Tidal stream detection in HSC-SSP with Deep Learning

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Abstract

Galaxy mergers have a fundamental and critical role within the Lambda-CDM cosmogony but the relative contribution of in situ star formation and accreted stellar mass remains an open question across much of the galaxy mass spectrum. Merger remnants leave distinguishable imprints in the outskirts of galaxies only for a few dynamical periods. The outskirts are the faintest parts of galaxies and extremely deep observations are necessary. Therefore, mergers are difficult to spot and so far the census of observed mergers is small. In the next few years, deep wide surveys like Euclid and Vera Rubin Observatory (VRO) will provide high resolution images of millions of galaxies. The combination of deep imaging and automated algorithms (i.e., deep learning) for detecting tidal stream and low surface brightness features is crucial to boost the statistics of any previous sample.
I will show results of applying a deep learning algorithm to images form the Hyper Suprime-Cam Subaru Strategic Program (HSC-SSP) using the largest observational available catalogue up to date (Kado-Fong et al. 2018) as training set. One of the main advantages of deep learning algorithms is that it will be straight forward to extend the methodology to the full HSC-SSP sky coverage, allowing us to study the merger contribution with unprecedented statistics to quantify the merging mechanisms taking place in nearby galaxies. Finally, the developed analysis tools and algorithms can be adapted to future deep surveys such as Euclid or VRO by means of transfer learning, the use of simulated images or Generative Adversarial Networks. Having the necessary tools ready as soon as the first data arrives is one of the major challenges of large and expensive international collaborations.

Slides: in PDF
Video: https://youtu.be/n6yHIXVmzsE

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