

# Joseph Rance

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I am a Computer Science student at Cambridge University, about to begin my second year. I love how simple mathematical rules can create complex systems that learn to “think” in a way similar to how a human would think in order to produce elegant solutions for real world problems.

## Education

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### University of Cambridge

BA COMPUTER SCIENCE (2021-2024). Class I in first year

Modules covered in year 1: Databases, Digital Electronics, Discrete Maths, OCaml, Graphics, Java, Scientific Computing, Maths, Algorithms, Machine Learning and Real-world Data, Operating Systems, Interaction Design, Probability, Software and Security engineering

### 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

### CyberFirst advanced programme

Two week course on computer security with a CTF at the end (Summer 2020)

SCQF level 6 qualification standard

## Experience

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### Research internship

University of Cambridge Computer Laboratory (Summer 2022)

I wrote a paper 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. The paper is currently being reviewed for ICLR2023.

### Deutsche Bank, AI4Good Hack from Home

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.

## Projects

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### Robotic arm with object detection

I coordinated a project to write an unsupervised object detection algorithm for a robotic arm as part of my school's student run computing society. [Link to GitHub](#)

### Generating images using a VAE-GAN

I generated images of faces using a VAE combined with a GAN to achieve a more semantic loss function than the usual pixelwise distance metric for a VAE. I trained the model on a gathered by automatically cropping faces from images on the internet. [Link to code](#)

### **Reinforcement Learning to improve decision making in the sport of fencing**

Worked on developing a set of machine learning algorithms to generate tactical policies for the sport of fencing. Created 3 different agents to learn from data gathered about my own competition bouts and generated predictions to learn about how I can improve decisions I make during matches. [Link to code](#)

## **Skills**

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

## **Awards and achievements**

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### **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.

### **UKMT Team Maths Challenge**

Represented my school in the UKMT Team Maths Challenge in 2020 placing 2nd in the region.

### **Jack Petchey Achievement award**

Received the award for leading and developing the school's Sixth Form's Computing Society during lockdown through online tutorials, talks, debates and challenges (2019-2021). [Link to GitHub](#)

### **Achievements in the sport of fencing**

Represented England for under 17 men's foil in Paris and am ranked 23rd in Great Britain for under 20 men's foil. I am currently the Eastern Region Senior champion.