

Menglu Li

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RESEARCH INTERESTS

Modeling, analysis and design of speech anti-spoofing systems using machine learning and signal processing. Topics of focus include multi-modal learning, multimedia processing, statistical modeling, generative AI, and Internet of Things (IoT) applications.

EDUCATION

- **Toronto Metropolitan University** Jan. 2021 - Oct. 2025 (Expected)
Ph.D - Electrical and Computer Engineering
Toronto, Canada
 - Advisor: Prof. Xiao-Ping Zhang, and Prof. Lian Zhao
 - GPA: 4.33/4.33
- **Toronto Metropolitan University** Sep. 2019 - Dec. 2020
M.Eng - Electrical and Computer Engineering
Toronto, Canada
 - GPA: 4.26/4.33
- **University of Toronto** Sep. 2014 - Jun. 2019
B.ASc. - Computer Engineering
Toronto, Canada
 - 4th-year GPA: 3.88/4.00

PUBLICATIONS

J=JOURNAL, C=CONFERENCE, U=UNDER REVIEW

- [J.1] M. Li, Y. Ahmadiadli, and X.-P. Zhang, "A survey on speech deepfake detection", *ACM Computing Surveys*, vol. 57, no. 7, pp. 1–38, Feb. 2025.
- [J.2] H. Jebamikyous, M. Li, Y. Suhas, and R. Kashef, "Leveraging machine learning and blockchain in e-commerce and beyond: Benefits, models, and application", *Discover Artificial Intelligence*, Vol. 3, Issue 1, 2023.
- [J.3] M. Li, R. Kashef, and A. Ibrahim, "Multi-level clustering-based outlier's detection (MCOD) using self-organizing maps", *Big Data and Cognitive Computing*, Vol. 4, Issue 4, pp. 24, 2020.
- [J.4] A. Ibrahim, R. Kashef, M. Li, E. Valencia, and E. Huang, "Bitcoin Network Mechanics: Forecasting the BTC closing price using vector auto-regression models based on endogenous and exogenous feature variables", *Journal of Risk and Financial Management*, Vol. 13, Issue 9, pp. 189, 2020.
- [C.1] M. Li and X.-P. Zhang, "Interpretable temporal class activation representation for audio spoofing detection", *Interspeech 2024*, pp. 1120-1124. Sep. 2024. (Oral Presentation)
- [C.2] M. Li and X.-P. Zhang, "Robust audio anti-spoofing system based on low-frequency sub-band information", *2023 IEEE Workshop on Applications of Signal Processing to Audio and Acoustics (WASPAA)*, New Paltz, NY, USA, 2023 pp. 1-5. (Poster Presentation)
- [C.3] M. Li, Y. Ahmadiadli, and X.-P. Zhang, "Robust deepfake audio detection via bi-level optimization", *2023 IEEE 25th International Workshop on Multimedia Signal Processing (MMSP)*, Poitiers, France, 2023, pp. 1-6. (Poster Presentation)
- [C.4] M. Li, Y. Ahmadiadli, and X.-P. Zhang, "A comparative study on physical and perceptual features for Deepfake Audio Detection", *Proceedings of the 1st International Workshop on Deepfake Detection for Audio Multimedia*, Lisboa, Portugal, 2022, pp. 34-41. (Oral Presentation)

HONORS & AWARDS

- Ontario Graduate Scholarship (one of the 4 international student recipients @ TMU each year) 2023, 2024
- IEEE ComSoc FNS Project Competition Award - Bronze Medal (\$600) Sep, 2023
- Travel Grant from WASPAA (\$1500) 2022
- Toronto Metropolitan Graduate Scholarship (\$15000) 2022
- Travel Grant from ACM MM (\$2000) 2022
- Toronto Metropolitan International Student Scholarship (\$7000 each year) 2021, 2022
- Dean's List, University of Toronto 2019
- University of Toronto, Edward S. Rogers Scholarship 2015

RESEARCH PROJECTS

• Deepfake Speech Detection [Audio Processing, Deep Learning]

Jan. 2022 - Present

Research Assistant (with Prof. Xiao-Ping Zhang, Prof. Lian Zhao)

- Generated and processed synthesized speech data across 5+ languages by fine-tuning over 10 generative models, ensuring diverse and representative datasets.
- Conducted a comprehensive analysis of 16 handcrafted physical, perceptual features and deep embeddings using statistical methods to identify key indicators of deepfake speech.
- Developed an interpretable detection model with a temporal attention mechanism, allowing visualizable interpretation of results while improving detection accuracy by 11%.
- Addressed partially deepfake speech issues by leveraging temporal consistency, fine-tuning wav2vec2 features to increase detection accuracy by 4% over the published SOTA model.

• Customer Rating Distribution Analysis [Statistics, Data Science]

Jun 2021 - Dec 2022

Research Assistant (with Prof. Xiao-Ping Zhang)

- Collected and preprocessed customer rating data from hotel and movie reviews using NumPy and Pandas for efficient data handling and cleaning.
- Uncovered a statistical relationship between the mean and variance of rating distributions using linear programming, demonstrating that customer ratings can be modeled as a finite discrete distribution.
- Performed rigorous hypothesis testing to reveal patterns in user preferences and rating behaviors, informing customer satisfaction analyses.

• Unsupervised Learning Model for Outlier Detection [Machine Learning]

Jan 2020 - Dec 2020

Research Assistant (with Dr. Rasha Kashef)

- Trained five clustering-based outlier detection models as benchmarks across six datasets with varying sizes and outlier densities to assess detection efficacy.
- Developed a multi-level, clustering-based outlier detection algorithm, dynamically adapting to dataset characteristics and improving detection rates by up to 20% over baseline models.
- Demonstrated the robustness of the algorithm by applying it across diverse domains, showcasing adaptability in fields such as finance, healthcare, and e-commerce for early anomaly detection.

TEACHING

Teaching Assistant

• COE 328	Digital Systems	Fall 2022-2024 & Summer 2023, 2024
• COE 628	Operating System	Winter 2020-2024
• CEN 100	Introduction to Engineering	Fall 2022, 2023
• COE 528	Object Oriented Eng Analysis and Design	Summer 2022
• ELE 888	Intelligent Systems	Winter 2021
• COE 318	Software System	Fall 2019-2021

Tutorials

- Multimedia Deepfake Detection in *IEEE International Conference on Multimedia and Expo (ICME)* July, 2024
Co-organized with You (Neil) Zhang, Luchuan Song, Xiao-Ping Zhang, Chenliang Xu, Zhiyao Duan

Tutor

- Easy Education - Software Tools and System Programming Winter 2021, 2022 & Summer 2021
 - Delivered two-hour weekly lectures on C programming and shell scripting, covering foundational programming concepts and hands-on coding exercises.
 - Provided personalized feedback and support to students, fostering a collaborative learning environment through Q&A office hours.
 - Taught over 250 students, achieving a 95% positive feedback rate and emphasizing effective teaching strategies and student engagement.

Students Mentored

• Majd Alber	ECE, M.Eng student	Since Sep. 2024
• Ramtin Asgarianamiri	ECE, M.Eng student	Since Sep. 2024

ACADEMIC SERVICES

Conference Chairing

- Session Chair - IEEE International Conference on Multimedia and Expo (ICME) *July, 2024*
- Project / Local Arrangement Co-Chair - IEEE Toronto Leaders of Tomorrow Workshop *June, 2024*

Reviewer

- Neurocomputing
- China Communications
- IEEE Transactions on Neural Networks and Learning Systems (TNNLS)
- IEEE Signal Processing Letters (SPL)
- Computers and Security
- Data Mining and Knowledge Discovery

Volunteer

- Secretary at IEEE Toronto ComSoc Chapter *Mar, 2024 - Present*
- IEEE ICME 2024 Student Volunteer *July, 2024*
- ACM MM 2022 Student Volunteer *Oct, 2022*
- IEEE ICASSP 2021 Student Volunteer *Jun, 2021*

SKILLS

- **Programming Languages:** Python, C, SQL, JAVA, Matlab, Latex, VHDL
- **Frameworks:** Scikit, Pytorch, HuggingFace, Spipy, Matplotlib, Seaborn, NLTK, TensorFlow, Keras, OpenCV
- **Platforms:** GIT, MySQL, Jupyter Notebook, Visual Studio Code
- **Languages:** English (Fluent), Mandarin Chinese (Native), Cantonese Chinese (Fluent)