

# 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); invited, in progress

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

## Fellowships and Awards

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

## Students Supervised

Undergrad **Michael Guevarra**, University of Manitoba, 2019

## Academic and Volunteer Service

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