# Pushing the limits of the Gaia space mission through the analysis of galaxy morphology

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One of the most ambitious projects of modern Astronomy, the ESA Gaia space mission, to be launch during 2013, will observe more than one billion objects throughout the sky, providing astrometric, photometric and spectroscopic data with unprecedented scale and precision.

Among all these objects, it is expected that $\sim 10^{6\text{-}7}$ sources will be of extragalactic origin, and most of them will be small galaxies (due to the satellite on-board detection and transmission prioritization algorithms). This will provide a large space-based dataset with unprecedented spatial resolution, and will allow the study of objects that cannot be spatially resolved from the ground-based large surveys of the present, as SDSS, or the future, as DES and LSST.

Due to its natural Galactic and Astrometric priority, Gaia's observational strategy was optimized for point sources. However, a focused analysis of its raw data may allow the recovery of the morphology of extended objects' (such as galaxies) at ~200 mas level, constituting a unique all sky survey.

Gaia's observations are 1D integrated profiles observed from several position angles. This observational specificity prevents the adoption of off-the-shelf tools for analysing the raw data. So, we are implementing a pipeline to allow harnessing morphological content from Gaia data. The pipeline is based on 2D image reconstruction from 1D data, non-parametric and weighted measurements of light distribution tracing quantities (concentration, asymmetry, clumpiness, gini's coefficient, momentum), support vector machines and forward modelling on the Radon space.

The pipeline is being entirely coded in Java, as this is the official language adopted by the Gaia Data Processing and Analysis Consortium. It is being designed and implemented to run at the CNES facilities, and the scientific algorithms are being optimized to analyse each galaxy in only a few minutes on one core. The workflow engine is being developed specifically for Gaia codes running at CNES, runs atop of Hadoop, and is proprietary, but the scientific codes are expected to be made public.

In this work we will present the conceptual design adopted for the morphological analysis of these small galaxies, and also the corresponding workflow under implementation. We will also present some results obtained from its application on data simulations of Gaia low-resolution data, showing that it will be possible to use Gaia data to probe the morphology of millions of galaxies for the first time.