Michael Smith

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Education

2018–Present	**University of Hertfordshire, UK.** PhD astrophysics, expected to graduate September 2022.
2018–2020	**Queen's University, Canada.** Visiting graduate student at Queen's Department of Physics.
2013–2017	**Leeds University, UK with *intl.* year at Queen's University, Canada.** First class MPhys, and first class BSc in Physics.

Research interests

Applying novel deep learning methods (particularly self-supervised, unsupervised, and generative learning methods) to cross-disciplinary problems in astrophysics, earth observation, medical diagnosis and imagery, and other fields.

Experience

I have a background in physics, with a MPhys degree and bachelors degree in the subject. In 2018 I started my PhD at Hertfordshire University, with a focus on novel applications of machine learning in astronomy. During my MPhys and my PhD I have developed multiple projects that use deep learning to solve difficult problems, here is a breakdown:

- For my master's thesis at the University of Leeds I developed a Convolutional Neural Network (CNN) that provided state-of-the-art heart disease diagnosis in both electro- and magneto- cardiography scans. A copy of the thesis, and the code used is available at `https://github.com/Smith42/neuralnet-mcg/`.
- After graduation, I spent the summer of 2017 as a research assistant at the University of Hertfordshire. During that time I developed software for use with medical imagery. I developed a machine learning heart disease classifier (and dead cell detector) for Single Photon Emission Topography (SPECT) scans (`https://github.com/Smith42/heart-cnn/`). I also wrote a watershed transformation code for the instance segmentation of cell vacuoles (`https://github.com/Smith42/cell-vacuole-finder/`).
- During the first year of my astrophysics PhD at the University of Hertfordshire I wrote a paper on using a Generative Adversarial Network (GAN) to generate synthetic "blank field" astronomical survey data. The paper has been published in MNRAS, and its DOI is `https://doi.org/10.1093/mnras/stz2886`. The code is available at `https://github.com/Smith42/XDF-GAN/`.
- I have applied GANs to Earth Observation (EO) imagery, adapting the deep watershed transformation algorithm to automate farm field instance segmentation. I have also developed a deep generative learning code for the translation of Synthetic Aperture Radar (SAR) imagery to visible/infrared imagery, allowing the removal of transparent-to-SAR objects (i.e. cloud cover) from satellite imagery.

Publications, talks, and posters

Deep learning of data cubes: from human hearts to galaxies. Michael J. Smith, James E. Geach. 2018. Poster presented at *The Physics of Galaxy Scaling Relations & the Nature of Dark Matter 2018*, in Kingston, ON, Canada.

Generative deep fields: arbitrarily sized, random synthetic astronomical images through deep learning. Michael J. Smith, James E. Geach. Monthly Notices of the Royal Astronomical Society, Volume 490, Issue 4, December 2019, Pages 4985–4990. `https://doi.org/10.1093/mnras/stz2886`. Work presentated at *The Big Data Era in Astronomy 2020*, online.

DeepEO: deep learning for earth observation. Michael J. Smith. 2020-01-22. Invited talk for Falmouth University's Launchpad at Goonhilly Earth Station, Cornwall, UK.