

Kenneth Brezinski, PhD

Post Doctoral Fellow

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Education

- 08/18-08/24 **Doctor of Philosophy**, *University of Manitoba*, Winnipeg, MB.
Electrical and Computer Engineering
Dissertation: Complexity-Based Graph Attention Network for Metamorphic Malware Detection
- 01/16-09/18 **Master of Science**, *University of Manitoba*, Winnipeg, MB.
Civil Engineering
Dissertation: High Performance Chromatography as a Natural Organic Matter Property Indicator in Ion-Exchange Applications
- 08/10-08/15 **Bachelor of Science**, *University of Winnipeg*, Winnipeg, MB.
Chemistry
Dissertation: Monitoring the Natural Organic Matter Composition throughout Manitoba Water Treatment Plants using Solid Phase Extraction

Journal and Book Publications

Machine Learning, Deep Learning, Security, Complexity, Malware

Graph-Ensemble Methods for Detecting Metamorphic Malware, [Brezinski, K.](#), Ferens, K., 2023. *Cybersecurity: Cyber Defense, Privacy and Cyber Warfare*. De Gruyter (book); accepted, in press

Metamorphic Malware and Obfuscation - A Survey of Techniques, Variants and Generation Kits, [Brezinski, K.](#), Ferens, K., 2023. *Security and Communications* (journal); DOI: 10.1155/2023/8227751

Incorporating Topological Complexity into a Multilayer Perceptron, [Brezinski, K.](#), Ferens, K., 2022. *Transactions on Computational Science & Computational Intelligence*. Springer Nature (book); accepted, in press

Classifying SARS-CoV-2 and Common Co-infections from Genome Assemblies, Mohaimen Rahman, [Brezinski, K.](#), Ferens, K., 2022. *Transactions on Computational Science & Computational Intelligence*. Springer Nature (book); accepted, in press

Transformers – Malware in Disguise, [Brezinski, K.](#), Ferens, K., 2021. *Advances in Security, Networks, and Internet of Things*, In book: *Transactions on Computational Science & Computational Intelligence Chapter*. Springer Nature (book); accepted, in press

Sandy Toolbox: A Framework for Dynamic Malware Analysis and Model Development, [Brezinski, K.](#), Ferens, K., 2021. *Security & Management (SAM'21) Advances in Security, Networks, and Internet of Things*. Springer Nature (book); accepted, in press

An Adaptive Tribal Topology for Particle Swarm Optimization, [Brezinski, K.](#), Ferens, K., 2020. *Advances in Artificial Intelligence and Applied Cognitive Computing*. Springer Nature (book); DOI: 10.4018/IJSSCI.2020040105

Population Based Equilibrium in Hybrid SA/PSO for Combinatorial Optimization, [Brezinski, K.](#), Ferens, K., 2020. *International Journal of Software Science and Computational Intelligence* (journal); DOI: 10.4018/IJSSCI.2020040105

Cognitive Hybrid PSO/SA Combinatorial Optimization, Brezinski, K., Ferens, K., 2020. *Advances in Security, Networks, and Internet of Things*. Springer Nature (book); DOI: 10.1109/ICCICC46617.2019.9146062

Environmental Engineering, Chemistry

Ozonation of natural organic matter and aquatic humic substances: the effects of ozone on the structural characteristics and subsequent trihalomethane formation potential, Mehrnaz Sadrnourmohamadi, Ken Brezinski, Beata Gorczyca, 2020. *Water Quality Research Journal of Canada* (journal); DOI: <https://doi.org/10.2166/wqrj.2020.011>

Multi-spectral characterization of natural organic matter (NOM) from Manitoba surface waters using high performance size exclusion chromatography (HPSEC), Ken Brezinski, Beata Gorczyca, 2019. *Chemosphere* (journal); DOI: <https://doi.org/10.1016/j.chemosphere.2019.02.176>

An overview of the uses of high-performance size exclusion chromatography (HPSEC) in the characterization of natural organic matter (NOM) in potable water, and ion-exchange applications, Ken Brezinski, Beata Gorczyca, 2018. *Chemosphere* (journal); DOI: <https://doi.org/10.1016/j.chemosphere.2018.10.028>

Ion-Exchange for Trihalomethane control in potable water treatment – A municipal water treatment case study in Rainy River, Ontario, Canada, Ken Brezinski, Mehrnaz Sadrnourmohamadi, Beata Gorczyca, 2018. *Water Quality Research Journal of Canada* (journal); DOI: <https://doi.org/10.2166/wqrj.2018.134>

Effect of total organic carbon and aquatic humic substances on the occurrence of lead at the tap, Lisa Winning, Beata Gorczyca, Ken Brezinski, 2017. *Water Quality Research Journal of Canada* (journal); DOI: 10.2166/wqrjc.2017.028

Conference Publications

Graph-Oriented Modelling of Process Event Activity for the Detection of Malware, Brezinski, K., Ferens, K., 2023. *7th International Conference on Applied Cognitive Computing* (proceedings); IEEE. DOI: 10.1109/CSCE60160.2023.00085

Complexity-Based Lambda Layer for Time Series Prediction, Brezinski, K., Ferens, K., 2021. *IEEE Congress on Evolutionary Computation* (proceedings); IEEE. DOI: 10.1109/CEC45853.2021.9504995

Complexity-Based Convolutional Neural Network for Malware Classification, Brezinski, K., Ferens, K., 2020. *International Conference on Computational Science and Computational Intelligence* (proceedings); IEEE. DOI: 10.1109/CSCI51800.2020.00008

Professional Experience

Since 09/24 **Post Doctoral Fellow**, *University of Manitoba, Winnipeg, Canada*

- Carry out research on the application of Chaos Theory and Fractal Complexity analysis towards improving machine learning and deep learning frameworks.
- Improve host-based intrusion detection systems for an industry partner, Canadian Tire Corp.

Since 05/23 **Instrumentation and Controls Designer, Water & Wastewater**, *WSP Canada, Winnipeg, Canada*

- Carrying out water and wastewater treatment plant assessments, investigations, and process design & system optimization, including SCADA and PLC designs.
- Develop OT networking architecture, perform cyber security audits; configure and install firewall, switches, routers, and intrusion detection systems.

- 09/22-12/22 **Visiting Researcher**, *National Institute for Informatics*, Tokyo, Japan
- Develop a graph autoencoder to detect network anomalies from backbone network traffic connecting Japanese Academic institutions to North America.
 - Automate firewall rule generation using node embeddings, GNNExplainer and explainable AI and scale the application to billions of network packets daily.
- 05/22-08/22 **Data Scientist Intern**, *Microsoft*, Redmond, WA
- Worked with the Windows Defender for Endpoint Team on developing detectors to alert customers in the early stages of an exfiltration or ransomware attack.
 - Leveraged PySpark and cross-product telemetry to improve the signal-noise-ratio of the detector to 80% and to scale to billions of live customer events.
 - Coordinate with Security Engineers and Threat Researchers on identifying the most important precursors to malicious network connections.
- 05/21-08/21 **Applied Research Scientist II Intern**, *Amazon Web Services*, New York, NY
- Worked with the Amazon GuardDuty threat detection research team on developing novel semi-supervised techniques to apply weak labelling to Linux binaries.
 - Established a working group of Security Engineers and SWE to coordinate and consult on the ongoing project.
- 10/19-10/22 **Research Intern Lead**, *Canadian Tire Corp.*, Winnipeg, MB
- First-authored six publications in close collaboration with an industry collaboration with Canadian Tire executives with a focus on Malware detection of enterprise security threats.

Teaching Experience

- 09/16-05/22 **Teacher's Assistant**, *University of Manitoba, Winnipeg, Canada*
- Worked as a Teacher Assistant for the following courses over 20+ appointments:
- CHEM 1300 – Chemistry
 - CHEM 1122 – Introduction to Chemistry Techniques for Engineering 1
 - CHEM 1126 - Introduction to Chemistry Techniques for Engineering 2
 - ENG 3000 - Engineering Economics
 - ECE 3740 - Systems Engineering Principles 1
 - CIVL 3700 - Environmental Engineering Design
 - MECH 4860 - Engineering Design
 - CIVL 3690 - Environmental Engineering Analysis
 - CIVL 4100 - Engineering Management and the Environment
 - ENG 2040 - Engineering Communication: Strategies, Practice and Design
 - ENG 2030 - Engineering Communication: Strategies for the Profession
- 08/17-04/18 **Engineering Graduate Student Tutor**, *University of Manitoba, Winnipeg, Canada*
- Proofread manuscripts, thesis dissertations, award applications and course deliverables for graduate students in the department of Biosystems, Civil, Electrical and Computer Engineering.

Professional Memberships

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| ISA | Member , Industrial Society for Automation |
| EngGeoMB | Engineer In-Training (EIT) , Engineers Geoscientists Manitoba |
| CTTAM | Certified Technician (C.Tech.) , Certified Technicians & Technologists Association of Manitoba |
| PMI | Project Management Professional (PMP) , Project Management Institute |
| ACPA | Chemist in Training (C.I.T.) , Association of the Chemical Profession of Alberta |
| WCW | Member , Western Canada Water |
| WEF | Member , Water Environment Foundation |

Fellowships and Awards

2024-2016	Mitacs Accelerate – Post Doctorate
2023	Research Completion Scholarship
2022	Emily and Lynette Hain Graduate Engineering Scholarship
2021-2022	University of Manitoba Graduate Fellowship
2021-2022	Edward R. Toporeck Graduate Fellowship in Engineering
2021	Mitacs Globalink - JSPS
2020	A. Keith Dixon Graduate Scholarship in Engineering
2021-2022	Philip and Marjorie Eckman Scholarship in Engineering
2019-2022	Mitacs Accelerate – Ph. D
2019	NSERC – CGS M
2016	Mitacs Accelerate – M.Sc.

Students Supervised

Undergrad	Gabriel Barnabe , University of Manitoba, 2024
Undergrad	Michael Guevarra , University of Manitoba, 2019

Academic and Volunteer Service

since 10/24	Member , ISA99 Committee and 62443 standards
since 05/20	Reviewer , International Journal of Software Science and Computational Engineering
11/17-01/21	Reviewer , Journal of Desalination and Water Treatment
04/17-01/21	Reviewer , Journal of Water Science and Technology
09/18-05/21	Student Peer Mentor , University of Manitoba Students' Union
01/19-01/21	Language Partner Volunteer , English Language Center
09/19-09/20	Faculty of Science Mentor , Faculty of Science
04/19-12/19	Language Exchange Program Volunteer , International Center
06/19-01/21	President and Founder , University of Manitoba Engineering Masters (UMEM)
06/20-06/23	Personal Disaster Response Volunteer , Canadian Red Cross
11/16-11/17	Vice-President , University of Manitoba Water and Environmental Foundation (UMWEF)