

# 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:* Introduction to Machine Learning, Reinforcement Learning, Deep Learning, Natural Language Processing, Probabilistic Inference, Logic-based Learning, Knowledge Representation, Robotics, Independent Study

**University of Manchester**, United Kingdom Sep 15 - Jun 19  
**MPhys (Hons) in Physics with Theoretical Physics**

Degree Classification: First Class Final Grade: 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, PyTorch, Keras, Linux, 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  
*Survey of State of the Art Neuro-symbolic Approaches*

- Evaluating progress in Neuro-symbolic hybrid approaches to AI, with the aim of producing a survey article that will serve to highlight promising avenues of research, as well as key benchmarks
- The motivation behind the project is to become familiar with recent conceptual advances in both deep-learning and symbolic AI, as these may enhance the generalizability and interpretability of AI
- This work is being carried out under the supervision of Prof. A. Russo, and will likely serve as the basis for subsequent work on an MSc project beginning in April 2020

**Coursework**, Imperial College London Oct 19 - Dec 19  
*Machine Learning Projects*

- Implemented decision trees and multi-layer feedforward networks in Python (numpy/pandas) as part of two group projects, requiring collaboration through version control (gitlab)
- Implemented double Deep Q-Learning algorithm using PyTorch to solve random maze tasks

### *Other Projects*

- Utilized Answer Set Programming (Clingo) to solve a maze world task as well as implementing action description languages for concurrent block worlds and simple diagnostic problems
- Performed Bayesian Linear Regression, PCA, LDA and applied SVMs in Python and Matlab
- Constructed a differential drive Lego robot (using the Python BrickPi API) capable of performing probabilistic localization and navigation utilizing a sonar sensor. Carried out as a group project

**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

### *Published: 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
- Balanced research and academic work through strict time management and long-term planning

## 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

## PUBLICATIONS

- Nachman, B. & Spies, A.F. (2019). Nonlocal Thresholds for Improving the Spatial Resolution of Pixel Detectors. *Journal of Instrumentation*. **Available Online**

## INTERESTS

- **Professional:** deep learning, logic programming, computational neuroscience, biological physics
- **Leisure:** playing piano, squash, badminton, table tennis, sailing, reading, board and card games