# Joseph Rance

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## Education

**University of Cambridge** <span style="float:right">2021-2024</span>

B.A. in Computer Science | Link to all courses (part IA - II)
Class I in both years 1 and 2. Full Blue (fencing). Dissertation on: Evaluating attacks on fairness in Federated Learning

**Colchester Royal Grammar School** <span style="float:right">2014-2021</span>

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** <span style="float:right">Summer 2023</span>

*University of Cambridge Computer Laboratory* <span style="float:right">*Python, PyTorch, Flwr, Linux, Git*</span>

- 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** <span style="float:right">Summer 2023</span>

*Microsoft Azure for Operators* <span style="float:right">*Rust, Azure, Linux, Git*</span>

- 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** <span style="float:right">Summer 2022</span>

*University of Cambridge Computer Laboratory* <span style="float:right">*Python, PyTorch, TensorFlow, Linux, Git*</span>

- 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** <span style="float:right">Aug. - Oct. 2020</span>

*AIforGood organisation* <span style="float:right">*Python, SKLearn, Dash, Git*</span>

- 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)** <span style="float:right">Under review, 2023</span>

Joseph Rance, Filip Svoboda

**Augmentation Backdoors (link)** <span style="float:right">BANDS workshop at ICLR 2023</span>

Joseph Rance, Yiren Zhao, Ilia Shumailov, Robert D. Mullins

## Projects

**Automatic Entrepreneur** <span style="float:right">*Python, Flask, Huggingface, Git* | Jan. - Mar. 2023</span>

- 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** <span style="float:right">*Python, NumPy, RaspberryPi, Git* | Jan. - Mar. 2023</span>

- 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.