CHRISTOPHER W. F. PARSONSON

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EDUCATION

University College London, Ph.D. 2019-22

Thesis: 'Combinatorial Optimisation in Network Systems with Artificial Intelligence', EEE Dept., Optical Networks Group
Supervised by Dr. Georgios Zervas. Working on solving optimisation problems with AI. Specific research interests include: (1) Machine learning for combinatorial optimisation over graphs applied to resource allocation in optical data centre networks and distributed deep learning clusters; (2) optimisation algorithms applied to ultra-fast optical switching; and (3) benchmarking.

University of Cambridge (Gonville & Caius College), M.Res. 2018-19

Integrated Photonic & Electronic Systems Engineering, ***Distinction***
Research interests included: (1) Computer-generated 3D holography for AR and VR displays (80%); (2) ultra-fast all-optical switching for future data centre networks (82%). Relevant modules: Software for Network Services and Design (75%); Embedded Systems for the Internet of Things (77%); Photonic Systems (80%); Optical Transmission Networks (80%).

Imperial College London, M.Eng. 2014-18

Materials Science and Engineering, ***First-Class Honours***
Averaged **79.4%** in third- and fourth-year exams and overall scored in **top 5% of class** (out of 120 students) in third year. Won 2016 Morgan Advanced Ceramics prize for highest mark in year for ceramics extended lab. Achieved distinctions and first-class grades in various business management courses.

INTERNSHIPS & ADDITIONAL RESEARCH EXPERIENCE

Visiting Researcher, The Alan Turing Institute, London 2022-Present
Currently enrolled on the Turing Enrichment PhD programme. Working on graph neural networks, reinforcement learning, and optical cluster management for distributed deep learning. Using Python, PyTorch, DGL, RLlib, Gym, etc.

Research Scientist Intern, InstaDeep Ltd., London 2021-22
Developed approach for using graph neural networks and deep reinforcement learning to solve mixed integer linear programming problems exactly. Used Python, PyTorch Geometric, W&B, Ecole, etc. Two papers under peer review.

Research Engineer Intern, VividQ Ltd., Cambridge 2018-19
Worked with 3D display company VividQ (reference available). Performed simulations in MATLAB and Zemax. Experimentally demonstrated ideas. Collaborated with University of Cambridge to develop large FOV and eyebox displays without compromising display size and quality using a waveguide and holographic optical elements.

Research Engineer Intern, Dyson Ltd., Bristol Summer 2017
Worked in Dyson's Research, Design and Development branch as part of the Thermodynamics team, focusing on research of heat exchangers (received graduate job offer, reference available). Experience with CAD (NX11), materials characterisation and evaluation (CT scans, SEM, MATLAB etc.), and test rig design and build. Allocated $20,000 budget to set up new suppliers and write Statements of Work for contracted researchers. Participated in 2017 Hackathon, taking third place.

Research Engineer Intern, Cambridge Nanosystems Ltd., Cambridge Summer 2016
Focused on material optimisation, laboratory research and industrial graphene production (reference available). Researched and wrote report on graphene heat treatement and analysis and nanocomposite production and testing.

Analyst Intern, Polygelco PLC, Cambridge Summer 2015
Focused on polymer property, competitor and market research, looking at top established companies and how Polygelco's innovative recycled polymer may compete (reference available).

Engineer Intern, Ubisense PLC, Cambridge Summer 2014
Focused on performance enhancement. Used Google SketchUp, Inkscape and Gimp 2 to reallocate nodes (reducing image size by 90% to increase software performance) and to convert images to vector format.

RELEVANT TECHNICAL SKILLS

Python, MATLAB, PyTorch, TensorFlow, DGL, PyTorch Geometric, W&B, TensorBoard, Ray, RLlib, Gym, Pandas, NumPy, SciPy, Scikit-learn, Jupyter, Neovim, VSCode, Git, Linux, tmux, Sphinx, Docker, LaTeX

RELEVANT TECHNICAL PROJECTS

Reinforcement Learning for Combinatorial Optimisation (Ongoing): Created novel RL-GNN approach to learning to branch and exactly solve NP-hard mixed integer linear programmes with branch-and-bound. Developed algorithms and solvers with Python, SCIP, PyTorch Geometric, and Ecole. In process of developing similar approaches for resource management in distributed deep learning optical clusters. Two papers under peer review.

Data Centre Network Traffic Generation and Benchmarking Tool: Developed open-source traffic generation suite in Python. Flexible to any network topology, handles individual flow and job computation graph traffic, and integrates with Jupyter Notebook front-end interactive interface. One paper published, one under peer review.

Ultra-Fast Optical Switch Optimisation: Built SOA simulation in Python, MATLAB and ADS. Designed gradient descent, PID control, GA, and PSO algorithms using Python and MATLAB. Open-accessed code. Experimentally demonstrated order of magnitude improvement over previous switch speed world-record. Two papers published.

Smart Ski Boot: 'Over-bare-metal' coding in C to build smart ski boot from scratch. Used FRDM-KL03Z dev board, an OLED, 3 INA219 current sensors and 3 A201 FlexiForce sensors, writing drivers for each and integrating to make final working prototype. Developed algorithm to give user real-time feedback and calculate final score to evaluate performance. Characterised system uncertainty and error.

Network Attack Detection: Used KKD dataset of 5 million network request fingerprints to build network attack detection system. Implemented deep NN model with Python and Tensorflow for supervised ML approach. Trained and tested in client-server architecture using Socket.

Huawei DriveML Challenge: Worked in team of 3 to build autonomous driving agents in Python using NEAT algorithm and RLlib. Trained and tested in custom PyGame environment. Attended finals in British Museum and gained insights into practical applications of ML.

ConceptionX: 9-month entrepreneurship programme to explore the commercial potential of my team's academic research. Met industry representatives and customers, discussed with angel and VC investors, and collaborated with peers.

Engineers Without Borders Challenge: Competitive 20-week national competition focusing on innovating an engineering solution to real-world problems in Bambui, Cameroon. Designed innovative solution to Bambui's waste and power shortage problems. Won entry out of >4,600 applicants to compete in finals. Presented to >200 engineers and panel of 18. Finished in third place, placing in top 0.1% of applicants.

TEACHING EXPERIENCE

- Lecturer, Machine Learning MSc, 'Cloud Data Centres and Edge Computing', EEE & CS Dept., UCL 2020-Present
- Post Graduate Teaching Assistant and marker, Python Programming, EEE & CS Dept., UCL 2020-Present
- Post Graduate Teaching Assistant and marker, Mathematical Modelling & Analysis, EEE Dept., UCL 2019-Present
- TutorHunt Private Tutor for school-level Mathematics, Physics and Aptitude Testing 2019-Present

VOLUNTEERING

- **South Africa, Mount Camdeboo, 2015**: 2 weeks volunteering on Mount Camdeboo game reserve, South Africa.
- **Madagascar, Nosy Bay, 2014:** 3 weeks volunteering in Madagascar, Nosy Bay.
- **South Africa, Athlone, 2013:** Won competitive travel scholarship to work on a self-organised 3-week project in the Christine Revell orphanage in Athlone (a township in Cape Town, South Africa).

SPORTS, HOBBIES & INTERESTS

- *Organisational and leadership roles include:* Gonville & Caius M2 rowing team 2018-19, Imperial College boxing sponsorship secretary 2015-17, Stowe teams for rugby, cricket, hockey and swimming (1st team). Student paper journalist.
- *Other interests:* Sailing (Level 4), diving (PADI Open Water qualification), skiing, tennis, golf and downhill mountain biking. Clarinet and percussion for 10 and 3 years respectively. Member of Stowe CCF, various courses completed.

PUBLICATIONS

- **C. W. F. Parsonson**, A. Laterre and T. Barrett, 'Reinforcement Learning for Branch-and-Bound Optimisation using Retrospective Trajectories', *Under peer review*, March 2022
- T. Barrett, **C. W. F. Parsonson** and A. Laterre, 'Learning to Solve Combinatorial Graph Partitioning Problems via Efficient Exploration', *Under peer review*, March 2022
- **C. W. F. Parsonson** and G. Zervas, 'Traffic Generation for Data Centre Networks', *Under peer review*, March 2022
- Joshua L. Benjamin, Alessandro Ottino, **C. W. F. Parsonson** and G. Zervas, 'Traffic Tolerance of Nanosecond Scheduling on Optical Circuit Switched Data Centre Networks', *Optical Fiber Communications*, March 2022
- T. Gerard, **C. W. F. Parsonson**, Z. Shabka, P. Bayvel, D. Lavery and G. Zervas, 'AI-Optimised Tuneable Sources for Bandwidth-Scalable, Sub-Nanosecond Wavelength Switching', *Optics Express*, August 2021
- **C. W. F. Parsonson**, Z. Shabka, W. K. Chlupka, B. Goh and G. Zervas, 'Optimal Control of SOAs with Artificial Intelligence for Sub-Nanosecond Optical Switching', in *IEEE/OSA Journal of Lightwave Technology (JLT)*, June 2020