Proposition de stage de M2 Recherche
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Subject : Observational astronomy and machine learning

Title : Searching for variable stars in the largest astronomical survey ever constructed

Summary: Astronomy has been going through a data revolution in the last decade. Bigger telescopes, coupled with even more powerful cameras give us insights into regions of the Universe that were hidden from us until not so long ago. However, getting data is only the first stage of a very long process which will eventually result in a scientific discovery. Since we are getting more data than ever before, we need to use automatic machine learning algorithms and other similar tools to help us identify a few interesting needles in a haystack of astronomical observations.

The goal of this project is to study the possibility of using machine learning to search for cataclysmic variable stars in the largest astronomical survey ever constructed.

Cataclysmic variables are binary star systems where a white dwarf exchanges matter with a companion star. Observationally, this effect is observed as a change in brightness over time. These abrupt changes can be singular or periodic, and by observing their pattern we can make inferences about the properties of such stars.

The Vera Rubin Observatory Legacy Survey of Space and Time[1] (LSST), is an 8.4m telescope which is being constructed in Chile and is expected to begin operations in 2025. At each night, the LSST is expected to detect 10 million transient candidates which need to be classified before they can be used to produce scientific results. These candidates will be distributed via community brokers. Software systems capable of dealing with large data sets, which are already in operation.

Fink[2] is one of such brokers, born in LPC in 2018, it is able to receive and process and classify large volumes of complex astronomical data. This is done via the construction of science modules which are specialised in a given type of astronomical transient.

The goal of this project is to prepare the first stages of a science module for Fink, that will focus on using machine learning to find cataclysmic variable stars in large astronomical data sets. If successful, the module will be integrated within the broker.

The successful candidate should be willing to work in an interdisciplinary team; willing to learn new things in an active research environment; comfortable with programming in Python and with basic statistics tools. Familiarity with collaborative code development, e.g., github is welcome. All the activities and discussions related to the work will happen in English. An interest in stellar astrophysics and curiosity for the subject are also important.

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[1] https://www.lsst.org/lsst/
[2] https://fink-broker.org/