Machine Learning and Image Deblending for Astrophysical Data

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), while signal processing techniques, such as sparsity, have been shown to be extremely effective at deblending multi-band images (Joseph et al. 2016). The combination of these tools may help in reducing the bias on galaxy properties introduced by blended sources.

Outline of project objectives

The internship will be broadly divided into the following main blocks and objectives:

1. Get familiarised with the work of a previous internship, which compared the performance of SExtractor (Bertin & Arnouts 1996) with machine learning methods for identifying blended sources in monochromatic images.
2. Extend the existing applications of machine learning tools for identifying blended sources to simulations of multi-band data and to real observed images.
3. Develop new techniques for dealing with blended sources using machine learning and/or signal processing tools.
4. Interact with other members in CosmoStat to gauge the impact of the newly developed deblending scheme on projects such as CFIS.

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 machine learning methods would be a plus. Experience coding in Python is not required, but would be advantageous.

Internship

The internship will take place in the CosmoStat laboratory, under the supervision of Jean-Luc Starck and Samuel Farrens.

- *Deadline for applications:* February 28th, 2018.
- *Contact:* Samuel Farrens (samuel.farrens@cea.fr).
- *Duration:* 4-6 months.
- *Possibility to continue on for a PhD:* Yes.

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

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