CALEB McIRVIN

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EDUCATION

PhD in Computer Engineering, Virginia Tech, Blacksburg, VA — Anticipated May 2028
BS with Honors in Computer Science, Virginia Tech, Blacksburg, VA — Dec 2023, 3.98 GPA

WORK EXPERIENCE

Machine Learning Engineer, The Boeing Company, Fairfax, Virginia — Dec 2023 - Aug 2024
- Developed graph neural networks in PyTorch to uncover correlations between hundreds of radio frequency emitters
- Compared scikit-learn statistical techniques with deep learning methods for pattern of life anomaly detection

CS Undergraduate Teaching Assistant, Virginia Tech, Blacksburg, Virginia — Dec 2022 – May 2023, Aug 2023 - Dec 2023
- Assisted with three courses - Data Structures and Algorithms, Problem Solving in CS, and Comparative Languages

DSP Engineering Intern (Machine Learning), The Boeing Company, Fairfax, Virginia — May 2023 - Aug 2023
- Synthesized custom target signal training datasets using Matlab vector-based digital signal processing operations
- Built lightweight custom computer vision models for faster than real-time signal identification and classification
- Trained image segmentation and object detection models from scratch for signal processing using PyTorch

Software Engineering Intern, Exelaration, Blacksburg, Virginia — Nov 2021 – May 2022, Sep 2022 – Jan 2023
- Designed a website using the Vue.JS framework to store and display 30+ publications
- Collaborated using Git for version control, implemented features within a Dockerized application
- Boosted site performance by up to 2x through careful code analysis, bottleneck testing, and unit testing

Machine Learning Research Intern, IOMAXIS, Ballston, Virginia — Jun 2022 – Aug 2022
- Wrote custom PyTorch Lightning dataloaders to handle massive NetFlow datasets using Amazon EC2 instances
- Pretrained custom transformers using causal/masked language modeling and visualized metrics in Tensorboard
- Finetuned pretrained transformers on labeled NetFlow data for downstream forecasting and signature generation

RESEARCH EXPERIENCE

AWS Cloud Undergraduate Researcher, Hume Center, Blacksburg, Virginia — Sep 2023 - Aug 2024
- Developed custom 1D convolutional modulation classification models to accurately distinguish between signal types
- Built a heterogeneous sensor fusion pipeline using Amazon Sagemaker to demonstrate signal processing capabilities
- Collaborated with Amazon Web Services to explore cloud solutions for machine learning on radio frequency data

Quantum Information Undergraduate Researcher, Virginia Tech, Blacksburg, Virginia — Sep 2023 - Dec 2023
- Developed candidate closed-form measurements for the quantum state exclusion problem
- Proved bounds on exclusion probabilities for candidate measurements, experimentally verified bounds using Matlab

Machine Learning Undergraduate Researcher, Virginia Tech, Blacksburg, Virginia — Jun 2022 – May 2023
- Identified 4000+ descriptors for historical costuming ontology development using natural language processing
- Constructed an interactive web app using Vue.JS on Amazon Lightsail to identify relevance of potential descriptors

Reinforcement Learning Undergraduate Researcher, Hume Center, Blacksburg, Virginia — Jan 2023 – May 2023
- Wrote custom OpenAI Gym environments for reinforcement learning agents acting on radio frequency channels
- Crafted a collaborative research paper exploring reinforcement learning for dynamic spectrum access

Quantum Software Co-Design Undergraduate Researcher, Virginia Tech, Blacksburg, Virginia — Sep 2022 – May 2023
- Explored GPU performance of quantum algorithms using emulator tools to motivate NISQ-era developments

Natural Language Processing Undergraduate Researcher, Virginia Tech, Blacksburg, Virginia — Sep 2021 – May 2022
- Pulled 60000+ abstracts from multiple journals in the food science and food chemistry domains
- Finetuned Gensim Word2Vec natural language processing models to perform exploratory data analysis on text data

SKILLS

- AWS Certified Solutions Architect - Associate — Mar 2024
- Programming languages: Python (PyTorch, PyTorch Lightning, NumPy, Pandas, Matplotlib, Seaborn, TensorFlow, Scikit-Learn, Qiskit, Pennylane, Cirq), Java, HTML, CSS, JS (Vue, React), C, SQL, LaTeX, Lua
- Software - IDEs (Neovim), version control software (Git, GitHub, GitLab, Bitbucket), software development tools (Jupyter Notebooks, Docker)

PUBLICATIONS

- CLOUD-D RF: Cloud-based Distributed Radio Frequency Heterogenous Spectrum Sensing. D. Green, **C. McIrvin**, et al. ACM Machine Learning for NextG Networks 2024 Conference, 2024.
- Quantum state exclusion through offset measurement. **C McIrvin**, A Mohan, J Sikora. Physical Review A, 2024.
- Automatic Expansion of Metadata Standards for Historic Costume Collections. **C McIrvin**, C Miller, D Smith-Glaviana, WN Ng. JeSLIB, 2024.
- RFRL Gym: A Reinforcement Learning Testbed for Cognitive Radio Applications. D Rosen, I Rochez, **C McIrvin**, et al. IEEE, 2023.
- Comparative Study and Expansion of Metadata Standards for Historic Fashion Collections. D Smith-Glaviana, WN Ng, **C McIrvin**, C Miller. Visual Resources Association, 2023.
- Simulating Noisy Quantum Circuits for Cryptographic Algorithms. S Harshvardhan, S Jain, JE McClure, **C McIrvin**, NQ Tran. Cybersecurity Research Forum at the Citadel, 2023.