

Machine Learning and Physics Seminar Series

Thursday, 7 November 2019 at 2.30pm
Dennis Sciama Lecture Theatre, Denys Wilkinson building

Deep learning techniques applied to radio astronomy

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Machine learning techniques have proven to be increasingly useful in astronomical applications over the last few years, for example in image classification and time series analysis. A topic of current interest is to classify the morphology of radio galaxies, as it gives us insight into the nature of the Active Galactic Nuclei and structure formation. Future surveys, for example with the Square Kilometre Array (SKA), will detect many million sources and will require the use of automated techniques. Convolutional neural networks are a machine learning technique that have been very successful in image classification, due to their ability to capture high-dimensional features in the data. A drawback of the technique is the use of the pooling operation, which results in information losses and does not preserve the relative position of features in the image. Capsule networks however are able to preserve this information with the use of dynamic routing. We explore a couple of convolutional neural network architectures against variations of Capsule network setups and evaluate their performance in replicating the classifications of radio galaxies detected by the Low Frequency Array (LOFAR). Finally, we also show how it is possible to use convolutional autoencoders to perform source finding in radio surveys.

I completed a Bachelor of Engineering/Science and Masters of Physics at the University of Melbourne. Afterwards I worked as a research assistant in Bioinformatics for almost 4 years, implementing software algorithms and statistics to analyse genetic data, running NGS pipelines on sequencing data of individuals in pedigrees with rare diseases to identify rare potentially disease-causing variants, and researching in-silico gene prioritisation using Allen Human Brain Atlas data to identify potentially co-expressed genes. I am currently at the University of Hamburg completing a PhD on applying deep learning techniques to radio galaxy data.