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Radio Galaxy Classification with Deep Learning

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Abstract: Machine learning techniques have proven to be increasingly useful in astronomical applications over the last few years, for example in object classification, estimating redshifts and data mining. A topic of current interest is to classify radio galaxy morphology, as it gives us insight into the nature of the AGN, surrounding environment and evolution of the host galaxy. The task of performing classifications manually is tedious, especially with the development of future surveys that probe more deeply and widely into search-space, such as the SKA and EMU. This necessitates 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 loss 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 via capsules. We explore a convolutional neural network architecture against variations of Capsule network setups and evaluate their performance in replicating the classifications of radio galaxies detected by LOFAR.

Biography: 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 using deep learning techniques to classify radio galaxies, with the first publication exploring the classification of sources from the Radio Galaxy Zoo, where an accuracy of 94.8% was achieved on Data Release 1, when classifying into 3 classes of data.

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