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, 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 Jan 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 highlighting promising avenues of research, as well as key benchmarks and approaches
- Working to acquire familiarity with these techniques and their implementations as combining deep-learning and symbolic AI may yield hybrids which address the shortcomings of modern approaches
- Project supervised by Prof. A. Russo, with a view to potential future work

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)

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**. arXiv: 1903.01624

INTERESTS

- **Professional:** deep learning, symbolic AI, computational neuroscience, theoretical particle physics
- **Leisure:** playing piano, squash, badminton, table tennis, sailing, reading, board and card games