

Micah Bowles

Manchester, UK

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Education

PhD AI x Astro

Astronomy's Undeclared Priors: Advancing Artificial Intelligence in Astrophysics

Manchester, UK

THE UNIVERSITY OF MANCHESTER

2020 - Present

- *Summary:* Researching priors for deep learning applications in radio astronomy. Developing neural network based approaches to classification of radio galaxies using data priors. Priors are inspired through my understanding of the data gained through active involvement in modern radio interferometric calibration, imaging, and polarisation measurements.
- Equivariant attention in CNNs for physics inspired robustness in interpretable computer vision [10, [code](#)].
- Domain specific inductive biases for transformation invariant deep learning through custom data specific data augmentations. [v0.0.1]
- Self-supervised learning for representation learning with sparse data through masked autoencoding (publication in prep.).
- Deriving new semantic class targets as data priors in scientific applications [3,4, [code](#), [press release](#)].
- Score based diffusion models for reverse imaging in radio interferometry in collaboration with CIELA, University of Montreal (publication in prep.).
- Contributed to collaborative deep learning based software projects including [Zoobot](#) [2].
- Management, calibration, and imaging data pipelines of TB scale radio interferometric data as part of the international MIGHTEE-POL collaboration [publications in prep., [code](#)] on various HPC systems.
- Active member of large astronomy collaborations (MIGHTEE and EMU). Including as a core member of both [MIGHTEE-POL](#) and [RGZ-EMU](#).
- Invited speaker at leading universities and research groups. Disseminated research at globally leading conferences.

MScR Astronomy and Astrophysics, Distinction

Manchester, UK

THE UNIVERSITY OF MANCHESTER

2019 - 2020

- Explainable AI through self-attention [11, [code](#)].
- First in my class.
- Audited undergraduate machine learning courses.

BSc Physics

Cologne, Germany

THE UNIVERSITY OF COLOGNE

2012 - 2018

- Simulating galaxy mergers through N-Body simulations [13].

Internships

Quantum Innovation

UK

DIRAC

Sep. 2023 - Mar. 2024

- Developing, researching, and benchmarking qubit based AI models on radio astronomy pulsar data with Google's Quantum AI group.

Machine Learning Scientist

London, UK

EXPEDIA GROUP

Summer 2023

- Personalising recommendation systems for Expedia Group search results (10 million searches per day).
- Feature engineering and evaluation of terabyte scale data from the internal data lake.

Skills

Programming

Proficient in Python, git, Bash, SLURM, Scala, LaTeX; Knowledge of Cython, FORTRAN

ML Stack

PyTorch, PyTorch-lightning, Weights and Biases, JAX, TensorFlow, Scikit-learn, SpaCy, NLTK, Spark/PySpark, Seaborn, Matplotlib, NumPy, Pandas

Languages

English (Native), German (Fluent)

Professional Activities

Reviewer

- Monthly Notices of the Royal Astronomical Society.
- NeurIPS 2023 Machine Learning for the Physical Sciences Workshop (top machine learning conference).
- ICML 2023 Machine Learning for Astrophysics Workshop (top machine learning conference).
- National Astronomy Meeting 2023 ML Session.

2021 - Present

Organiser and Host

Manchester, UK and Virtual

ML AND DATA JOURNAL CLUB

2020 - 2023

- [Disseminating and discussing](#) AI research relevant to astronomy and astrophysics.
- Collaboration with intergovernmental organisation ([SKAO](#)).
- Hosting ML and deep learning teaching sessions for beginners, practitioners and researchers.
- AI ethics consideration and communication with attendees.

Leadership

- Session moderator at [The Alan Turing Institute's UK AI meeting 2023](#).
- Co-supervision of undergrad project using an early version of my [AstroAugmentations](#) package (2022).
- Supervision and mentoring of two summer researchers culminating in a publication [9] (2021).
- Designing and running intensive courses on machine learning, deep learning, and software development to astronomy and astrophysics researchers (grad students and researchers). Some material is public on the [JACS site](#).

2021 - Present

Hackathons

- Market making volatility forecasting: deep learning based regression of volatility.
- Cloud coverage forecasting with geospatial time series data: High fidelity image regression with u-nets.

2021 - Present

Softwares

- [Cata2Data](#): Using catalogues and respective FITS files to build a dynamic data loader for AI applications.
- [AstroAugmentations](#): Using knowledge of instrumentation to leverage data symmetries and invariances to construct approximate transformations for deep learning.
- [Zoobot](#): Framework for finetuning pretrained models based on Galaxy Zoo data enabling parallel tensorflow and pytorch implementations.
- [ProcessMeerKAT](#): Parallel large scale data pipeline for interferometric imaging with TB scale data on HPC systems. I adapted this for our HPC system and provided code to enable it to run simply on any SLURM based HPC. Contribution under review.

Work Experience

- Technical Recruitment Consultant, NES Global Talent, 2019.
- Technical Translator, Omikron Systemhaus GmbH, 2015 - 2018.
- Translator, Deutsche Welle, 2014.

Talks and Speaking Engagements

Invited Seminars

- University of Birmingham Astrophysics Seminar, *AI in Astrophysics: Inductive Biases and Beyond*, 2024.
- Zooniverse Internal Seminar Series, *RGZ-EMU and the Semantic Radio Galaxy Taxonomy*, 2023.
- University of Montréal, CIELA Institute, Astronomerique Speaker Series, *Let's Talk about Undeclared Priors: Symmetries and Language in Astronomical Classifications*, 2022.
- EMU Collaboration Meeting, *Towards a Modern Radio Galaxy Morphology Ontology*, 2022.
- Open University, Physical Sciences Seminar, *Paying Attention to Radio Galaxy Morphologies*, 2022.

Conference Talks

- The Alan Turing Institute's UK AI meeting, *Reducing Labelling Costs by Learning Semantic Class Targets*, 2023.
- The SKA Pathfinder Radio Continuum Survey Conference, SPARCS XI, *The Semantically Meaningful Morphology Taxonomy*, 2022.
- European Astronomical Society Meeting, EAS, *Challenging Language in Astronomical Classifications*, 2022.
- European Astronomical Society Meeting, EAS, *Open-Source Domain Specific Astronomy Augmentations for your Data Set*, 2022.
- International Union of Radio Science, URSI, *Astrophysically Informed Priors for Self-Attention Classification in Radio Astronomy*, 2022.

Paid Public Speaking

- InvestIN Education, Data Science in Astronomy and Astrophysics, 2022