Joseph Rance

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Education

University of Cambridge 2021-2025
MEng in Computer Science

- Modules: Explainable AI (L193), Natural Language Processing (L390), Machine Learning Systems (L46), Reinforcement Learning (R171), Proof Assistants (L81)

University of Cambridge 2021-2024
BA in Computer Science

- Dissertation: Evaluating attacks on fairness in Federated Learning (link)
- Supervisors: Filip Svoboda, Nicholas Lane
- First Class in all three years, CST department prize for Highly Commended Part II Dissertation
- Full blue (fencing)

Experience

Software Engineer Intern, Microsoft Summer 2023

- Evaluated the performance of the Azure for Operators MLOps codebase under different loads.
- Designed and implemented updates to the MLOps codebase, leading to a 75% cost reduction by processing low-priority data at off-peak times.
- Advocated for a more general framework based on Rust proc macros, leading to my code's integration to the open-source Apache Arrow library (link).
- Presented my work to audiences of more than 30 managers and engineers.

Research Intern, University of Cambridge Summer 2022

- Developed and tested three new backdoor attacks, which were the first to use compromised data augmentation functions as an attack vector. Our attacks include one of a few existing methods for inserting backdoors with in-distribution data.
- Presented our paper at the ICLR BANDS workshop.
- Supervisors: Yiren Zhao, Ilia Shumailov

Student Volunteer, AI4Good organisation Summer 2020

- Worked as part of a team to simulate the spread of coronavirus in refugee camps.
- Produced a library of metrics help evaluate the accuracy of our simulation.
- Our simulation was used to inform decisions made in real camps.

Publications

Can Private Machine Learning Be Fair? (link) Preprint, 2024
Joseph Rance, Filip Svoboda

Augmentation Backdoors (link) BANDS @ ICLR 2023
Joseph Rance, Yiren Zhao, Ilia Shumailov, Robert D. Mullins

Evaluating attacks on fairness in federated learning (link) Dissertation, 2023
Joseph Rance

Other Projects

Image generation with a VAE-GAN 2019

- Implemented the VAE-GAN architecture in TensorFlow.
- Trained a VAE-GAN to generate images of faces using a dataset I scraped from the internet.

Using RL to evaulate decision making in the sport of fencing 2020

- Developed a set of RL agents to generate tactical policies for the sport of fencing.
- Achieved a 20% improvement in match outcome prediction over the naïve, score-based method.

Robotic arm with object detection 2020

- Led a team of six students to build an autonomous robot arm that used computer vision to pick up objects.
- This project was funded by the Jack Petchey Achievement Award.

Automatic Entrepreneur 2023

- Worked in a team of six student to generate reports on companies based on automatically scraped data
- Responsible for integrating LLMs into the generation pipeline and then using Flask to build an interactive WebApp.

Oort client sampling in the Flower framework 2024

- Implemented the Oort client sampler for the Flower FL framework.
- Submitted as undergraduate coursework; awarded 77%.

Skills

Languages: Python (TensorFlow, PyTorch), OCaml, Rust, Java, SQL, C/C++, Bash, Prolog, C#, JavaScript, TypeScript, Go, RISC-V assembly, SystemVerilog, LaTeX
Tools: Git, Linux (Ubuntu), Docker, Slurm, Azure, AWS

Awards & Achievements

Competition Results:

- **2nd** UKMT Team Maths Challenge regional finals.
- **5th** 2023 Belgian U20 fencing championships
- **15th** Aix-en-Provence U20 fencing world cup 2023 (as part of the Belgian team)
- **1st** 2024 Cambridge Open fencing tournament
- **1st** BUCS Fencing Premier League South (as part of the Cambridge team)

Awards: Arkwright Engineering Scholarship, Cambridge Hawks Award, CST Department Award for Highly Commended Part II Dissertation, Jack Petchey Achievement Award, Robinson College Scholarship