

# Alexander F. Spies

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## EDUCATION

**Imperial College London**, United Kingdom Sep 19 - Present

### MSc in Computing (Artificial Intelligence and Machine Learning)

*Relevant Courses:* Knowledge Representation, Machine Learning, Reinforcement Learning, Deep Learning, Natural Language Processing, Logic-based Learning

**University of Manchester**, United Kingdom Sep 15 - Jun 19

### MPhys (Hons) in Physics with Theoretical Physics

Degree Classification: First Class Honours Final Mark: 79.8%

*Relevant Courses:* Computational Physics, Advanced Statistical Physics, Learning, Memory and Cognition

**University of California, Berkeley**, California, USA Aug 17 - May 18

### Study Abroad, Physics

GPA: 3.87/4.00

**Backwell Academy**, Somerset, United Kingdom Sep 13 - July 15

**A-Levels:** A2: A\*, A\*, A\*, A (Further Maths, Maths, Physics, Chemistry); **AS:** A (German)

## SKILLS

- **Computational:** Python, C++, Java, Linux, PyTorch, Keras, Assembly, LaTeX
- **Mathematical:** Statistical Methods (Stochastic and Non-stochastic), Multivariable Calculus (ODEs, PDEs), Linear Algebra (Tensor algebra, Vector spaces), Complex Analysis, Fourier Analysis
- **Languages:** Fluent in English and German

## EXPERIENCE

**Independent Study Module**, Imperial College London Dec 19 - Present

*Investigating the Neurosymbolic AI state of the art*

- Used Keras and Tensorflow to create and train recurrent and convolutional neural networks on the university's computationally shared high-performance computing cluster
- Worked for the first time in the context of biological physics, under the supervision of Prof. H. Zhang

**Project Work**, Imperial College London Oct 19 - Dec 19

*Machine Learning Projects*

- Implemented decision trees and multi-layer feedforward networks in Python (numpy/pandas)
- Implemented Deep Reinforcement learning algorithm using PyTorch to solve a maze task (Double Deep-Q Learning with prioritized replay and dueling networks)

*Mathematical / Formal Projects*

- Utilized Clingo and Potsdam ASP for Knowledge Representation coursework
- Performed Bayesian Linear Regression, PCA, LDA and applied SVMs in Python and Matlab

**Master's Project Research**, University of Manchester Oct 18 - June 19

*Artificial Intelligence for the Automated Diagnosis of Atrial Fibrillation*

- Used Keras and Tensorflow to create and train recurrent and convolutional neural networks on the university's computationally shared high-performance computing cluster

- Worked for the first time in the context of biological physics, under the supervision of Prof. H. Zhang
- Collaborated with a project partner, whilst adhering to self-enforced deadlines created as part of a proposed long-term project structure designed to satisfy and exceed stated project goals
- Successfully created a framework capable of achieving > 99% diagnostic accuracies on ECG data, which was constructed modularly to allow straightforward extensions by future Master's students

### **Summer Internship, DESY, Hamburg**

July 18 - Sep 18

#### *Exclusion analysis of Higgs decay channels in the MSSM*

- Learned to use unfamiliar, unstable computational tools utilized by the research group and used these to construct a Python framework for model creation and testing which could be easily tuned
- Maintained a high level of productivity on the project whilst also attending seminars and meetings
- Completed the proposed investigation during the extent of the internship, despite numerous unforeseen technical setbacks, as a result of effective collaboration within the group

### **Undergraduate Research, LBNL, Berkeley**

Feb 18 - July 18

#### *Using Nonlocal Thresholds for improving the Spatial Resolution of Pixel Detectors*

- Investigated a proposed novel technique for improved resolution and radiation hardness of pixel sensors, with potential application in the next generation detector upgrade at the LHC
- Co-wrote a paper with supervisor Dr. B. Nachman summarising the results (currently in preprint and under review), with extensive thought invested into relevant future work and practical concerns
- Balanced research and academic work through strict time management and long-term planning

### **Project Work, UC Berkeley**

Nov 17 - May 18

#### *CS61B Projects*

- Completed numerous projects in Java, including a simplified version of google maps (graphs, tries, traversal, rasterization) and a maze exploration game with creatures (inheritance, TDD)

### **Programming Work, University of Manchester and Personal**

Sep 16 - Dec 17

- Completed computational projects in both Python and C++ by utilizing Monte Carlo simulations, differential equation approximation techniques, matrix arithmetic and optimization algorithms
- Designed and deployed a personal webpage with self-taught HTML, CSS and JavaScript

## **TEACHING**

### **Python Course Leader, UniCS Society**

Oct 18 - May 19

- Created weekly lecture materials and exercises which were used in Python coding workshops for non-cs majors, as well as liaising with multiple TAs to ensure the adequacy of the materials
- Co-ran the weekly sessions, briefed TAs on the lesson plans, as well as lecturing and teaching students directly (see [hacksoc.gitbook.io/python-classes](https://hacksoc.gitbook.io/python-classes))

## **LEADERSHIP**

### **Events Director and Treasurer, UoM Game Development Society**

Sep 18 - June 19

- Was responsible for the high-level organisation of society events (including talks by Activision, Game Maker's Toolkit, PhD students, and biweekly Game Development workshops)
- Directed "Student Game Jam: Manchester" (March 2019). This was the society's first major event, with an attendance of 70 students for 14 hours; with catering, prizes and venue funded by sponsors

- Member of the committee since the founding of the society, and helped to expose over 500 students to different aspects of the gaming industry and game design through our events
- Managed society budgeting and reimbursement in all sub-teams as the official treasurer

**Project Leader**, MANSEDS Rocketry Project

Oct 16 - June 17

- Led a team of eight undergraduate physics and engineering students, giving frequent presentations and ensuring effective team coordination and communication
- Completed an original rocket design over the course of the academic year
- Raised £500 of funding alongside another project leader in a student union run funding competition; this involved creating an impactful presentation and lobbying other societies for votes

**Active Member**, Particle Physics Society

Sep 16 - June 17

- Aided in designing an electronically cooled, portable cloud chamber used for outreach in schools

## ACHIEVEMENTS

**First Prize**, StudentHackVII, Manchester

March 19

- Working in a team of four, won first prize, out of 37 submissions (~160 attendees)
- Brainstormed and created an MVP within a 24 hour period via effective task management and efficient use of numerous libraries and frameworks; utilized Unity, Python, Docker and AWS
- Used facial recognition and morphing libraries to extract faces from images and create virtual versions of these, which proceeded to live brief, but rich, lives in our virtual realm
- Presented the “TamaGotcha” MVP humorously to judges and attendees during closing ceremony

## INTERESTS

- **Professional:** deep learning, computer simulation, theoretical modelling, biological physics
- **Leisure:** playing piano, squash, badminton, table tennis, sailing, reading, board and card games