# Harry Langford

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## Introduction

I'm a Computer Science graduate from the University of Cambridge. I achieved a **first with distinction**, ranking 5th out of 113. This year, I'm undertaking the Advanced Computer Science masters at the University of Oxford.

## Research

**Overview**
I've done two 12-week research internships at the Cambridge Computer Lab, in summer 2023 and summer 2024. My Part II dissertation was a research project, as was a module project.

**Summer 2024**
I'm currently working on two projects, which are not yet public. The first is machine learning security and the second is an ML Systems project.

**Dissertation**
My dissertation investigated whether spiking layers limited the ability of current uncertainty estimation methods. To this end, I generalised uncertainty estimation methods to spiking neural networks and rigorously evaluated the produced uncertainty on a number of downstream tasks. I found that methods with Bayesian interpretation produced meaningful uncertainty, while those which attempted to exploit the timestep mechanism of Spiking Neural Networks did not. The resulting dissertation was highly commended.

**Module project**
I took the Deep Neural Networks Part II Module. My project for this module investigated whether the theoretical complexity of languages recognisable by sequence-to-sequence models corresponded to the languages empirically learnable by those models. I found that it did not: sequence-to-sequence models were theoretically able to recognise many languages which they did not learn.

**Hardware Locking**
In Summer 2023, I aimed to lock models to specific hardware: severely degrading their performance if they were run on different hardware. My contributions to this paper was the creation of a method which prevented pruning or quantization from working.

**Architectural Backdoors**
In Summer 2023, I investigated a weight-invariant backdoor embedded in the computation graph of neural networks. I automated their construction and overcame the limitations of previous methods.

## Skills

**Machine Learning**
I've done extensive work in many subfields of machine learning and am familiar with a wide range of them, including: Adversarial ML, Architectures, Interpretability, Causality, Uncertainty Estimation, Bayesian Neural Networks, Spiking Neural Networks, Data Augmentations *etc.*

**Languages**
My research has been implemented with Python , leading to roughly 30,000 lines of research code. I've done work and am comfortable with C++, Java and OCaml

## Skills (continued)

- **Linux**
  I use Manjaro with the Hyprland WM on my main laptop. As such I have great experience and confidence with Linux. I'm comfortable using servers, which I've done since Summer 2023.
- **LaTeX**
  I've been using LaTeXfor all work since 2021 and have produced thousands of pages of supervision work, papers, exam questions, notes *etc.*

## Education and Qualifications

### University of Oxford (2024 – present)

- Started the Advanced Computer Science masters at Merton College, Oxford

### University of Cambridge (2021 – 2024)

- Achieved a **1st with distinction** in Third Year, ranking 5th out of 113.
- Achieved a 1st in Second Year exams, ranking 5th out of 116.
- Mean, Median and Modal supervision estimated work of 1 in Second year
- 1st in the Data Science "Stoat Finding" competition
- 1st out of 38 in my college group's 2nd year mocks
- Achieved a 1st in First Year exams, ranking 18th, receiving a prize scholarship and jointly receiving the Jon Rabone prize for "the most meritorious performance, as chosen by their Director of Studies, for an undergraduate in Churchill College in the Computer Science Tripos exams".
- Mean, Median and Modal supervision feedback of 1 in First year.
- 4th out of 37 in my college group's 1st year mocks.
- 3rd in Hack Cambridge 2022 out of 107 (group of 4).

### The Royal Grammar School, High Wycombe (2014 – 2021)

- 1 in both STEP 2 and STEP 3; which I sat for fun after doing several hundred STEP questions for leisure over the preceding 2 years
- 4 A*'s in Maths, Further Maths, Physics and Computer Science at A Level
- Studied all 10 Further Maths Modules: in addition to my 4 examined Further Maths modules (Core Pure 1, Core Pure 2, Mechanics 1, Further Pure 1); I self-studied all 6 other modules: Decision Maths 1, Decision Maths 2, Further Statistics 1, Further Statistics 2, Further Mechanics 2 and Further Pure 2.
- Switchshop Computing Award 2021 (best in year at school for Computer Science)
- Senior Maths Olympiad 2021 (best in school in BMO)
- British Physics Olympiad Round 2 (2021): Silver (top 58 nationally)
- British Physics Olympiad 2021: Top Gold (top 120 nationally)
- British Maths Olympiad 2021: distinction (top 250 nationally)
- Finished self-studying the A Level syllabus to exam-level for all 4 A Level subjects in May 2020; 8 months into the 2 year course.
- Out of the 12 school exams in A Level; 7 were best in year
- PA Physics Award 2020 (best in year for physics in year 12)
- Senior Physics Challenge 2020: Gold (top 100 nationally)

## Education and Qualifications (continued)

- Duke of Edinburgh: Bronze and Silver
- 11 GCSEs: including 9s in Maths, Chemistry, French, German; and 8s in English Language, Computer Science, Physics, Geography and Italian; and an A in a freestanding mathematical qualification (A being the top grade)