

RAN LIU

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Education

University of Maryland Baltimore County

Ph.D of Science in Computer Science

September 2020 – May 2024

4.0 / 4.0

University of California Santa Barbara

Master of Science in Computer Science

September 2018 – May 2020

3.71 / 4.0

Johns Hopkins University

Master of Science in Information Security

September 2016 – December 2017

3.2 / 4.0

Experience

SAS Institute Inc.

Machine Learning Research Engineer Intern

January 2023 – August 2023

Minneapolis, MN

- Designed machine learning predictive model using PyTorch for competitors identification through Hidden Markov Model, Convolutional Neural Network and Dynamic Time Warping, improving detection accuracy from 46% to 67%.
- Developed RESTful APIs for the production system using Java Spring Framework, and implemented a lightweight version algorithms using MySQL, benefiting over 30,000 clients.
- Designed statistical model to predict errors in forecasting system through Random Forest and ARIMA, decreasing the mean absolute percentage error (MAPE) from 0.17 to 0.04, contributing to over \$12 million revenue.
- Designed clustering algorithms utilizing GNN and GAN with TensorFlow. Refactored the base code using Java functional programming, reducing running time from approximately 8 days to around 3 hours.

Amazon AWS

Backend Software Engineer Intern

May 2022 – August 2022

Seattle, WA

- Designed and implemented new I/O APIs optimizations using C++ that were used by all teams in the AWS Aurora division, reducing the IOPS (Input/Output Operations Per Second) of the AWS Aurora over 80%.
- Designed a new batch data structure for I/O submission, reducing system calls by a factor of 4,096.
- Refactored code to eliminate lock dependencies using multithreading techniques, reducing I/O latency by 77%.

Shift4 Payments Inc.

Application Security Engineer

February 2018 – August 2018

Las Vegas, NV

- Led 12 penetration tests on web and mobile applications using Burp Suite, NMAP, Windows shell, and Python. Delivered comprehensive risk assessments and recommended solutions to managers and stakeholders.
- Led code review processes before application releases, offering in-depth risk assessments and proposing technical solutions to enhance security and programming standards.
- Developed statistical models using Hidden Markov Model and Exponential Smoothing to detect transaction fraud.

Projects

Sparse Data ML Design | *Python, PyTorch*

August 2023

- Designed machine learning framework that support different domain using LCSS and HMM, achieving over 90% accuracy with a 20-sample training set, 500X smaller than state-of-arts. Presented at ACM DocEng 2023.
- Designed a feature set for object detection and evaluated the performance with Decision Tree and XGBoost, achieving 99%+ accuracy with 12 features, 20X smaller than state-of-arts. Presented at KDD workshop 2023
- Proposed a new dataset, which addresses representativeness issues in existing datasets, significantly improves the accuracy of malware detection task. Submitted to IEEE big data 2023.

Online Malware Detection Framework | *HMM, XGBoost, Qubit*

October 2021

- Designed a incremental malware detection engine for zero-day windows malware based on the Hidden Markov Model with 10,000 length specimens needed for training, achieved accuracy of 85.31%.
- Proposed hybrid framework of theoretical Quantum ML, combined with feature selection strategies to reduce the data size and malware classifier training time, achieved accuracy of 74% (+- 11.35%) on the IBM 5 qubits machines.
- Presented above works at Annual Malware Technical Exchange Meeting (METE) and International Conference on Cyber Warfare and Security (ICCWS).

Technical Skills

Languages: Python, Java, C++, HTML/CSS, JavaScript, SQL, Shell

Developer Tools: VS Code, Google Cloud Platform, Git, AWS, Docker

Technologies/Frameworks: Numpy, Pandas, PyTorch, TensorFlow, scikit-learn, statsmodels, NetworkX

Publications

- [IEEE Big Data' 23] Ran Liu, Robert Joyce, Cynthia Matuszek, Charles Nicholas. Evaluating Representativeness in PDF Malware Datasets: A Comparative Study and a New Dataset, accepted for publication in IEEE Big Data 2023 Conference Proceedings.
- [ACM DocEng' 23] Ran Liu, Cynthia Matuszek, Charles Nicholas. A PDF Malware Detection Method Using Extremely Small Training Sample Size, accepted for publication in ACM Symposium on Document Engineering 2023.
- [ACM KDD' 23] Ran Liu, Charles Nicholas, A Feature Set of Small Size for the PDF Malware Detection, accepted by 29th ACM SIGKDD International Conference on Knowledge Discovery and Data Mining (KDD) Workshop on Knowledge-infused Learning.
- [MTEM' 23] Ran Liu, Charles Nicholas. A Distance-Based Method for Detecting PDF Malware. Accepted in the 14th Annual Malware Technical Exchange Meeting.
- [MTEM' 22] Ran Liu, Maksim Eren, Charles Nicholas. Can Feature Engineering Help Quantum Machine Learning for Malware Detection? The 13th Annual Malware Technical Exchange Meeting.
- [ICCWS' 21] Ran Liu, Charles Nicholas. Incremental Malware Detection and Classification Using Hidden Markov Models. The 17th International Conference on Cyber Warfare and Security.
- [MTEM' 21] Ran Liu, Charles Nicholas. Incremental Malware Classification Using Hidden Markov Models. Poster in the 12th Annual Malware Technical Exchange Meeting.
- [IEEE iThings' 17] Shin, Chanyang, Prerit Chandok, Ran Liu, Seth James Nielson and Timothy R. Leschke. Potential Forensic Analysis of IoT Data: An Overview of the State-of-the-Art and Future Possibilities. 2017 IEEE International Conference on Internet of Things (iThings) (2017): 705-710.