Joseph Bullock

St. John's College
3 South Bailey
Durham, DH1 3RJ
United Kingdom

+44 7927 182 391
j.p.bullock@durham.ac.uk

Education

Institute of Particle Physics Phenomenology, Durham University
Ph.D, Data Intensive Science in Physics, 2017 - Present

Durham University Business School
Mini-MBA, ILM accredited, July 2018

Department of Natrual Sciences, Durham University
MSci, Natural Sciences (Mathematics and Physics), 2013 - 2017

- **Result:** 1st class honours (including 1st class in each year)
- **Masters thesis:** *Analogue Gravity: Developing a Relationship Between Fluids and Relativity.*

Distance Learning
The Ethics and Governance of Artificial Intelligence, MIT Media Lab
Natural Language Processing with Deep Learning (CS224n), Stanford Online
Justice, HarvardX
Introduction to Computer Science (CS50), HarvardX
Global Systems Science, UNESCO

Research

Numerati Partners LLC
Technology Consultant
June 2019 - Present (on retainer)

- Performing technical audits of companies to determine how different technologies are being developed and deployed with a particular focus on predicting and assessing CAT events with machine learning tools.
- Scoping out potential pilot programmes with the companies being audited, and advising on technologies to be used and synergies between organisations.
- Conducting research through literature reviews and supervising the use of new techniques to improve business strategies.

UN Global Pulse
Artificial Intelligence Research Fellow
October 2018 - Present

- Working with various UN agencies to develop a machine learning driven satellite image analysis tool for automated refugee camp mapping, improved shelter identification, flood mapping, and post-disaster damage assessment.
- Supervising and collaborating with two remote researchers working on both flood mapping and improvised shelter growth analysis in satellite imagery.
- Developing a highly customisable multi-media analysis tool, designed for use by UN country teams, employing topic modelling, query expansion and language agnostic classification techniques.
- Leading a project in collaboration with the Gender, Peace and Security Unit of the UN Department of Political and Peacebuilding Affairs to assess the use of gender-related language in a variety of contexts. Proof-of-concept: Analysis of UN General Assembly speeches.
- Mapping the risks of AI text generation techniques to society and human rights.

RiskEcon Lab, Courant Institute, New York University
Industrial Research Associate
November 2018 - Present

- Explored new methodologies for image classification and satellite image analysis.
- Worked with corporate partners to assess the potential use of satellite image analysis and, more broadly, AI based solutions within their organisations.
- Currently assessing the potential for future inter-University collaborative efforts within Data Science.

Institute of Particle Physics Phenomenology, Durham University
Ph.D Candidate, Data Intensive Science in Particle Physics
September 2017 - Present

- Developing and applying machine learning methods to high precision measurements in QCD.
- Specific focus on using Neural Networks to approximate highly complex scattering amplitude functions alleviating the need for expensive Monte Carlo simulations in favour of fast querying machine learning models.
- Developing software for the research to be easily applied by the community in accordance with field standards such as BLHA.
- Working to simplify the cross section calculations at high NLO multiplicity within accepted error ranges.
- Additional focus on developing methods for explicit error propagation calculation in Neural Networks.

IBEX Innovations Ltd.
Research Consultant
April 2018 - June 2018

- Explored novel ways of applying machine learning solutions to real world X-Ray image processing problems.
- Developed a unique methodology for performing X-Ray image segmentation on (small) datasets representative of those produced at medical institutions.
- This work resulted in several publications, and has been developed into an open-source tool: XNet.

Additional Relevant Experience

DataKind
Pro-bono Consultant
April 2018 - Present

- Offering advice and assistance in scoping out new data-driven projects, with particular expertise in remote sensing and AI/machine learning.
- Worked with the Irish Mission to the UN on planning a hackathon.

Department of Mathematics, Durham University
Teaching Assistant, Complex Analysis II
October 2016 - June 2017

Awards and Fellowships

Best Student Paper: SPIE Medical Imaging 2019: Biomedical Applications in Molecular, Structural, and Functional Imaging

UN Global Pulse Research Fellowship: Fellowship supporting my work with UN Global Pulse.

Intel Research Award: Financial and computational support relating to the publication of papers in medical imaging.

NVIDIA Hardware Grant: Awarded access to NVIDIA computational resources

STFC Ph.D Studentship: Full funding for my doctoral programme.

Best Presentation: Josephine Butler Research Forum, Durham University

Durham Award: For exceptional contribution to University and College life, community outreach, and developing key skills for increased employability.

Selection of Additional Projects

World Data Visulization Prize: Tackled the challenge of understanding the 'Future of Government' through a linguistic analysis of business reports, Google Trends queries and political speeches given at the United Nations General Assembly. Our entry can be found at: corpusmobiles.com

Data4Refugees Competition: Explored mobility patterns of citizens and refugees in Turkey, using Call Detail Records (CDRs), to determine the cities and districts in which refugees struggle to become integrated.

Northumbrian Water Hackathon: Worked with data from Northumbrian Water to develop systems for predicting leaks in water pipelines throughout the UK.

Protein Folding: Developed an open source, generalisable protein folding algorithm with command line interface, employing Monte Carlo methods and implemented in C++. Repository can be found here: Protein

Publications

J. Bullock, M. Luengo-Oroz, *Automated Speech Generation from UN General Assembly Statements: Mapping Risks in AI Generated Texts*, AI for Social Good Workshop, 36^{th} International Conference on Machine Learning (ICML) (2019) [arXiv:1906.01946]

J. Bullock, C. Cuesta-Lázaro, A. Quera-Bofarull, *XNet: a convolutional neural network (CNN) implementation for medical x-ray image segmentation suitable for small datasets*, Proc. SPIE 10953, Medical Imaging 2019: Biomedical Applications in Molecular, Structural, and Functional Imaging (2019) [arXiv:1812.00548]

J. Bullock, S. Badger, *Learning n-gluon Phase Space Amplitude Mappings*, Journal of High Energy Physics (JHEP) (in progress)

J. Bullock, E. de Leon, *Predictive accountability: assessing AI performance in human centered decision-making*, Harvard Business Review (under review) **J. Bullock**, C. Cuesta-Lázaro, A. Quera-Bofarull, *Automatic X-Ray image segmentation with small datasets*, Poster session, SPIE Medical Imaging Conference (2019)

J. Bullock, C. Cuesta-Lázaro, A. Quera-Bofarull, *XNet: A convolutional neural network (CNN) implementation for medical X-Ray image segmentation suitable for small datasets*, Poster session, STFC AI Summer School, University College London, UK (2018); National Meeting of the Centres for Data Intensive Science, University of Edinburgh, UK (2018)

Service to the Profession

Co-Chair, *The United Nations AI-Geo Working Group*
Senior Programme Chair, *AI for Social Impact, AAAI* (2020)
Organiser and Track Chair, *AI for Social Good Workshop, NeurIPS* (2019)
Organiser, *Data Science Forum, Institute for Data Science, Durham University*
Convener, *Annual Young Experimentalists and Theorists Institute* (2019)
Lead Convener, *12th Annual Young Theorists Forum* (2019)
Convener, *11th Annual Young Theorists Forum* (2018)
Co-founder, *Machine Learning Journal Club, Durham University*
Reviewer, *Computers and Geosciences, Elsevier*

Recent Invited Talks and Workshops

Mapping Risks in Generated Text, Institute for Data Science Launch Event, Durham University (2019)

AI for Humanitarian Relief, Digital Aid Workshop, Alan Turing Institute (2019)

Data Science for Humanitarian Relief, Office of the United Nations High Commissioner for Human Rights (2019)

A complex systems approach to AI and converging technologies, ITU AI for Good Global Summit (2019)

AI for Social Good, Second Annual Conference of the Durham University STFC Centre for Doctoral Training in Data Intensive Science (2019)

Humanitarian uses of AI, Durham University Advanced Research Computing launch event (2019)

Segmenting X-Ray Images with Neural Networks, Live Demonstration, Showcase event, United Kingdom House of Commons (2019)

Applied Ethics in Data Analytics, Guest Lecture, Data Analytics and Metrics for the Nonprofit Sector, Columbia University School of Professional Studies (2019)

Segmenting X-Ray Images with Neural Networks, Live Demonstration, Computer-Aided Diagnosis Workshop, SPIE Medical Imaging (2019)

Satellite Image Analysis for Humanitarian Relief, InsureTech Alliance Meeting (2019)

Satellite Image Analysis for Humanitarian Relief, Center for Data Science, New York University (2018)

Introduction to Machine Learning, 4-day workshop, IBEX Innovations Ltd. (2018)

X-Ray Image Segmentation, First Annual Conference of the Durham University STFC Centre for Doctoral Training in Data Intensive Science (2018)

Hey Google: Show me a llama: An Introduction to Machine Learning, Josephine Butler Research Forum, Durham University (2018)

An Introduction to Machine Learning, Broaderlands Lecture Series, Durham University (2018)

Outreach and Leadership

Speaker, *Saturday Morning Science*: weekly open-lecture series run by Durham University

Volunteer, *National Science Festival* (2019)

Ambassador, *Institute for Economics and Peace*: program designed to provide peacebuilders with the new ways of analysing and articulating peace including an in-depth understanding of IEP's findings and methodology, along with tools to communicate innovative peace research (2019)

UK Delegate, *23rd Annual Youth Assembly*: conference bringing together youth leaders from around the world to discuss and debate ways in which to achieve the United Nations Sustainable Development Goals (2019)

Advisor, *Common Purpose*: shared experience of how data science and AI are used in the humanitarian sector to aid in planning a workshop, focused on AI for social good, for students from across the State of New York (2019)

Organiser, *Data Science and Machine Learning in Particle Physics and Astronomy*: workshop for local high school students (2018)

Volunteer, *Jesuit Refugee Service, Romania* (2018)

Volunteer, *National Science Festival* (2017)

Pastoral Tutor, *St. John's College, Durham University* (2017 - 2018)

Board Member, *St. John's Common Room Trust*: the board governing the students' union of St. John's College, Durham University (2014 - 2016)

Vice President, *St. John's Common Room* (2015 - 2016)

Treasurer, *St. John's Common Room* (2014 - 2015)