Joseph Rance

CS student @ University of Cambridge

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I am a penultimate year Computer Science student at the University of Cambridge with strong programming skills in languages such as python (TensorFlow, PyTorch), OCaml, Rust, Java, and C/C++

Education

University of Cambridge

BA COMPUTER SCIENCE (2021-2025).

Class I in both years 1 and 2. Full Blue (fencing). Dissertation on: Evaluating attacks on fairness in Federated Learning

Colchester Royal Grammar School

A LEVELS (2021) A*A*A*A*A in Maths, Further Maths, Physics, Computer Science, EPQ

GCSEs (2019) 9999999776A* in Maths, Physics, Computing, Chemistry, Biology, French, Tech., Art, Eng. Lit., Eng. Lang., F. Maths

Experience

Machine Learning researcher

University of Cambridge Computer Lab (Summer 2023)

Researched attacks on Federated Learning as part of the CamMLSys group. Designed and implemented a new type of attack on FL that targets fairness by predicting the updates of clean clients and inverting the aggregation function. My paper on this is currently in review.

Software Engineer intern

Microsoft Azure for Operators (12 weeks, Summer 2023)

I worked in an AIOps team within Azure for operators. My initial project involved updating the data processing code that my team works on to run in a new configuration which could see reduced latency and ~75% cost savings. I pushed for the use of a rust procedural macro in the implementation and contributed my work to open source. I then evaluated the performance upgrades and presented them at the engineering all hands.

Research internship

University of Cambridge Computer Laboratory (12 weeks, Summer 2022)

Published a paper to the ICLR BANDS workshop proposing three new methods of inserting backdoors into machine learning models. The backdoors are inserted into the ML pipeline using data augmentation which makes them a more practical threat than many previous methods, while achieving similar accuracy metrics.

Student volunteer

Deutsche Bank, AI4Good (October – November 2020)

I worked as part of a team to create and evaluate a set of algorithms to simulate the spread of coronavirus in refugee camps.

Publications

Modifying backdoor attacks to compromise fairness in federated learning

Joseph Rance, Filip Svoboda

Under review, 2023

Augmentation Backdoors
Joseph Rance, Yiren Zhao, Ilia Shumailov, Robert D. Mullins
BANDS workshop at ICLR 2023

Projects

Automatic Entrepreneur
I worked as part of a team of six to develop an automated system to generate a report on any company based on information scraped from the internet. I created the front end for the report, and used fine-tuned LLMs to automatically generate the FAQ and report summary sections.

Robotic arm with object detection
I lead a team of six students to create an unsupervised object detection algorithm for a robotic arm we built as part of my school's student run computing society.

Reinforcement Learning to improve decision making in the sport of fencing
I developed a set of machine learning algorithms to generate tactical policies for the sport of fencing. Based on its state value function, the best agent could predict the winner of my competition matches with 20% higher accuracy than simply considering the scoreline.

Generating images using a VAE-GAN
I generated images of faces using a VAE-GAN. I trained the model on a dataset I gathered by automatically cropping faces from images on the internet.

Skills

I have substantial experience programming in Python (numpy, TensorFlow/Keras, pytorch/Lightning, ...), Rust, Java, C#, SQL, OCaml, as well as experience with Git and Linux.

Awards and achievements

Achievements in the sport of fencing
I am a competitive fencer, having represented Team Belgium at five U20 world cups, as well as the Cambridge University team. Fencing as part of a team under high pressure has improved my teamwork and leadership skills, and my ability to stay positive in stressful situations.

Arkwright scholarship (2019-2021)
This prestigious engineering scholarship was awarded to me after a rigorous selection process, providing a financial award to support my studies.

Jack Petchey Achievement award (2019-2021)
Received the award for leading and developing the school's Sixth Form's Computing Society during lockdown though online tutorials, talks, debates and challenges.