Deep Learning for Multiclass Classification of Blended Galaxy Images

Keywords – Astrophysics - Machine Learning - Signal/Image Processing

Context

Upcoming astrophysical surveys such as CFIS [1] and Euclid [2] aim to constrain cosmological parameters using properties derived from galaxy images, in particular their shapes via weak gravitational lensing. However, blending of sources (*i.e.* the overlap of extended objects) has a significant impact on the measurement of the morphological and structural properties of galaxies. It is therefore essential to develop effective and reliable methods for identifying blended sources in survey data and establishing appropriate means of dealing with them.

Machine learning techniques have been show to be incredibly successful when applied to complex classification problems (see *e.g.* Kotsiantis 2007). The effectiveness of these tools, however, can be difficult to gauge without reliable labelled data, which is the case for real images. Circumventing these issues requires an innovative implementation of these tools.

Outline of project objectives

The internship will essentially be comprised of the following tasks and objectives:

1. Get familiarised with the work of a previous internship, which compared the performance of several machine learning methods for the binary identification of blended sources in monochromatic images.

2. Extend the convolutional neural network approach, which performed best for binary classification, to a full multiclass classification case.

3. Demonstrate the effectiveness of this framework on simulated CFIS images.

4. Interact with other members in CosmoStat to gauge the impact of the newly developed scheme on real CFIS images.

Candidate

The candidate should be a Master 2 (or equivalent) student with background in either physics/astrophysics or applied maths/signal processing/data science. Knowledge of machine learning methods would be a plus. Experience with Python is not required, but would be advantageous.

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[1] http://www.cfht.hawaii.edu/Science/CFIS/
[2] https://www.euclid-ec.org/

Internship

The internship will take place in the CosmoStat laboratory, under the supervision of Samuel Farrens.

- *Deadline for applications:* February 28th, 2019.

- *Contact:* Samuel Farrens (samuel.farrens@cea.fr).

- *Duration:* 4-6 months.

References

Bertin, E. & Arnouts, S. 1996, Astronomy and Astrophysics Supplement, 117, 393

Joseph, R., Courbin, F., & Starck, J.-L. 2016, Astronomy & Astrophysics, 589, A2

Kotsiantis, S. 2007, 31, 249