

## Paulo Shakarian, Ph.D.

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Associate Professor  
Fulton Schools of Engineering  
Arizona State University

**Paulo Shakarian, Ph.D.**

Fulton Schools of Engineering  
Arizona State University  
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Paulo Shakarian, Ph.D. is a tenured Associate Professor at the Fulton Schools of Engineering at Arizona State University. He specializes in 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 also co-founded and led the startup company Cyber Reconnaissance, Inc. – which was the first commercial solution to use machine learning to predict future exploits. The company raised over \$8 million in venture capital, obtained over 80 customers, and was eventually acquired by Cyber Security Works. 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.

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## PROFESSIONAL EXPERIENCE NARRATIVE:

2014-Present                      Assistant and Associate Professor, Arizona State University

I was selected for a tenured position at Arizona State University where I created a research group initially focused on the intersection of artificial intelligence and security. I successfully mentored and graduated 6 Ph.D. students, raised over \$3 million in grant funding over a 5 year period, which included a major grant from IARPA, received multiple “best paper” awards at ACM and IEEE conferences, and received numerous accolades such as the Air Force’s “Young Investigator Award.” I was also named an “Entrepreneurial Professor” which gave me time to develop initial commercial prototypes based on some of my research, which led, in particular, to the founding of Cyber Reconnaissance, Inc. (for which I took a sabbatical to focus on those efforts).

2016-2022                      CEO and Co-Founder, Cyber Reconnaissance, Inc.

Cyber Reconnaissance, Inc. sold a SaaS-based platform that combined intelligence automatically mined from over 1,300 websites spanning deepweb, darkweb, open sources, and social media to feed a supervised machine learning approach to predict which software vulnerabilities would be exploited. It was the first such solution on the market and later replicated by other companies in the industry. Cyber Reconnaissance raised over \$8 million in venture capital, received multiple government grants, and had over 80 paying customers – including several major Fortune 500 firms. The company was acquired in 2022 by Cyber Security Works.

2002-2014                      Commissioned Officer, U.S. Army

After graduating from West Point, I started my active-duty military career as an intelligence officer in the Army, primarily serving in tactical units such as First Armored Division and First Infantry Division. I had served two combat tours in Iraq earning the Bronze Star, Army Commendation Medal with Valor Device, and the Combat Action Badge. After my second combat tour, I was selected for the DARPA Service Chiefs’ Fellows Program and later returned to West Point as an Assistant Professor where I taught computer science to undergraduates – which was the last assignment of my military career.

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## PROFESSIONAL EXPERIENCE:

2020-Present Associate Professor (with tenure), SCAI, Arizona State University, Tempe AZ  
2016-2022 CEO and Co-founder, Cyber Reconnaissance, Inc.  
2014-2020 Assistant Professor, CIDSE, Arizona State University, Tempe AZ

- Fulton Entrepreneurial Professor, 2016-2018

2002-2014 Commissioned Officer, U.S. Army

- Assistant Professor, D/EECS, U.S. Military Academy, West Point NY, 2011-2014
- Graduate Research Assistant, University of Maryland, College Park, MD, 2008-2011
- Military Fellow, DARPA Service Chiefs' Fellows Program (3 months), 2007
- 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

## CONSULTING AND PART-TIME POSITIONS:

2016-Present Board Member, Arx Nimbus  
2016-2017 Fellow, Cybersecurity Initiative, New America Foundation  
2012-2014 Consultant, IARPA IcArUs project

## 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  
U.S. Military Academy, Information Assurance, Depth of Study, 2002

## AWARDS AND ACCOLADES:

- Best Presentation, IEEE CCWC 2020
- Best Paper, IEEE ICDIS-2019
- Winner, Lorenz e-Science 2019 (co-author with Vincent Lengkeek, Roy Lindelauf, Arnout van de Rijt, and V.S. Subrahmanian)
- Best Paper, IEEE ICDIS-2018
- Best Poster, IEEE ICDIS-2018 (x2)
- Paper "A review of evolutionary graph theory with applications to game theory" was the most cited article of the Elsevier journal *BioSystems* (2017)
- Named a [KDD Rising Stars](#) by Microsoft Research Asia (2016)
- Best Paper, FOSINT-SI (2016)
- Fulton Entrepreneurial Professor (2016-2017)
- Selected for Innovation Showcase at [TechConnect 2016](#) for invention "Improved Malware Detection Technology".
- Defense University Research Instrumentation Program (DURIP) award (2016)
  - One of 176 funded proposals (622 submitted)
- Cybersecurity Initiative Fellow, New America (2016-2017)
- Nominee, Sidney Drell Award (2016)
- ASU Leadership Academy (2016)
  - Selected through a nomination process
- 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)
- 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.")

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- MIT Technology Review [“Best of 2013”](#) (2013)
  - selected as one of 12 academic papers uploaded to arXiv in 2013 - selected from across all scientific disciplines
- Best Poster, ACM Tapia (2013)
- DARPA Service Chiefs’ Fellowship (2007)
  - selected as one of four military officers from FORCECOM
- Various awards and grants associated with CYR3CON, a startup co-founded by Paulo Shakarian including: State of Arizona EmergeAZ grant (2021), 2021 National Security Accelerator (2021), Finalist, CISO choice awards (2020), TRUMPF Venture Forum (cybersecurity) (2019), Plug-and-Play accelerator (2019), SixThirtyCyber accelerator (2018), [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)
- 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)

## PREVIOUS PROJECT AWARDS:

- Principle Investigator (CYR3CON team) for “EFFECT,” IARPA CAUSE Phase II program, \$402K, 2018-2019.
- Principal Investigator for “Understanding Social Influence without Markov Assumptions,” ARO Single Investigator Program, \$469K, 2015-2018.
- 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.
- 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.
- Principle Investigator (ASU team) for “EFFECT,” IARPA CAUSE Phase I program, 2016-2018.
- 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 for “Viral Marketing for Social Networks” USAF A2II, \$100K, 2013-2014 (project complete)
- Principal Investigator, DARPA UROP program, R.0004972.001, \$21K, 2013-2014 (project complete)
- Principal Investigator for “Combinatorial and Scalable Initiation in Complex Networks,” ARO Single Investigator Program, project 2GDATXR042, \$249K, 2012-2014. (project complete)
- Consultant (to the Program Manager), “Integrated Cognitive-Neuroscience Architectures for Understanding Sensemaking (ICArUS)” IARPA, 2012-2014 (project complete).
- Principal Investigator for “Landowner-Red (LOR),” DoD project N4175613MP50287, \$50K, 2013. (project complete)
- Principal Investigator for “Searching Huge Attribute and Relational Knowledgebases (SHARK),” DoD project N4175613MP50285, \$50K, 2013. (project complete)
- Principal Investigator for “Allocation of Special Forces Resources in a COIN Environment,” DoD project F1AF262025G001, \$23K, 2012. (project complete)

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### **MEDIA (AND OTHER NOTEWORTHY) APPEARANCES:**

- Mar. 2022: CYR3CON acquisition by CSW covered in [HelpNetSecurity](#) and [New Mexico Inno](#)
- Feb. 2021: Wrote article entitled [North Korea targeted cybersecurity researchers using a blend of hacking and espionage](#) for *The Conversation*.
- Dec. 2020: Wrote article entitled [The Sunburst hack was massive and devastating – 5 observations from a cybersecurity expert](#) for *The Conversation*.
- Aug. 2018: Pathogenic social media research featured in the [Wall Street Journal](#)
- July 2018: CYR3CON featured in [St. Louis Dispatch](#).
- Apr. 2018: Featured in [Cyberwire](#)
- Mar. 2018: Quoted by [Business Insider](#).
- Feb. 2018: Quoted by [Vox](#).
- Jan. 2018: Quoted on [CNN](#).
- Nov. 2017: Research featured on [Defense One](#).
- Oct. 2017: Featured on [KJZZ](#).
- Oct. 2017: CYR3CON mentioned in [Phoenix Business Journal](#)
- Oct. 2017: CYR3CON Featured in [IT Nation](#)
- Sep. 2017: Quoted in [Dimension Data's blog](#).
- Sep. 2017: Quoted in [Business Insider](#).
- July 2017: Quoted in [Business Insider](#), interviewed on [Arizona Horizon](#).
- June 2017: Quoted in [Business Insider](#) and [Sputnik News](#).
- May 2017: Mentioned in [Gizmodo](#), [TECH.CO](#) and [Free Enterprise \(US Chamber of Commerce\)](#).
- May 2017: Coverage in [Slate](#), [The Economist](#), quoted by [CNN](#) and interviewed on [CBC](#).
- Apr. 2017: Featured in [National Defense Magazine](#).
- Mar. 2017: Interviewed on Canada's [CBC](#).
- Feb. 2017: Featured on [AZ Central](#) and [TECH.CO](#).
- Dec. 2016: Quoted in [Phoenix Business Journal](#) and [KTAR](#).
- Dec. 2016: Quoted by the [New York Times](#).
- Sep. 2016: Interviewed on radio station [KJZZ](#) and Phoenix [3TV](#) news for darkweb cybersecurity research.
- Aug. 2016: Missing persons software featured in [Quartz](#) and [Chinese media](#).
- Aug. 2016: Quoted on [Bloomberg](#).
- Aug. 2016: Darkweb scraping technology featured on [Forbes](#), [Cisco Continuum](#), and [MIT Technology Review](#).
- July 2016: Darkweb marketplace research featured on [Softpedia](#).
- June 2016: Quoted by the [L.A. Times](#).
- Apr. 2016: Interviewed with my student Elham Shaabani on [Data Skeptic](#).
- Mar. 2016: Quoted in the [New Yorker](#).
- Mar. 2016: Ongoing work on software to locate missing persons featured on [Tucson News 4 \(NBC\)](#)
- Mar. 2016: An editorial I wrote entitled "Know Thy Enemy" about proactive cyber intelligence was published by [New America](#) and [Slate Future Tense](#).
- Jan. 2016: Featured in the print edition of [The Economist](#).
- Dec. 2015: Featured in Chinese media: [Almost Human](#) and [Zihu](#).
- Nov. 2015: Featured in [Business Insider](#) as part of a Veteran's day series. The major Chinese news outlet [Sohu](#) published a similar article.
- Oct. 2015: My CySIS Lab was featured in the [State Press](#).
- 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](#).
- July 2015: My editorial entitled "[Why the Sony Hack Matters](#)" was named one of the "Top three cyber articles" by Elsevier [SciTechConnect](#).

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- July 2015: Television interview with [Arizona CBS 5](#) (receiving over 27,000 views and estimated publicity value over \$10,000 according to ASU Media Relations), [Phoenix ABC 15](#), [Phoenix 12 \(NBC\)](#), and radio interview with [KJZZ](#) on award of Minerva grant, also featured in the [International Business Times](#).
- Apr. 2015: Quoted in [DefenseOne](#) on the U.S. military campaign against ISIS.
- Apr. 2015: My lab was featured in the [Arizona Daily Independent](#).
- Aug. 2014: *Introduction to Cyber-Warfare* receives a 9 out of 10 rating on [Slashdot](#).
- 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.
- Nov. 2013: I was interviewed by the radio show [Promise of Tomorrow](#) regarding cyber-warfare.
- Sep., Oct. 2013: My work on viral marketing was featured in [MIT Technology Review](#), [Event Marketer Magazine](#), and [Folha De S. Paulo](#) (Brazil’s largest paper). Previously this work was featured on [Slashdot](#).
- 15 Sep. 2013: The [Boston Globe](#) quoted me concerning cyber warfare.
- Jul.-Aug. 2013: [Help Net Security](#), [Professional Security Magazine Online](#), and [Krypt3ia](#) reviewed my book *Introduction to Cyber-Warfare*. The [Naval Postgraduate School](#) is also using *Introduction to Cyber-Warfare* as a text for a graduate-level introductory cyber-security course.
- Jul. 2013: [BBC Future](#) published an article describing my ORCA software which was also featured on [NBC News](#), [Government Technology](#), [SlashDot](#), [MIT Technology Review](#) and [Small Wars Journal](#).
- 30 Mar. 2013: [The Economist](#) quoted me in an article on the market for software exploits.
- 14 Dec. 2012: I briefed staffers from the [House Permanent Select Committee on Intelligence \(HPSCI\)](#) on my research regarding new ways to attack robust terror networks.
- 6 Dec. 2012: [WIRED \(online\)](#) featured my research on attacking robust terror networks.
- 17 Jul. 2012: The [L.A. Times](#) quoted me in an article regarding the use of software to analyze counter-insurgency data.
- 21 Apr. 2012: [The Economist](#) featured my work on the SCARE counter-IED software.
- Apr. 2011: [MSNBC CosmicLog](#) featured my work on the SCARE-S2 counter-IED software. [Nature](#) also featured SCARE in an article during this month. Earlier versions of SCARE were previously featured in [Science News](#), [The Baltimore Sun](#), and [Popular Science \(online\)](#).

### PLENARY AND KEYNOTE PRESENTATIONS:

- 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 panel talk, Sep. 2016.

### SELECTED INVITED TALKS:

- 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

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- 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, *Avoiding 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).
- 2016 P. Shakarian, [Diffusion in Social Networks](#). AAI Tutorial, Phoenix, AZ, Feb., 2016.
- 2015 P. Shakarian, [The Cyber Battlefield: Now and the Near Future](#). Invited talks, ISC2, Phoenix Chapter, Phoenix, AZ, Oct. 2015
- 2015 P. Shakarian, [Diffusion in Social Networks](#). IJCAI Tutorial, July, 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.

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- 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 4<sup>th</sup> 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.

### SELECTED POSTER PRESENTATIONS:

- 2018 M. Almukaynizi, E. Marin, E. Nunes, **P. Shakarian**, D. Kapoor, G. Simari, T. Siedlecki, DARKMENTION: Reasoning about enterprise-related external cyber threats using a rule learning approach, *IEEE International Conference on Data Intelligence and Security* (ICDIS-18) (April 2018). **Best Poster**.
- 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**.
- 2013 J. Hannigan, S. J. Matthews, J.K. Wickiser, **P. Shakarian**, Leveraging Host Protein Network Topology to Identify Cancer Causing Pathogens. 2014 ACM Richard Tapia Conference, February 2014. **Best Poster**.

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

- 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).
- 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**.
- 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.



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

- 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, Springer.
- 2018 *E. Nunes, C. Buto, P. Shakarian, C. Lebiere, S. Bennati, R. Thomson, [Malware Task Identification: A Data Driven Approach](#)*, in *Open Source Intelligence and Security Informatics*, 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*, 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):

- 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](#)**, *MDPI 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

## Paulo Shakarian, Ph.D.

Associate Professor  
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- 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 since 2012 (as of July, 2017).*
- 2012 *P. Shakarian, J.P. Dickerson, V.S. Subrahmanian. [Adversarial Geospatial Abduction Problems](#). *ACM Transactions on Intelligent Systems and Technology* 3(2).*
- 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 Transaction 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. Otsstott. [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):

- 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)* (tech. communication) (accepted).*
- 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**.*
- 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](#), *2019 IEEE/ACM International Conference on Advances in Social Networks Analysis and Mining (ASONAM-2019)* (Aug. 2019). 15% acceptance rate.*

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- 2019 *M. Almukaynizi, M. Shah, P. Shakarian, A Hybrid KRR-ML Approach to Predict Malicious Email Campaigns, Foundations of Open-Source Intelligence and Security Informatics (FOSINT-SI, held in conjunction with ASONAM-19) (Aug. 2019).*
- 2019 *V. Paliath, P. Shakarian, Reasoning about Sequential Cyberattacks, Foundations of Open-Source Intelligence and Security Informatics (FOSINT-SI, held in conjunction with ASONAM-19) (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.*
- 2018 *N. Tavabi, P. Goyal, M. Almukaynizi, P. Shakarian, K. Lerman, DarkEmbed: Exploit Prediction with Neural Language Models, 30th Innovative Applications of Artificial Intelligence (IAAI-18, held in conjunction with AAAI) (Feb. 2018).*

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- 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* (CSSS-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](#), *Foundations of Open-Source Intelligence and Security Informatics* (FOSINT-SI, held in conjunction with ASONAM-16) (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. 2015). 19.8% acceptance rate.
- 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](#), *28th Innovative Applications of Artificial Intelligence* (IAAI-16, held in conjunction with AAAI) (Feb. 2016). **Provisional patent 62/261,200 (Nov. 30, 2015)**
- 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; Provisional patent 62/191,086 (July 10, 2015); Featured on Data Skeptic.**

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- 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](#), *21<sup>st</sup> 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.
- 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. [Provisional patent 62/201,517 \(Aug. 5, 2015\)](#)
- 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.
- 2015 E. Nunes, N. Kulkarni, **P. Shakarian**, A Ruef, J. Little, [Cyber-Deception and Attribution in Capture-the-Flag Exercises](#), *Foundations of Open-Source Intelligence and Security Informatics (FOSINT-SI, held in conjunction with ASONAM-15)* (Aug. 2015).
- 2015 E. Nunes, C. Buto, **P. Shakarian**, C. Lebiere, S. Bennati, R. Thomson, H. Jaenisch, [Malware Task Identification: A Data Driven Approach](#), *Foundations of Open-Source Intelligence and Security Informatics (FOSINT-SI, held in conjunction with ASONAM-15)* (Aug. 2015). [Provisional patent 62/182,006 \(June 19, 2015\)](#); 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](#). *13<sup>th</sup> 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](#). *20<sup>th</sup> ACM SIGKDD Conference on Knowledge, Discovery, and Data Mining (KDD)* (Aug. 2014). 22% acceptance rate.
- 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](#). *11<sup>th</sup> 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](#). *13<sup>th</sup> Intl. Conf. on Autonomous Agents and Multiagent Systems (AAMAS-14)* (May 2014). 23.8% acceptance rate. [Featured in Foreign Policy \(online\)](#).
- 2014 **P. Shakarian**, G. Simari, M. Falappa. [Belief Revision in Structured Probabilistic Argumentation](#). *Foundation 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](#). *Foundations of Open-Source Intelligence and Security Informatics (FOSINT-SI, held in conjunction with ASONAM-13)* (Aug. 2013). [Featured in the Jan. 2014 print edition of Popular Science](#).

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- 2013 **P. Shakarian**, P. Roos, D. Callahan, C. Kirk. [Mining for Geographically Disperse Communities in Social Networks by Leveraging Distance Modularity](#). *19<sup>th</sup> ACM SIGKDD Conference on Knowledge, Discovery, and Data Mining (KDD)* (Aug. 2013). 17% acceptance rate.
- 2013 **P. Shakarian**, G.I. Simari, D. Callahan. [Reasoning about Complex Networks: A Logic Programming Approach](#). *29<sup>th</sup> Intl. Conference on Logic Programming (ICLP-13)* (tech. communication) (Aug. 2013).
- 2013 **P. Shakarian**, G.I. Simari, R. Schroeder. [MANCaLog: A Logic for Multi-Attribute Network Cascades](#). *12<sup>th</sup> Intl. Conf. on Autonomous Agents and Multiagent Systems (AAMAS-13)* (May 2013).
- 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.**
- 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.
- 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 AAI)* (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)* (tech. communication) (Jul. 2010).
- 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.**

### 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.
- 2018 **P. Shakarian**, [How do vulnerabilities get exploited?](#), Medium, 2018.
- 2018 **P. Shakarian**, [Jackpotting ATMs in the United States: Could we have seen it coming?](#), Medium, 2018.
- 2018 **P. Shakarian**, [Third Party Risk and Cybersecurity Part I: What it is and Why it Matters](#), LinkedIn Blog, 2018.

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- 2018 **P. Shakarian**, [Third Party Risk and Cybersecurity Part II: Mitigating Risk from Third Parties](#), LinkedIn Blog, 2018.
- 2018 **P. Shakarian**, [Third Party Risk and Cybersecurity Part III: Threat Intelligence and Third Party Risk](#), LinkedIn Blog, 2018.
- 2017 **P. Shakarian**, [Why Patching is Hard and How it Can Be Improved](#), LinkedIn Blog, 2017.
- 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 2015.
- 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*, 3<sup>rd</sup> quarter, 2013.
- 2013 **P. Shakarian**. [震网——掀起网空战争军事革命](#). *Air and Space Power Journal - 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:

- [US11126679](#) (Sep. 21, 2021) Systems and methods for detecting pathogenic social media accounts without content or network structure
  - PCT application [WO2019157335A1](#)
  - ASU invention M18-147P
- [US10313385](#) (Jun. 4, 2019) Systems and methods for data driven game theoretic cyber threat mitigation
  - ASU invention M16-040P
- [US10437945B2](#) (Oct. 8, 2019) Systems and methods for order-of-magnitude viral cascade prediction in social networks
  - ASU invention M15-222P
- [US10176438](#) (Jan. 8, 2019) Systems and Methods for Data Driven Malware Task Identification
  - ASU invention M15-167P

## Paulo Shakarian, Ph.D.

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### **PUBLISHED PATENTS (NOT YET ISSUED):**

- US20220004630A1 (Jan. 6, 2022) Systems and methods for a multi-model approach to predicting the development of cyber threats to technology products
  - CYR3CON invention
- [US20210273969A1](#) (Sep. 2, 2021) Systems and methods for identifying hacker communications related to vulnerabilities
  - CYR3CON invention
- [US20210288991A1](#) (Sep. 16, 2021) Systems and methods for assessing software vulnerabilities through a combination of external threat intelligence and internal enterprise information technology data
  - CYR3CON invention
- [WO2020236960A1](#) (Nov. 26, 2020) Systems and methods for calculating aggregation risk and systemic risk across a population of organizations
  - CYR3CON invention
- [US20200364349A1](#) (Nov. 11, 2020) Systems and methods for an at-risk system identification via analysis of online hacker community discussions
  - ASU invention
- [US20200327237A1](#) (Oct. 15, 2020) Systems and methods for aggregating, ranking, and minimizing threats to computer systems based on external vulnerability intelligence
  - CYR3CON invention
- [US20200134579A1](#) (Apr. 30, 2020) Systems and methods for identifying indicators of cryptocurrency price reversals leveraging data from the dark/deep web
  - CYR3CON invention
- [US20200036743A1](#) (Jan. 30, 2020) Systems and methods for predicting the likelihood of cyber-threats leveraging intelligence associated with hacker communities
  - ASU invention M18-234P
- [US20190347327A1](#) (Nov. 14, 2019) Systems and methods for automatically assigning one or more labels to discussion topics shown in online forums on the dark web
  - ASU invention M18-191P
- [US20190349393A1](#) (Nov. 14, 2019) Systems and methods for third party risk assessment
  - ASU invention M18-175P
- [WO2019089389A1](#) (May 9, 2019) Systems and methods for prioritizing software vulnerabilities for patching
  - ASU invention M18-009P

### **PROVISIONAL PATENTS (U.S.):**

- 62/745,731 (Oct. 15, 2018), Social network analysis on the dark web forums to predict enterprise cyber incidents: Methods and Applications
- 67/721,401 (Aug. 22, 2018), Systems and Methods for a Text Mining Approach for the Prediction of Exploited Software Vulnerabilities
- 62/409,291 (Oct. 17, 2016) Systems and Methods for an Intelligent Infrastructure for Cyber Threat Intelligence Gathering
- 62/345,193 (June 3, 2016) Missing Person Intelligence Synthesis Toolkit
- 62/191,086 (July 10, 2015) Systems and Methods for Early Identification of Violent Criminal Gang Members



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## **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*

## **GRADUATED DOCTORAL STUDENTS (CHAIR)**

- Eric Nunes (Ph.D., Computer Engineering, ASU, successfully defended in 2018, graduated in 2019, now at PayPal)
  - *Reasoning about Cyber Threat Actors*
- Elham Shaabani (Ph.D., Computer Science, ASU, successfully defended in 2019, graduated in 2019, now at LinkedIn)
  - *Data Driven Inference in Populations of Agents*
- Mohammed Almukaynizi (Ph.D., Computer Science, successfully defended in 2019, graduated in 2019, now at 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 at WalMart Labs)
  - *Understanding Propagation of Malicious Information Online*
- Soumajyoti Sarkar (Ph.D., Computer Science, successfully defended in 2020, graduated in 2020, currently a scientist at Twitter)
  - *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*

## **ASU UNDERGRADUATE MENTORSHIP:**

- UNDERGRADUATE HONORS THESIS:
  - 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)
- FURI:
  - ASU Fulton Undergraduate Research Initiative (FURI) – Cody Iwertz, Fall 2017
  - ASU Fulton Undergraduate Research Initiative (FURI) – Nidhal Selmi, Spring 2017
  - ASU Fulton Undergraduate Research Initiative (FURI) 2x – John Robertson, Fall 2015, Spring 2016
  - ASU Fulton Undergraduate Research Initiative (FURI) – James Hutchins, Fall 2016
  - ASU Fulton Undergraduate Research Initiative (FURI) – Riyan Setiadji, Spring 2015
  - ASU Fulton Undergraduate Research Initiative (FURI) – Amanda Thart, Fall 2015
  - ASU Fulton Undergraduate Research Initiative (FURI) 2x – Adam Tse, Spring 2015, Fall 2015
  - ASU Fulton Undergraduate Research Initiative (FURI) 2x – Spencer Offenberger, Spring 2015, Fall 2015
- Other undergraduate mentorship programs
  - Army Research Office Undergraduate Research Program – John Robertson (2016)
  - ASU Grand Challenge Scholar Research Stipend – Cody Iwertz, Fall 2016

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### EDITORIAL BOARD MEMBERSHIPS:

- Editorial board member, *Springer Social Network Analysis and Mining* (2021-present)
- Editorial board member, *Cyber Defense Review* (2017-present)
- Guest editor, *MDPI Information* (special issue “Social Influence”) (2020)
- Guest editor, *MDPI 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:

- Co-Chair, *Workshop on Social Influence (WOSINF)* (held in conjunction with ASONAM) 2014, 2016-2021
- General Chair, FOSINT-SI 2021
- 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 Cyber Team, Emerging Technologies subgroup (2018-Present)
- Member, Arizona Technology Council Committee of Cybersecurity (2018-Present)

### OTHER EXTERNAL SERVICE:

- 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, AAAI-2016
- PC member, KDD (2015, 2016)
- PC member, AAMAS (2015, 2016)
- Mentor, IEEE-ISI 2016 Doctoral Consortium
- Journal Reviewer Duties
  - Reviewer for Elsevier *Computers and Security* (2021)
  - Reviewer for Springer-Nature *Scientific Reports* (2018)
  - Reviewer for journal *IEEE Transaction on Big Data* (2017)
  - Reviewer for Springer *Social Network Analysis and Mining* (2016-2017)
  - Reviewer for Cambridge *Knowledge Engineering Review* (2016)
  - Reviewer for *Proceedings of the Royal Society A (PRSA)* (2013, 2015)
  - Reviewer for *Europhysics Letters (EPL)* (2015)
  - Reviewer for *IEEE Transactions on Human-Machine Systems* (2015)
  - Reviewer for *Journal of Autonomous Agents and Multi-Agent Systems* (2015)
  - Reviewer for Elsevier journal *BioSystems* (2012-2014)
  - Reviewer for Springer *Security Informatics* (2014)
  - Reviewer for *IEEE Transactions on Multimedia* (2013)
  - Reviewer for ACM journal *Transactions of Knowledge Discovery from Data (TKDD)* (2012)
  - Reviewer for the Elsevier journal *Physics Letters A* (2012)
  - Reviewer for MDPI journal *Future Internet* (2012)
- Funding Agency Reviewer Duties
  - Reviewer for Army Research Office (ARO) grant proposals (2012-2013, 2015-2018)
  - Reviewer for Air Force Office of Scientific Research (AFOSR) grant proposals (2017)

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- Book Reviewer Duties
  - Reviewer for Springer book *Open Source Intelligence and Security Informatics* (2018)
  - Reviewer for Elsevier/Syngress book proposals (2013)
  - Reviewer for Routledge book proposals (2014-2015)
  - Reviewer for the book *Game Theoretical Models in Biology* by M. Broom and J. Rychtar (2012)
- Conference Reviewer Duties
  - Reviewer for ISC(2) talk proposals (one of the top industry conferences in cybersecurity, 2018)
  - Reviewer for *European Symposium on Research in Computer Security* (ESORICS) (2013)
- Workshop/symposium committees
  - PC member, *Data Mining in Politics* (sponsored by Thomson Reuters) (2016)
  - PC member, SecMAS (2016)
  - PC member, ArgMAS-15 (2015)
  - PC member, HoloMAS-15 (2015)
  - PC member, *IEEE Region 10 Humanitarian Technology Conference* (2014)
  - PC member, *International Workshop on Multimodal Social Data Management* (2014)
  - Track chair, IEEE International Conference on Behavioral, Economic and Socio-cultural Computing (BESC) - International Security and Data Analytics Track (2014)

## PROFESSIONAL MEMBERSHIP:

Military Cyber Professional Association (MCPA), Member At-Large (2021-Present)

## UNIVERSITY SERVICE:

- DEPARTMENT-LEVEL:
  - 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
- SCHOOL-LEVEL:
  - Head Faculty Advisor, Fulton Student Veterans Organization (ASU) 2019-Present
  - Faculty Advisor, Fulton Student Veterans Organization (ASU) 2016-2019
  - Mentor, Fulton Undergraduate Research Initiative (FURI) (ASU) Spring 2015-2017
- UNIVERSITY-LEVEL:
  - 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

## INVENTION DISCLOSURES (Skysong Innovations / ASU):

- M22-185P: Systems And Methods for Optimization Driven Design of Self-Assembled Nanostructures
- M19-268P: At-risk system identification via analysis of discussions on the darkweb
- M19-002P: Social network analysis on the dark web forums to predict enterprise cyber incidents: Methods and Applications
- M18-247P: Dark/deepweb text-mining-based approach for the prediction of exploited software vulnerabilities
- M18-234P: Systems and methods for reasoning about the likelihood of certain external cyber-threats using intelligence gathered from Darkweb/Deepweb
- M18-191P: Systems and Methods for Automatically Assigning One or More Labels to Discussion Topics shown in Online Forums on the Darkweb (Provisional patent 62/668,878)

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- M18-175P: Systems and Methods for Third Party Risk Assessment
- M18-147P: Systems and Methods for Detecting Pathogenic Social Media Accounts without Content or Network Structure
- M18-009P: Dark/deepweb based model for the prediction of exploited software vulnerabilities (Provisional patent 62/581,123)
- M17-046P: Intelligent Darkweb Crawling Infrastructure for Cyber Threat Intelligence Collection - patentable portion (Provisional patent 62/409,291)
- M16-135P: MIST: Missing Person Intelligence Synthesis Toolkit (Provisional patent 62/345,193)
- M16-100P: Causal rule learning for combat information (submitted Dec., 2015)
- M16-090P: Intelligent Darkweb Crawling Infrastructure for Cyber Threat Intelligence Collection (submitted Nov. 2015)
  - License agreement signed with IntelliSpyre, Inc. (May, 2016)
- M16-044P: Analytics for Marketing – BEAD: Build-Expand-Analyze-Decide (submitted Sep., 2015)
- M16-040P: Data Driven Game Theoretic Cyber Threat Mitigation (Provisional patent 62/261,200)
  - Patent awarded (June, 2019)
- M15-222P: Cascade prediction (Provisional patent 62/201,517)
  - Non-Provisional Patent initiated (July, 2016)
- M15-195P: VPRED: Violence Prediction Software (Provisional patent 62/191,086)
- M15-194P: SNAKE-T: Social Network Analysis Knowledge Engine-Twitter (to receive formal copyright)
- M15-191P: Cyber Threat Warnings through Hacker Group Analysis
- M15-167P: Data Driven Malware Task Identification (Provisional patent 62/182,006)
  - Selected for Innovation Showcase at [TechConnect 2016](#).
  - Patent awarded (Jan., 2010)

## SAMPLE LECTURES:

- 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](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>
- Reducing Gang Violence through Network Influence Based Targeting of Social Programs (KDD 2014)  
[http://videlectures.net/kdd2014\\_shakarian\\_network\\_influence/](http://videlectures.net/kdd2014_shakarian_network_influence/)
- 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://archive.org/details/ShmooCon2014_Science_of_Cyber_and_Next_Gen_Security_Tools)  
<https://www.youtube.com/watch?v=btvwhY-eMEw>
- Similar Pathogen Targets in Arabidopsis thaliana and Homo sapiens Protein Networks (2013)  
<http://www.youtube.com/watch?v=37DESwnAsnc>
- Targeting Large Social Networks for Viral Marketing (originally presented at ASONAM 2012)  
[http://www.youtube.com/watch?v=cl\\_88YoYOPY](http://www.youtube.com/watch?v=cl_88YoYOPY)

## COURSES TAUGHT:

- **Arizona State (Fall 2014-Present):**
  - CSE 494: Artificial Intelligence for Cybersecurity

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- Spring, 2019 (15 undergraduate)
  - CSE 591: Security Informatics
    - Spring, 2016 (14 graduate)
  - CSE 573: Semantic Web Mining
    - Fall, 2015 (57 graduate)
  - CSE471/598: Introduction to Artificial Intelligence
    - Spring, 2015, 50 total students (43 undergraduate, 7 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**)
  - 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
  - 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
  - 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

### AWARDS WON BY MY STUDENTS:

- Graduate student awards:
  - Tillman Scholarship, Vivin Paliath, 2018 (<http://pattillmanfoundation.org/scholar/vivin-paliath/>)
  - CIKM Student Travel Grant, Elham Shaabani, 2016
  - eSeed Challenge selectee – Abhinav Bhatnagar (2016)
  - Edson Entrepreneur award finalist – Abhinav Bhatnagar (2016)
  - KDD Student Travel Grant – Elham Shaabani, 2015 (ASU)
  - ASU Graduate Travel Grant – Elham Shaabani, 2015, 2016
  - ASU Graduate Travel Grant – Ashkan Aleali, 2015
- Other:
  - 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)

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- 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 DISSERTATION OR THESIS COMMITTEE (NON-CHAIR):**

- Doctorate
  - Kai Zhu (Ph.D., Electrical Engineering, ASU; Thesis Advisor: 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 Advisor: Hasan Davulcu, graduated spring 2016) “Semantic Feature Extraction for Narrative Analysis”
  - Feng Wang (Ph.D., Computer Science, ASU; Thesis Advisor: Ross Maciejewski, graduated spring, 2016) “Visual Analytics Methods for Exploring Geographically Networked Phenomena”
  - Jessica Bodford (Ph.D., Psychology, ASU; Thesis Advisor: 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

### **CURRENT STUDENTS FOR WHICH DR. SHAKARIAN IS ON A DISSERTATION OR THESIS COMMITTEE (NON-CHAIR):**

- Isaac Jones (Ph.D., Computer Science, ASU; Thesis Advisor: Huan Liu)
- Randy Compton (Ph.D., Computer Science, ASU; Thesis Advisor: Charles Colbourn)
- Kazuaki Kashihara (Ph.D., Computer Science, ASU; Thesis Advisor: Chitta Baral)
- Abdulhakim Sabur (M.S., Computer Engineering, ASU; Thesis Advisor: Dijiang Huang)

### **WEST POINT UNDERGRADUATE CAPSTONE AND HONORS THESIS ADVISEES:**

- Geoffrey Moores (B.S., Computer Science and Physics, West Point, 2014)
- Damon Paulo (B.S., Computer Science and Mathematics, West Point, 2014;
- Joseph Hannigan (B.S., Computer Science, West Point, 2014)
- Brad Fischl (B.S., Computer Science, West Point, 2014)
- Guillermo Hernandez (B.S., Computer Science, West Point, 2014)
- Joseph Salmento (B.S., Computer Science, West Point, 2014)
- Jacob Lademan (B.S., Information Technology, West Point, 2014)
- Evan Kenney (B.S., Information Technology, West Point, 2014)
- Christian Young (B.S., Information Technology, West Point, 2014)
- Cory Kirk (B.S., Information Technology, West Point, 2013)
- Sean Eyre (B.S., Computer Science, West Point, 2012)
- Theodore Taggart (B.S., Computer Science, West Point, 2012)
- Randolph Rotte (B.S., Information Technology, West Point, 2012)