Thomas Davies

Southampton - UK

t.o.m.davies@soton.ac.uk • github.com/tomogwen

Education

PhD, Computer Science — **University of Southampton**
Southampton, UK — *September 2019 – Present*

- My research aims to combine tools from topological data analysis with techniques from machine learning to enable topology-driven deep learning.
- I'm interested in both the theoretical study of machine learning, with a focus on TDA-based algorithms, and applications of ML to other disciplines: in my first paper we apply a novel algorithm to achieve state-of-the-art classification of transformed materials science datasets.
- I have gained practical experience using PyTorch for modelling and research.

MSci, Mathematics — **University of Birmingham**
Birmingham, UK — *September 2015 – July 2019*

- I graduated with a first class Mathematics MSci with honours, earning an overall mark of 80%.
- My master's thesis, *The Persistent Homology of Complexes from Point Data Sets*, studied the algebraic topology underpinning topological data analysis, attaining a mark of 83%.
- My bachelor's thesis was *Burnside's Theorem and Representations of Finite Groups* and achieved a mark of 84%.

Publications

Fuzzy c-Means Clustering for Persistence Diagrams, *Thomas O M Davies, Jack Aspinall, Bryan Wilder, Long Tran-Thanh*, arXiv:2006.02796, preprint (2020)

- We developed an algorithm for fuzzy c-means clustering on the space of persistence diagrams, enabling unsupervised learning that automatically captures the topological structure of data.
- We ran experiments that showed our algorithm can classify transformed lattice structures from materials science where comparable algorithms fail.

Technical Experience

EPS EdTech/Maplesoft — **Birmingham, UK**
Team Lead — *July 2019 - September 2019*

- I led a team of five interns, implementing mathematical questions in a computer algebra system (Maple) to allow for automated, randomised testing within an online assessment system (Maple TA/Möbius).
- As the team lead I was responsible for liaising with clients to confirm individual project requirements, organising the interns to ensure that we met the deadlines for deployment and testing, and dealing with any problems that arose.

Developer — *September 2017 – July 2019*

- I worked as a developer for the edtech team over a period of two years, most notably working full-time over Christmas 2017 and 2018.
- As well as implementing questions in Maple, this involved writing web applications in JavaScript (using bootstrap, jquery, and more) to act as learning aids.

Intern — *July 2017 – September 2017*

- As an intern I was jointly funded by Birmingham University and Maplesoft, with the same responsibilities as when working as a developer.
- I developed a CNN in TensorFlow that successfully classified hand-sketched graphs as part of a project to automate marking. I presented this to a VP of Maplesoft.

Fusion Innovations **Birmingham, UK**

Data Scientist *July 2018 – September 2018*

- I created an end-to-end data science pipeline for Fusion Innovations, an automotive engineering start-up aiming to create smart car tyres. This involved cleaning, processing, visualising, and modelling large amounts of data.
- I successfully engineered features extracted from tyre-embedded piezoelectric sensor data to predict technical information about the state of the tyres.
- I developed a convolutional recurrent neural network to predict road surface from sensor input.
- I wrote and gave presentations to investors and was involved in patent applications for the company.

The R&A **St Andrews, UK**

Pace of Play Project *January 2017 – March 2017*

- I worked with The R&A on a research project into the pace of play, developing a model that could accurately predict the location of pins and tees given raw GPS data from transceivers worn by golfers.

Civil Service **UK**

Cybersecurity Intern *July 2016 – September 2016*

- I learned a large array of cyber skills such as penetration testing, reverse engineering/malware analysis, information assurance, secure coding, hardware hacking, and more.
- As an independent project, I wrote a chat client/server in C that implemented the WEP usage of the RC4 stream cipher, then broke it using the FMS attack. I was selected to present my project to senior management at the end of the internship.

Other Experience

University of Southampton **Southampton, UK**

Demonstrator *September 2019 – Present*

- Demonstrating for the following courses, which includes leading tutorials, marking, and helping in labs.
- Foundations of Computer Science: introductory mathematics for first year undergraduates.
- Software Security: penetration testing and software reverse engineering for masters students.
- Software Engineering Group Project: agile development for second year undergraduates.

University of Birmingham **Birmingham, UK**

Teaching Assistant *September 2018 – July 2019*

- TA for Data Science for Everyone: introductory python and data science for first year undergraduates.

Birmingham University Debating Society **Birmingham, UK**

President *February 2017 - February 2018*

- I was elected to a voluntary position overseeing a committee of 13 that: ran weekly workshops in public speaking and British parliamentary debating; regularly sent competitors to national and international tournaments; organised a competition attended by students from around Europe that ran at a profit of over £900; and organised a competition for secondary school students that promoted public speaking skills to attendees from around the UK, with a focus on providing opportunities for poorly performing schools.
- I have strongly developed my public speaking and communication skills through competitive debating.

Secretary *February 2016 - February 2017*

- I introduced and organised an end-of-year formal which sold out, running at a profit for the society.

Build-A-Plane Project, Royal Aeronautical Society/Boeing **Stroud, UK**

Project Manager *September 2010 – July 2014*

- I was part of a team of students that built a Rans S6-ES Coyote II light aircraft, which received its certificate of airworthiness in March 2014. In July 2014 it flew at the world-renowned Farnborough airshow, becoming the first student-built aircraft to do so.
- As a project manager I helped organise build sessions for the construction of the aircraft, liaising with Boeing and the RAeS. I represented the RAeS at the Houses of Parliament and Boeing at several international air shows and tattoos.