54 students, 3 sections
    - CS489: Hard Problems in Complex Networks (pilot course)
        - Spring 2013, 3 students
        - Fall, 2012, 1 student
    - CS401/IT401: Software Systems Design I (capstone course)
        - Fall 2013, 6 students
    - XE402: Software Systems Design II (capstone course)
        - Spring 2014, 6 students

OTHER AWARDS WON BY MY STUDENTS:

- Army Research Office High School Research Apprenticeship Program – Anay Gupta (2016/2017)

- NSF Graduate Research Fellowship Award – Geoffrey Moores 2014 (West Point)
- NSF Graduate Research Fellowship Award – Damon Paulo 2014 (West Point)
- NSF Graduate Research Fellowship Honorable Mention – Joseph Hannigan 2014 (West Point)
- 2014 DARPA Innovation Challenge Finalist Team (Guillermo Hernandez, Joseph Hannigan, Bradley Fischl, Christian Young, Evan Kenney, Jacob Lademan)
- Letter of Commendation from the Superintendent of the Chicago Police – Guillermo Hernandez 2014 (West Point)
- Best Student Poster – 2014 ACM Tapia Conference – Joseph Hannigan 2014 (West Point)
- Society of American Military Engineers (SAME) Fellowship – Geoffrey Moores 2013 (West Point)

GRADUATED STUDENTS FOR WHICH DR. SHAKARIAN IS ON A DISSERTAITON OR THESIS COMMITTEE (NON-CHAIR):

- Doctorate
  - Vivin Paliath (Ph.D., Computer Science, ASU; Thesis Chairs: Adam Doupe and Yan Shoshitaishvili, graduated fall 2023) "Modeling State to Improve Defensive Cyberattack Strategies."
  - Kai Zhu (Ph.D., Electrical Engineering, ASU; Thesis Chair: Lei Ying, graduated fall, 2015) "Social Network Analysis: Detection of the Information Source," currently at Google.
  - Saadet Betul Ceran (Ph.D., Computer Science, ASU; Thesis Chair: Hasan Davulcu, graduated spring 2016) "Semantic Feature Extraction for Narrative Analysis."
  - Feng Wang (Ph.D., Computer Science, ASU; Thesis Chair: Ross Maciejewski, graduated spring, 2016) "Visual Analytics Methods for Exploring Geographically Networked Phenomena."
  - Jessica Bodford (Ph.D., Psychology, ASU; Thesis Chair: Virginia Kwan, graduated spring, 2016) "Blurring Safety Between Online and Offline Worlds: Archival, Correlational, and Experimental Evidence of Generalized Threat in the Digital Age."
- Masters
  - Sravan Kumar Garipalli (M.S., Computer Science, ASU; Thesis Advisor: Hasan Davulcu, graduated fall, 2015) "Visualization Tool for Islamic Radical and Counter Radical Movements and their online followers"
  - Jessica Bodford (M.S., Psychology, ASU; Thesis Advisor: Virginia Kwan, graduated spring, 2015) "We are Legion: Hacktivism as a Product of Deindividuation, Power, and Social Injustice," currently a Ph.D. student at ASU

RECENT AND SELECTED MEDIA APPEARANCES (2023 AND LATER):

- Feb. 2024: Wall Street Journal https://www.wsj.com/tech/ai/ai-is-tutoring-students-but-still-struggles-with-basic-math-694e76d3 (quoted on the topic of ChatGPT's ability to solve math word problems)

- Nov. 2023: Daily Independent https://www.yourvalley.net/stories/inaugural-asu-artificial-intelligence-day-scheduled-for-tempe,460271 (quoted on SCAI's AI day)
- Oct. 2023: ZDNet https://www.zdnet.com/article/using-chatgpt-for-accounting-you-may-want-to-think-again/ (quoted on work relating to evaluation of LLMs on math problems)
- Oct. 2023: ASU News https://news.asu.edu/20231020-government-calling-tech-leaders-help-crafting-artificial-intelligence-legislation
- Aug. 2023: ASU Full Circle https://fullcircle.asu.edu/fulton-schools/asu-researchers-bridge-security-and-ai/ (regarding participation in DARPA AI Forward)
- Jul. 2023: AI Magazine https://onlinelibrary-wiley-com.ezproxy1.lib.asu.edu/doi/full/10.1002/aaai.12094 (regarding work on LLM performance on math problems)
- Feb. 2023: ASU News https://news.asu.edu/20230221-discoveries-do-math-chatgpt-sometimes-cant-expert-says
- Mar. 2022: CYR3CON acquisition by CSW covered in HelpNetSecurity and New Mexico Inno
- Aug. 2018: Pathogenic social media research featured in the Wall Street Journal
- May 2017: Coverage in Slate, The Economist, quoted by CNN and interviewed on CBC.
- Aug. 2016: Darkweb scraping technology featured on Forbes, Cisco Continuum, and MIT Technology Review.
- Jan. 2016: Featured in the print edition of The Economist.
- Nov. 2015: Featured in Business Insider as part of a Veteran's day series. The major Chinese news outlet Sohu published a similar article.
- Sep./Oct., 2015: Our work on information cascades featured in TechCrunch, ExtremeTech, and the Irish Times.
- Aug., 2015: My KDD-2015 paper on causal learning to understand Islamic State military actions was featured as BBC Technology's lead story and also featured in the Huffington Post, Business Insider (with a follow-up) and Australian news media.
- Jan. 2014: *MIT Technology Review* included my research on viral marketing (as published in the paper A Scalable Heuristic for Viral Marketing Under the Tipping Model) as one of the "Best of 2013." Also, in the same month, my work on protecting the power grid was featured in Foreign Policy's Complex Blog.
- Jan. 2014: My ORCA software package was featured in the print edition of *Popular Science.* The story was also carried by Focus.it – a major Italian technology blog/magazine.
- 6 Dec. 2012: *WIRED* (online) featured my research on attacking robust terror networks.
- 21 Apr. 2012: *The Economist* featured my work on the SCARE counter-IED software.