[Technological Advances Impact The Insider Threat By]

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Detection and prediction of insider threats to cyber security: a systematic literature review and meta-analysis

Iffat A. Gheyas* and Ali E. Abdallah

* Correspondence:
Iffat.Gheyas@bcu.ac.uk
School of Computing and Digital Technology, Birmingham City University, City Centre Campus, Millennium Point, Birmingham B4 7XG, United Kingdom

Abstract

Cyber security is vital to the success of today's digital economy. The major security threats are coming from within, as opposed to outside forces. Insider threat detection and prediction are important mitigation techniques. This study addresses the following research questions: 1) what are the research trends in insider threat detection and prediction nowadays? 2) What are the challenges associated with insider threat detection and prediction? 3) What are the best-to-date insider threat detection and prediction algorithms? We conduct a systematic review of 37 articles published in peer-reviewed journals, conference proceedings and edited books for the period of 1950–2015 to address the first two questions. Our survey suggests that game theoretic approach (GTA) is a popular source of insider threat data; the insiders' online activities are the most widely used features in insider threat detection and prediction; most of the papers use single point estimates of threat likelihood; and graph algorithms are the most widely used tools for detecting and predicting insider threats. The key challenges facing the insider threat detection and prediction system include unbounded patterns, uneven time lags between activities, data nonstationarity, individuality, collusion attacks, high false alarm rates, class imbalance problem, undetected insider attacks, uncertainty, and the large number of free parameters in the model. To identify the best-to-date insider threat detection and prediction algorithms, our meta-analysis study excludes theoretical papers proposing conceptual algorithms from the 37 selected papers resulting in the selection of 13 papers. We rank the insider threat detection and prediction algorithms presented in the 13 selected papers based on the theoretical merits and the transparency of information. To determine the significance of rank sums, we perform "the Friedman two-way analysis of variance by ranks" test and "multiple comparisons between groups or conditions" tests.

Keywords: Insider threat prediction, Anomaly detection, Machine learning, Cyber security, Individual attacks, Collusion attacks

Background

We live in the digital age and like anything, this new reality has its upsides and downsides. Its major downside is the security risk. As more and more of our sensitive information is moving to the digital world, confidentiality breaches are becoming more common and significant. "HIV patient tells of fears of disclosure after details leak" [1], "Barclays bank leaks thousands of customer records" [2], "Pepsi alerted Coca-Cola to stolen-coke-secrets offer" [3], "PlayStation Network users fear identity theft after major

Technological Advances Impact the Insider Threat By... Transforming the Landscape of Security

The rise of sophisticated technology has revolutionized nearly every aspect of our lives, but this progress comes with a double-edged sword. While technology empowers businesses and individuals, it also creates new avenues for insider threats – malicious or negligent actions by individuals with legitimate access to an organization's systems. This blog post will delve into how technological

advances both exacerbate and mitigate the insider threat, exploring the complex interplay between innovation and security. We'll examine specific technological advancements and their impact, ultimately offering insights into how organizations can leverage technology to proactively address and minimize this significant risk.

1. Increased Data Accessibility & the Expanding Attack Surface

The cloud's proliferation and the rise of remote work have dramatically increased data accessibility. While offering flexibility and collaboration, this also expands the attack surface. A disgruntled employee with remote access can potentially cause far more damage than one confined to a physical office. Moreover, the sheer volume of data stored digitally presents a larger target for insider threats. The easier it is to access data, the more opportunities there are for misuse, accidental disclosure, or deliberate sabotage.

Subtle Sabotage in the Cloud:

Cloud services, while offering scalability, also introduce complexity. Insider threats can subtly manipulate cloud configurations, altering permissions or deleting vital data without readily apparent traces. The distributed nature of cloud environments makes forensic investigation significantly more challenging.

2. AI & Machine Learning: Double-Edged Swords in Insider Threat Detection

Artificial intelligence (AI) and machine learning (ML) offer potent tools for detecting insider threats. These technologies can analyze vast datasets of user activity, identifying anomalous patterns indicative of malicious intent. For instance, unusual access times, large data transfers outside normal business hours, or frequent attempts to access sensitive files can trigger alerts.

The Dark Side of AI: Automation and Sophistication

However, AI can also be used by malicious insiders. Advanced AI tools could automate malicious tasks, enabling a single insider to carry out large-scale data exfiltration or sabotage with minimal effort. Furthermore, AI-powered tools can help insiders cover their tracks more effectively, making detection even more difficult.

3. IoT Devices & the Expansion of Vulnerable Entry Points

The Internet of Things (IoT) presents another significant challenge. The sheer number of interconnected devices within many organizations creates a vast network of potential entry points for insider threats. A compromised IoT device could act as a backdoor, allowing an insider to bypass traditional security measures.

IoT’s Silent Threat:

The often-overlooked security vulnerabilities of IoT devices make them prime targets. An insider could leverage a compromised IoT device to gain access to sensitive internal networks, potentially leading to significant data breaches or system disruptions.

4. Enhanced Security Technologies: Mitigation Strategies

While technology expands the potential for insider threats, it also provides powerful tools for mitigation. Advanced technologies such as User and Entity Behavior Analytics (UEBA) can continuously monitor user activity, identifying deviations from established baselines. Data Loss Prevention (DLP) tools can prevent sensitive data from leaving the organization’s control, regardless of the access method.

Proactive Security Measures:

Investing in robust security information and event management (SIEM) systems, coupled with regular security awareness training, can significantly reduce the risk of insider threats. Implementing strong access controls, multi-factor authentication (MFA), and regular security audits are also essential preventative measures.

5. Blockchain's Potential for Enhanced Data Integrity

Blockchain technology, with its inherent immutability and transparency, could play a crucial role in mitigating insider threats. By recording all data modifications and access attempts on an immutable ledger, it becomes significantly more difficult for insiders to tamper with data without detection.

Blockchain’s Limitations:

However, blockchain adoption requires significant infrastructure changes and integration

challenges. It's not a silver bullet solution and still relies on robust security protocols surrounding the blockchain itself.

Conclusion

The impact of technological advances on insider threats is multifaceted. While new technologies increase accessibility and create opportunities for malicious activities, they also equip organizations with more powerful tools for detection and prevention. The key to mitigating insider threats lies in a proactive approach: a combination of robust security technologies, comprehensive security awareness training, and a strong security culture within the organization. By embracing advanced technologies responsibly and strategically, organizations can minimize the risk associated with insider threats and protect their valuable assets.

FAQs

1. Q: Are all technological advancements inherently detrimental to insider threat prevention? A: No, many technological advancements offer significant improvements to security, such as advanced threat detection systems and data loss prevention tools. The key is to implement and utilize these technologies effectively.

2. Q: How can we train employees to be more aware of insider threats? A: Regular security awareness training, including phishing simulations and realistic scenarios, is crucial. Employees should be educated about the potential risks and their responsibilities in preventing insider threats.

3. Q: What is the role of human oversight in mitigating insider threats, even with AI-powered security systems? A: Human oversight remains crucial. AI systems can flag potential threats, but human analysts are needed to interpret alerts, investigate suspicious activity, and make informed decisions.

4. Q: Is complete prevention of insider threats possible? A: Complete prevention is highly unlikely. Human error and malicious intent are unpredictable factors. The goal should be to minimize the impact of insider threats through proactive measures and robust security systems.

5. Q: How can organizations balance the benefits of increased data accessibility with the risks of insider threats? A: Organizations must implement strong access controls, least privilege access policies, and robust monitoring systems. Regular security audits and employee training are vital to maintaining a secure environment while enabling collaboration and productivity.

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resource to use social science research to explain why traditional methods fail aga

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Information and Knowledge Management; Organizational Models and Information Systems; Software and Systems Modeling; Software Systems, Architectures, Applications and Tools; Multimedia Systems and Applications; Computer Networks, Mobility and Pervasive Systems; Intelligent and Decision Support Systems; Big Data Analytics and Applications; Human–Computer Interaction; Ethics, Computers & Security; Health Informatics; Information Technologies in Education; and Information Technologies in Radiocommunications.

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sabotage nuclear facilities. Contributors: Matthew Bunn, Harvard University; Andreas Hoelstad Dæhli, Oslo; Kathryn M. Glynn, IBM Global Business Services; Thomas Hegghammer, Norwegian Defence Research Establishment, Oslo; Austin Long, Columbia University; Scott D. Sagan, Stanford University; Ronald Schouten, Massachusetts General Hospital and Harvard Medical School; Jessica Stern, Harvard University; Amy B. Zegart, Stanford University

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Control, Communications and Intelligence (C3I) decision-making framework. A detailed view of the cyber-attack landscape will be garnered; touching on the tactics, techniques and procedures used, red and blue teaming initiatives, cyber resilience and the protection of larger scale systems. The integration of AI, smart societies, the human-centric approach and Augmented Humanity is discernible in the exponential growth, collection and use of [big] data; concepts woven throughout the diversity of topics covered in this publication; which also discusses the privacy and transparency of data ownership, and the potential dangers of exploitation through social media. As humans are become ever more interconnected, with the prolificacy of smart wearable devices and wearable body area networks, the availability of and abundance of user data and metadata derived from individuals has grown exponentially. The notion of data ownership, privacy and situational awareness are now at the forefront in this new age.

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technological advances impact the insider threat by: How to Avoid a Climate Disaster Bill Gates, 2021-02-16 NEW YORK TIMES BESTSELLER NATIONAL BESTSELLER In this urgent, singularly authoritative book, Bill Gates sets out a wide-ranging, practical--and accessible--plan for how the world can get to zero greenhouse gas emissions in time to avoid an irreversible climate catastrophe. Bill Gates has spent a decade investigating the causes and effects of climate change. With the help and guidance of experts in the fields of physics, chemistry, biology, engineering, political science and finance, he has focused on exactly what must be done in order to stop the planet's slide toward certain environmental disaster. In this book, he not only gathers together all the information we need to fully grasp how important it is that we work toward net-zero emissions of greenhouse gases but also details exactly what we need to do to achieve this profoundly important goal. He gives us a clear-eyed description of the challenges we face. He describes the areas in which technology is already helping to reduce emissions; where and how the current technology can be made to function more effectively; where breakthrough technologies are needed, and who is working on these essential innovations. Finally, he lays out a concrete plan for achieving the goal of zero emissions--suggesting not only policies that governments should adopt, but what we as individuals can do to keep our government, our employers and ourselves accountable in this crucial enterprise. As Bill Gates makes clear, achieving zero emissions will not be simple or easy to do, but by following the guidelines he sets out here, it is a goal firmly within our reach.

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cyber security analysts, computer engineers, IT specialists, practitioners, stakeholders, researchers, academicians, and students interested in AI applications in the realm of security research.

technological advances impact the insider threat by: Beyond Fear Bruce Schneier, 2006-05-10 Many of us, especially since 9/11, have become personally concerned about issues of security, and this is no surprise. Security is near the top of government and corporate agendas around the globe. Security-related stories appear on the front page everyday. How well though, do any of us truly understand what achieving real security involves? In Beyond Fear, Bruce Schneier invites us to take a critical look at not just the threats to our security, but the ways in which we're encouraged to think about security by law enforcement agencies, businesses of all shapes and sizes, and our national governments and militaries. Schneier believes we all can and should be better security consumers, and that the trade-offs we make in the name of security - in terms of cash outlays, taxes, inconvenience, and diminished freedoms - should be part of an ongoing negotiation in our personal, professional, and civic lives, and the subject of an open and informed national discussion. With a well-deserved reputation for original and sometimes iconoclastic thought, Schneier has a lot to say that is provocative, counter-intuitive, and just plain good sense. He explains in detail, for example, why we need to design security systems that don't just work well, but fail well, and why secrecy on the part of government often undermines security. He also believes, for instance, that national ID cards are an exceptionally bad idea: technically unsound, and even destructive of security. And, contrary to a lot of current nay-sayers, he thinks online shopping is fundamentally safe, and that many of the new airline security measure (though by no means all) are actually quite effective. A skeptic of much that's promised by highly touted technologies like biometrics, Schneier is also a refreshingly positive, problem-solving force in the often self-dramatizing and fear-mongering world of security pundits. Schneier helps the reader to understand the issues at stake, and how to best come to one's own conclusions, including the vast infrastructure we already have in place, and the vaster systems--some useful, others useless or worse--that we're being asked to submit to and pay for. Bruce Schneier is the author of seven books, including Applied Cryptography (which Wired called the one book the National Security Agency wanted never to be published) and Secrets and Lies (described in Fortune as startlingly lively...¦[a] jewel box of little surprises you can actually use.). He is also Founder and Chief Technology Officer of Counterpane Internet Security, Inc., and publishes Crypto-Gram, one of the most widely read newsletters in the field of online security.

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technological advances impact the insider threat by: The Second Machine Age: Work, Progress, and Prosperity in a Time of Brilliant Technologies Erik Brynjolfsson, Andrew McAfee, 2014-01-20 The big stories -- The skills of the new machines : technology races ahead -- Moore's law and the second half of the chessboard -- The digitization of just about everything -- Innovation : declining or recombining? -- Artificial and human intelligence in the second machine age -- Computing bounty -- Beyond GDP -- The spread -- The biggest winners : stars and superstars -- Implications of the bounty and the spread -- Learning to race with machines : recommendations for individuals -- Policy recommendations -- Long-term recommendations -- Technology and the future (which is very different from technology is the future).

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Ewert, 2014-01-08 Outdoor Adventure Education: Foundations, Theories, Models, and Research steeps students in the theories, concepts, and developments of outdoor adventure education, preparing them for careers in this burgeoning field. This text is based on author Alan W. Ewert's pioneering book Outdoor Adventure Pursuits: Foundations, Models, and Theories. Ewert and Sibthorp, both experienced practitioners, researchers, and educators, explore the outdoor adventure field today in relation to the changes that have occurred since Ewert's first book. The authors present a comprehensive text on outdoor and adventure foundations, theories, and research that will provide the basis for the next generation of professionals.

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