Joseph Rance

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Education

University of Cambridge 2024-2025
MEng in Advanced Computer Science
(Incoming)

University of Cambridge 2021-2024
BA in Computer Science | Link to all courses (part IA - II)
Class I in all three years. Full Blue (fencing). Dissertation on: Evaluating attacks on fairness in Federated Learning

Colchester Royal Grammar School 2014-2021
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 Summer 2023
University of Cambridge Computer Laboratory *Python, PyTorch, Flwr, Linux, Git*

- Researched attacks on Federated Learning as part of the CamMLSys group
- My paper (currently under review) is the first to present an attack on fairness in FL

Software Engineer intern Summer 2023
Microsoft Azure for Operators *Rust, Azure, Linux, Git*

- Updated the MLOps data processing pipeline that my team works on to run in a new configuration which could see reduced latency and 75% cost savings
- Was assigned additional responsibilities, including contributing my work to open source, updating the metrics output of the codebase, and evaluating the performance under different loads.

Research internship Summer 2022
University of Cambridge Computer Laboratory *Python, PyTorch, TensorFlow, Linux, Git*

- Published a paper to the ICLR BANDS workshop proposing three new methods of inserting backdoors into machine learning models
- I presented, to my knowledge, the second clean data, clean label, training time backdoor attack

Student volunteer Aug. - Oct. 2020
AIforGood organisation *Python, SKLearn, Dash, Git*

- Worked as part of a team to create and evaluate a set of algorithms that simulate the spread of coronavirus in refugee camps
- My contribution primarily consisted of a library of metrics that were used to help understand how the results of the simulation compared to ground truth data.

Publications

Attacks on fairness in federated learning (link) Under review, 2023
Joseph Rance, Filip Svoboda

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

Projects

Automatic Entrepreneur *Python, Flask, Huggingface, Git* | Jan. - Mar. 2023

- As part of a team of six I helped develop an automated system to generate a report on any company based on information scraped from the internet.
- I was responsible for both the front end, and the fine-tuned LLMs that automatically generate the FAQ and report summary sections.

Robotic arm with object detection *Python, NumPy, RaspberryPi, Git* | Jan. - Mar. 2023

- I led 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
- The robotic arm was able to detect the centres of objects and then compute and execute the movements needed to pick them up and move them to a specific location

Reinforcement Learning to improve decision making in the sport of fencing *Python, NumPy* | Jan. - Mar. 2023

- 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 *Python, TensorFlow, Keras* | Jan. - Mar. 2023

- I generated images of faces using a VAE-GAN. I trained the model on a gathered by automatically cropping faces from images on the internet.
- The resulting faces were clearly recognizable and could be parameterised by modifying the VAE's encoding vector.

Skills

Languages:

Python (TensorFlow/Keras, PyTorch/Lightning, ...), Rust, Java, C#, SQL, OCaml, C/C++, Prolog, SystemVerilog

Technologies & Tools:

Flask, Git, Linux, Azure, AWS

Awards and achievements

Representing team Belgium internationally in fencing Current

- I am a competitive fencer, having represented team Belgium at five U20 world cups
- Fencing as part of a team under high pressure has highlighted my teamwork and leadership skills, and my ability to stay positive in stressful situations.

University of Cambridge foil team anchor Current

- I am the foil anchor for my university's fencing team
- Last season, we placed joint fifth in the BUCS men's national championships.

UKMT Team Maths Challenge 2020

- Represented my school in the UKMT Team Maths Challenge placing 2nd in the region.
- My team of four came 2nd place in the region

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.