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Applying Self-Organising Maps to identify and classify complex radio morphologies in next-generation radio surveys

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Radio galaxies often exhibit complex morphologies that are challenging to identify using traditional source finders, necessitating visual inspection of radio maps. The large data volumes of the current and next generation of radio continuum surveys makes such visual inspection impractical. The objective of my research is to develop a more efficient method to identify and classify complex radio sources, including potentially rare objects such as Odd Radio Circles (ORCs). I am utilising an unsupervised machine learning method, specifically a Self-Organising Map (SOM), which has been trained on 251,259 sources from the Rapid ASKAP Continuum Survey (RACS). Morphological labels (compact, extended, double, and triple sources, among others) were assigned to the SOM neurons through visual inspection. These labels were then transferred to the sources in the catalogue via their best-matching neurons. Visual inspection of a sample of our catalogue showed that the reliability of the SOM-derived morphological labels in our catalogue exceeds 90% for approximately 80% of our sources, demonstrating its efficacy in identifying different types of radio sources. Notably, our method identified approximately 84,424 potential double sources with a >90% reliability. The trained SOM can be used to predict whether new radio galaxy images can be classified as complex sources or not. This project has the potential to improve the classification of complex radio sources, including those with rare or unusual morphologies, in future surveys. This talk will delve into detailed results and implications and discuss the potential impact of our approach on large-scale radio surveys.

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