ZHIDA LI

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EDUCATION

Ph.D. Engineering Science *Sept. 2015–Apr. 2022*
Simon Fraser University, Canada
- Dissertation: Machine Learning for Classifying Anomalies and Intrusions in Communication Networks

M.Eng.Sc. (thesis-based) Electrical and Electronic Engineering *Feb. 2013–Sept. 2015*
University College Cork, Ireland

M.Eng.Sc. (course-based) Microelectronic Engineering *Sept. 2011–Feb. 2013*
University College Cork, Ireland

B.E. (Hons.) Electrical and Electronic Engineering *Sept. 2009–Sept. 2011*
University College Cork, Ireland

B.E. Microelectronics *Sept. 2007–Sept. 2009*
Guilin University of Electronic Technology, China

TECHNICAL SKILLS

Programming Languages: Python, MATLAB, MySQL, JavaScript, Octave, C#, LaTeX

Machine Learning Libraries and Data Science Tools: PyTorch, Keras, Scikit-learn, NumPy, SciPy, Pandas, Matplotlib, Google Colab, Weka

Web Application Development: Flask, AWS Elastic Beanstalk

Certification: Cisco Certified Network Associate (CCNA)

RESEARCH AND WORK EXPERIENCE

Assistant Professor *Jan. 2023–Present*
Department of Computer Science, New York Institute of Technology Vancouver, BC
- **Teaching Responsibilities for the Master of Science in Cybersecurity (M.S.-Cybersecurity) Program**
  - Core courses: **CSCI 651** Algorithm Concepts; **INCS 615** Advanced Network and Internet Security; **INCS 775** Data Center Security; **INCS 870** Project I
  - Elective course: **CSCI 690** Computer Networks

- **Curriculum Development for Online Education**
  - **CSCI 760** Database Systems for the New York Campus

- **Research Involvement**
  - Network intrusion detection systems (NIDS): Developing a real-time machine learning (ML) system for the detection of network anomalies; Focusing on fast ML algorithms in cybersecurity
  - Brain-computer interfaces (BCI): Analyzing electroencephalogram (EEG) signals and developing ML classification models for BCI data

Postdoctoral Fellow *June 2022–Dec. 2022*

Faculty of Applied Sciences, Simon Fraser University Burnaby, BC

- Led the project for developing new machine learning algorithms based on echo state networks
- Explored applications of graph neural networks based on network topologies

Research Assistant *(Advisor: Prof. Ljiljana Trajković)* *Sept. 2015–Apr. 2022*

Faculty of Applied Sciences, Simon Fraser University Burnaby, BC

- **Applications of Machine Learning Techniques for Classifying Network Anomalies**
  - Processed the raw network data: BGP data from RIPE and Route Views
  - Analyzed and implemented various ML algorithms as well as employing feature selection
  - Performed experiments (cross-validation and testing) using a supercomputer managed by Compute Canada

- **Development of Novel Machine Learning Algorithms: VFBLS, VCFBLS**
  - Developed two fast BLS-based algorithms: variable features BLS algorithms without and with cascades
  - Developed generalized models based on various subsets of input data based on selected features and expanded the network structure

- **Development of Tool for Detecting Network Anomalies: BGPGuard**
  - The tool consists of multiple modules: real-time data retrieval, feature extraction, label refinement, data partition, data processing, ML algorithms, parameter selection, ML models, and classification
  - Integrated various stages of the anomaly detection process
  - Detected BGP anomalies based on routing records collected worldwide from major Internet exchange points
  - Facilitated creating new machine learning models based on historical BGP anomalous events

Data Analyst | Part-time *May 2021–Sept. 2021*

EVO-IN-MOTION Technology Richmond, BC

- Analyzed data from circuit simulations and experiments

Research Assistant *(Advisor: Prof. Peter Kennedy)* *Oct. 2011–Jan. 2015*

Tyndall National Institute Cork, Ireland

- Designed nonlinearity-tolerant requantizer architectures for fractional-N frequency synthesizers

Electrical Engineer | Internship *May 2010–Aug. 2010*

Dell EMC Cork, Ireland

- Supplied details of failure return to the suppliers and involved in customer service

TEACHING EXPERIENCE

Teaching Assistant *Sept. 2015–Apr. 2022*

Faculty of Applied Sciences, Simon Fraser University Burnaby, BC

- **ENSC 427/894 Communication Networks**, 6 terms (undergraduate and graduate levels)
  - Delivered lectures as needed; Designed and graded assignments and exams; Guided students with their projects using ns-3 and Riverbed Modeler

- **ENSC 220 Electric Circuits I**, 4 terms (undergraduate level)
  - Held lab sessions with both practical exercises and LTspice simulations: Kirchhoff's voltage and current laws, operational amplifiers, and RLC circuits; Graded assignments and exams

- **ENSC 120 Introduction to Electronics Laboratory Instruments Operation and Measurement Techniques**, 2 terms (undergraduate level)

- Held lab sessions for operating electronics laboratory instrumentation such as linear power supply, digital multi-meter, function generator, and oscilloscope; Graded exams

- **ENSC 252** **Fundamentals of Digital Logic and Design**, 2 terms (undergraduate level)
  - Held lab sessions for designing digital systems using VHDL on FPGA; Proctored exams

- **ENSC 180** **Introduction to Engineering Analysis**, 1 term (undergraduate level)
  - Helped design a lab assignment using MATLAB: Simulation for Red Bull Stratos Jump; Proctored exams

Teaching Assistant   *June 12, 2021*
IEEE SMC Society Summer School   Tokyo, Japan (virtual)
- TA for Lecture 4: Data mining and machine learning for detecting traffic anomalies and intrusions
- Designed and presented a demo of anomaly detection (Slammer worm) with Python on Colab

AWARDS

- IEEE Outstanding Leadership Award   *Dec. 2022*
  - Publicity Chair of the 2022 IEEE International Conference on Digital Twin as a part of the 2022 IEEE Smart World Congress
- Graduate Fellowship Award, SFU   *Fall 2017, Fall 2019*
- Faculty of Applied Sciences Graduate Fellowship Award, SFU   *Summer 2016, Fall 2016*
- Travel and Minor Research Award, SFU   *Summer 2016*

EXTERNAL SERVICE AND EVIDENCE OF IMPACT

Secretary   *Feb. 2022–Present*
Membership Development Committee, IEEE Canada

Secretary   *Jan. 2024–Present*
IEEE Vancouver Section

Chair/Treasurer   *June 2023–Present/ Jan. 2018–June 2023*
IEEE Circuits and Systems Society joint Chapter of the Vancouver/Victoria Sections

Counselor   *July 2023–Present*
IEEE NYIT-Vancouver Student Branch

Jury Member and Mentor   *Apr. 2023*
Virtual BR41N.IO Hackathon, Spring School 2023
- Assessed various projects: data analysis, gaming, and programming/art
- Mentored NYIT teams:
  - Data Analysis Project: Focused on EEG analysis, this project aimed to filter noise from EEG data, partition the data, and develop various machine learning models to classify brainwave signals
  - Gaming Project: Developed using Unity 3D and the Unicorn C# API, this project features a game that leverages P300 signals reflecting the player's attention to specific stimuli to control the music, creating a unique gaming experience

Chair/ Secretary   *Sept. 2020–Oct. 2021/ Sept. 2019–Sept. 2020*
IEEE SFU Student Branch

Technical Program Committee Membership
- IEEE International Conference on High Performance Computing and Communications: Member (*HPCC-2022*); Member and Session Chair (*HPCC-2020*)

- IEEE International Conference on Cyber, Physical and Social Computing: Member and Publicity Chair (*CPSCom-2022*); Member and Session Chair (*CPSCom-2020*)
- International Conference on E-Business and Internet: Member (*ICEBI 2022*)
- International Conference on Intelligent Sensing and Industrial Automation (*ISIA 2023*)

Reviewer
- IEEE Journal on Selected Areas in Communications (J-SAC) (*2022*); Computers & Security (*2022*); IEEE Transactions on Neural Networks and Learning Systems (*2021, 2022*); Neural Networks (*2020–2022*); IEEE International Symposium on Circuits and Systems *(2022)*; IEEE International Conference on Systems, Man, and Cybernetics (*2020–2022*); Concurrency and Computation: Practice and Experience (*2021*); IEEE Transactions on Emerging Topics in Computational Intelligence (*2019, 2021*); IEEE Access (*2019, 2020*)

PUBLICATIONS [Google Scholar]

Book Chapters:
1. Q. Ding, **Z. Li**, S. Haeri, and Lj. Trajković, "Application of machine learning techniques to detecting anomalies in communication networks: datasets and feature selection algorithms," in *Cyber Threat Intelligence*, A. Dehghantanha, M. Conti, T. Dargahi, Eds., Berlin: Springer, pp. 47–70, 2018.
2. **Z. Li**, Q. Ding, S. Haeri, and Lj. Trajković, "Application of machine learning techniques to detecting anomalies in communication networks: classification algorithms," in *Cyber Threat Intelligence*, A. Dehghantanha, M. Conti, T. Dargahi, Eds., Berlin: Springer, pp. 71–92, 2018.

Refereed Journals:
3. **Z. Li**, A. L. G. Rios, and Lj. Trajković, "Machine learning for detecting the WestRock ransomware attack using BGP routing records," *IEEE Commun. Mag.*, vol. 61, no. 3, pp. 20–26, Mar. 2023. (IF: 11.2)
4. **Z. Li**, A. L. G. Rios, and Lj. Trajković, "Machine learning for detecting anomalies and intrusions in communication networks," *IEEE Journal on Selected Areas in Communications (JSAC),* vol. 39, no. 7, pp. 2254–2264, July 2021. (IF: 16.4)
5. M. P. Kennedy, **Z. Li**, and Z. Huang, "Programmable analog frequency divider based on p-switching," *Nonlinear Theory and Its Applications, IEICE,* vol. 4, no. 4, pp. 389–399, Oct. 2013.

Publications in Refereed Conference Proceedings:
6. **Z. Li** and Lj. Trajković, "Enhancing Cyber Defense: Using Machine Learning Algorithms for Detection of Network Anomalies," in *Proc. IEEE Int. Conf. Syst., Man, Cybern.*, Honolulu, USA, Oct. 2023, pp. 1658-1663.
7. T. Sharma, K. Patni, **Z. Li**, and Lj. Trajković, "Deep Echo State Networks for Detecting Internet Worm and Ransomware Attacks," in *Proc. IEEE Int. Symp. Circuits Syst.*, Monterey, USA, May 2023.
8. **Z. Li**, A. L. G. Rios, and Lj. Trajković, "Classifying denial of service attacks using fast machine learning algorithms," in *Proc. IEEE Int. Conf. Syst., Man, Cybern.*, Melbourne, Australia, Oct. 2021, pp. 1221–1226.
9. **Z. Li**, A. L. G. Rios, and Lj. Trajković, "Detecting Internet worms, ransomware, and blackouts using recurrent neural networks," in *Proc. IEEE Int. Conf. Syst., Man, Cybern.*, Toronto, Canada, Oct. 2020, pp. 2165–2172.
10. A. L. G. Rios, **Z. Li**, K. Bekshentayeva, and Lj. Trajković, "Detection of denial of service attacks in communication networks," in *Proc. IEEE Int. Symp. Circuits Syst.*, Seville, Spain, Oct. 2020.
11. **Z. Li**, A. L. G. Rios, G. Xu, and Lj. Trajković, "Machine learning techniques for classifying network anomalies and intrusions," in *Proc. IEEE Int. Symp. Circuits Syst.*, Sapporo, Japan, May 2019, pp. 1–5.
12. A. L. G. Rios, **Z. Li**, G. Xu, A. Diaz Alonso, and Lj. Trajković, "Detecting network anomalies and intrusions in communication networks," in *Proc. 23rd IEEE Int. Conf. Intell. Eng. Syst.*, Hungary, Apr. 2019, pp. 29–34.
13. **Z. Li**, P. Batta, and Lj. Trajković, "Comparison of machine learning algorithms for detection of network intrusions," in *Proc. IEEE Int. Conf. Syst., Man, Cybern.*, Miyazaki, Japan, Oct. 2018, pp. 4248–4253.
14. P. Batta, M. Singh, **Z. Li**, Q. Ding, and Lj. Trajković, "Evaluation of support vector machine kernels for detecting network anomalies," in *Proc. IEEE Int. Symp. Circuits Syst.*, Florence, Italy, May 2018, pp. 1–4.

15. H. B. Yedder, Q. Ding, U. Zakia, **Z. Li**, S. Haeri, and Lj. Trajković, "Comparison of virtualization algorithms and topologies for data center networks," in *Proc. 26ᵗʰ Int. Conf. Comput. Commun. Netw., 2ⁿᵈ Workshop Netw. Security. Analytics Autom.*, Vancouver, Canada, Aug. 2017.

16. Q. Ding, **Z. Li**, P. Batta, and Lj. Trajković, "Detecting BGP anomalies using machine learning techniques," in *Proc. IEEE Int. Conf. Syst., Man, Cybern.*, Budapest, Hungary, Oct. 2016, pp. 3352–3355.

17. S. Haeri, Q. Ding, **Z. Li**, and Lj. Trajković, "Global resource capacity algorithm with path splitting for virtual network embedding," in *Proc. IEEE Int. Symp. Circuits Syst.*, Montreal, Canada, May 2016, pp. 666-669.

18. M. P. Kennedy, H. Mo, **Z. Li**, G. Hu, P. Scognamiglio, E. Napoli, "The noise and spur delusion in fractional-N frequency synthesizer design," in *Proc. IEEE Int. Symp. Circuits Syst.*, Lisbon, Portugal, May 2015.

19. **Z. Li**, H. Mo, and M. P. Kennedy, "Comparative spur performance of a fractional-N frequency synthesizer with a nested MASH-SQ3 divider controller in the presence of memoryless piecewise-linear and polynomial nonlinearities", in *Proc. 25ᵗʰ IET Irish Signals Syst. Conf.*, Limerick, Ireland, June 2014, pp. 374–379.

20. M. P. Kennedy, **Z. Li**, and H. Mo, "How to eliminate integer boundary spurs in fractional-N frequency synthesizers", in *Proc. 17ᵗʰ RIA/URSI Research Colloquium Commun. Radio Sci. into the 21ˢᵗ Century*, Dublin, Ireland, May 2014, pp. 1–4.

21. **Z. Li** and M.P. Kennedy, "The switched injection-locked oscillator (SILO) concept," in *Proc. Int. Symp. Nonlinear Theory and Its Applications (NOLTA)*, Palma, Mallorca, October 2012, pp. 868–871.

TALKS

UNM ME Seminar Series 2022:

- Zhida Li, "Machine Learning for Classifying Anomalies and Intrusions in Communication Networks," Mechanical Engineering Seminar Series (UNM ME Seminar Series), University of New Mexico, Albuquerque, USA, Dec. 2, 2022 (virtual).