Resilient Computational Citizen Science

Socio-computational Approaches to Mitigate Socio-cognitive Security Threats

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Abstract:
The growing weaponization of online platforms poses significant security threats to citizen science initiatives. At strategic and operational levels, adversarial campaigns (mis/dis/mal-information campaigns) can manipulate public perception, influencing regional or international views on citizen science activities. Tactically, online propaganda could be used to sway individuals into undermining or disrupting scientific projects through misinformation or coordinated disinformation campaigns. Bots, trolls, and other more sophisticated human-AI-teamed influence tactics can affect citizen science initiatives' privacy and security, leading to bad data quality, and many users struggle to distinguish between legitimate and malicious actors. These influence operations are often low-cost and covert, leading to increased AI-driven disinformation targeting citizen science efforts. Socio-cognitive threats are becoming collective, centered around online environments where adversaries exploit multimedia content to mislead or deceive (shallow/deep fakes, etc.). Our US DoD and NSF-funded research[1] focuses on detecting, analyzing, and predicting the cognitive threat levels posed by adversarial information campaigns to enhance the resilience of citizen science communities. Using a multi-model, multi-disciplinary, and multi-theoretical approach that integrates computational modeling, ML/AI, and big data analysis, we aim to characterize these campaigns, identify key actors and tactics, and develop proactive strategies to mitigate cognitive threats. More specifically, the research comprises various efforts, including discourse dynamics characterization, social bot behavior evolution modeling, coordinating structures of the network and dynamics, collective action dynamics, narrative evolution, mis/disinformation contagion modeling, scalable multimedia information processing, modeling toxicity and polarization, multi-platform network mapping of campaigns, evaluating AI/platform bias and vulnerability to adversarial attacks, and intelligent data collection methodologies. The approach is validated through real-world cases ranging from Saudi Arabian women's right-to-drive cyber campaigns to Autism awareness campaigns to ISIS' and anti-West/anti-NATO disinformation campaigns to COVID-19 misinformation campaigns to misinformation campaigns during elections in the Americas, Europe, and Asia/Indo-Pacific region to strengthen community resilience – something that can benefit citizen science initiatives.

About the Author:
Dr. Nitin Agarwal's research aims to push the boundaries of our understanding of digital and cyber social behaviors that emerge and evolve constantly in modern information and communication platforms. At COSMOS, he leads projects with a combined funding of over $25 million from an array of U.S. federal

[1] Nitin Agarwal. Developing Socio-computational Approaches to Mitigate Socio-cognitive Security Threats in a Multi-platform Multimedia-rich Information Environment. NATO Science & Technology Organization (STO) Symposium on Mitigating and Responding to Cognitive Warfare (STO-MP-HFM-361). November 13-14, 2023, Madrid, Spain.

agencies, including the Department of Defense (Army, Navy, and Air Force), DARPA, Department of State, and National Science Foundation. He plays a significant role in the long-term partnership between UA Little Rock and the Department of Homeland Security. He developed publicly available social media analysis tools (Blogtracker and VTracker), assisting NATO Strategic Communications and Public Affairs, European Defense agencies, the Australian Defense Science and Technology agency's strategic policy group, the Singapore government, Arkansas Attorney General's office, among others. Dr. Agarwal participates in the National Tech Innovation Hub launched by the U.S. Department of State to defeat foreign-based propaganda. Dr. Agarwal serves as an academic advisor on Governor Sarah Huckabee Sanders's committee for the AI Center of Excellence.

Dr. Agarwal's research contributions lie at the intersection of social computing, behavior-cultural modeling, collective action, social cyber forensics, Artificial Intelligence, data mining, machine learning, smart health, and privacy. From Saudi Arabian women's right-to-drive campaigns to Autism awareness campaigns to ISIS' propaganda campaigns to anti-West/anti-NATO disinformation campaigns to COVID-19 misinformation campaigns to misinformation campaigns during elections around the world, at COSMOS, he is directing several projects that have made foundational and applicational contributions to social and computational sciences, particularly in understanding coordinated cyber campaigns. He has published 12 books and over 350 articles in top-tier peer-reviewed forums, including NATO's Defense StratCom Journal, Army University Press, CANSOFCOM's Future Conflict journal, and Baltic Security, among others, with several best paper awards and nominations. His most recent book explores deviant behaviors on the Internet and is published by Springer in their series on cybersecurity. Local, national, and international media, including Bloomberg, US News, KUAR, Arkansas Business, Arkansas Times, Arkansas Democrat-Gazette, and many others, have covered his work. Over the last several years, Dr. Agarwal has spoken at various public and professional, national and international forums such as NATO's StratCom COE (Riga, Latvia), DARPA, US Department of State, US Naval Space and Warfare (SPAWAR), US Pentagon's Strategic Multilevel Assessment groups, US National Academies of Sciences Engineering and Medicine, US Office of the Director of National Intelligence, Facebook Asia Pacific HQ, Twitter Asia Pacific HQ, US Embassy in Singapore, Singapore Ministry of Communication and Information, NATO Senior Leadership meetings, USIP, among others. He serves as a technical advisor to Little Rock-based firms, including through the FinTech Accelerator.

Dr. Agarwal obtained Ph.D. from Arizona State University with outstanding dissertation recognition in 2009. He was recognized as one of 'The New Influentials: 20 In Their 20s' by Arkansas Business in 2012. He was recognized with the University-wide Faculty Excellence Award in Research and Creative Endeavors by UALR in 2015 and 2021. Dr. Agarwal received the Social Media Educator of the Year Award at the 21st International Education and Technology Conference in 2015. In 2017 the Arkansas Times featured Dr. Agarwal in their special issue on "Visionary Arkansans". Dr. Agarwal is a fellow of the International Academy, Research and Industry Association (IARIA), Arkansas Academy of Computing (AAoC), and Arkansas Research Alliance (ARA). His research is recognized as one of the top 10 solutions for "Countering Cognitive Warfare: The Invisible Threat" by NATO's Innovation Hub out of 132 teams from 30 NATO member nations. His COVID-19 Misinformation tracker is recognized by the World Health Organization (WHO) as one of the key technological innovations globally to address the COVID-19 pandemic. Dr. Agarwal is an IEEE senior member. Please visit agarwalnitin.com for more details.