

# Joseph Rance

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## Education

<b>University of Cambridge</b> MEng in Computer Science	2021-2025
<ul style="list-style-type: none"><li>• Modules: Explainable AI (<a href="#">L193</a>), Natural Language Processing (<a href="#">L390</a>), Machine Learning Systems (<a href="#">L46</a>), Reinforcement Learning (<a href="#">R171</a>), Proof Assistants (<a href="#">L81</a>)</li></ul>	
<b>University of Cambridge</b> BA in Computer Science	2021-2024
<ul style="list-style-type: none"><li>• Dissertation: Evaluating attacks on fairness in Federated Learning (<a href="#">link</a>)</li><li>• Supervisors: <a href="#">Filip Svoboda</a>, <a href="#">Nicholas Lane</a></li><li>• First Class in all three years, CST department prize for Highly Commended Part II Dissertation</li><li>• Full blue (fencing)</li></ul>	

## Experience

<b>Software Engineer Intern, Microsoft</b>	Summer 2023
<ul style="list-style-type: none"><li>• Evaluated the performance of the Azure for Operators MLOps codebase under different loads.</li><li>• Designed and implemented updates to the MLOps codebase, leading to a 75% cost reduction by processing low-priority data at off-peak times.</li><li>• Advocated for a more general framework based on Rust proc macros, leading to my code's integration to the open-source Apache Arrow library (<a href="#">link</a>).</li><li>• Presented my work to audiences of more than 30 managers and engineers.</li></ul>	
<b>Research Intern, University of Cambridge</b>	Summer 2022
<ul style="list-style-type: none"><li>• 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.</li><li>• Presented our paper at the ICLR BANDS workshop.</li><li>• Supervisors: <a href="#">Yiren Zhao</a>, <a href="#">Ilia Shumailov</a></li></ul>	
<b>Student Volunteer, AI4Good organisation</b>	Summer 2020
<ul style="list-style-type: none"><li>• Worked as part of a team to simulate the spread of coronavirus in refugee camps.</li><li>• Produced a library of metrics help evaluate the accuracy of our simulation.</li><li>• Our simulation was used to inform decisions made in real camps.</li></ul>	

## Publications

<b>Can Private Machine Learning Be Fair? (<a href="#">link</a>)</b> <a href="#">Joseph Rance</a> , <a href="#">Filip Svoboda</a>	Preprint, 2024
<b>Augmentation Backdoors (<a href="#">link</a>)</b> <a href="#">Joseph Rance</a> , <a href="#">Yiren Zhao</a> , <a href="#">Ilia Shumailov</a> , <a href="#">Robert D. Mullins</a>	BANDS @ ICLR 2023
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<b>Evaluating attacks on fairness in federated learning (<a href="#">link</a>)</b> <a href="#">Joseph Rance</a>	Dissertation, 2023

## Other Projects

<b>Image generation with a VAE-GAN</b>	2019
<ul style="list-style-type: none"><li>• Implemented the VAE-GAN architecture in TensorFlow.</li><li>• Trained a VAE-GAN to generate images of faces using a dataset I scraped from the internet.</li></ul>	
<b>Using RL to evaluate decision making in the sport of fencing</b>	2020
<ul style="list-style-type: none"><li>• Developed a set of RL agents to generate tactical policies for the sport of fencing.</li><li>• Achieved a 20% improvement in match outcome prediction over the naïve, score-based method.</li></ul>	

### 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,  $\text{\LaTeX}$

**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