Position Offered: UNIVERSITY GRADUATE
Project: *Artificial Intelligence optimization techniques for astronomical scheduling tools*

Technological and scientific fields: AI, Optimization,digital tools

Location: Bellaterra, Barcelona, Catalunya, ICE, www.ice.csic.es

Research Group/PI: STARS group / Daniele Viganò

PROJECT SUMMARY

In the current era of large astronomical surveys, the planning of observations in astronomical facilities has become a complex task. The large number of observations and other tasks to perform, the different constraints and objectives that such observations must fulfill, makes the problem unaffordable for human operators. Thus, optimization tools that can explore the vast parameter space are essential to find the combination of tasks that maximizes the use of the telescopes and the science outcome. At our institute, we are developing automatic scheduling tools based on Artificial Intelligence (AI) optimization techniques for several projects such as the European Space Agency (ESA) mission's PLATO and ARIEL, and the ESFRI-project Cherenkov Telescope Array (CTA). We are responsible for delivering the software tools for scheduling these facilities, and hard requirements exist regarding their functionality and performance. The problem to tackle is how to allocate multiple tasks to one or to multiple telescopes while maximizing the use of the observatory operational time, reducing idling, and/or slewing, and/or night sky background, and maximizing the scientific return. In the case of CTA, in addition of scheduling the multiple scientific aims described in the Key Science Programs, the scheduler has to take into account that there are several sub-arrays, multiple modes of observations, the need to react to astronomical transients with the lesser number of programs disturbed, and in accordance to constraints induced by other operations (e.g. laser handling) that greatly affect operations. A similar complexity appears for organizing, sometimes recurring, observations of stellar hosts of exoplanets for hundreds, or even thousands of candidates. This project aims at investigating the different AI optimization techniques that best suit each observational facility and constraints, testing different algorithmic solutions beyond the ones we have implemented till now, and adapting it to tackle requirements of more complex situations, as for instance sub-arrays or multi-facility scheduling.

PROFESSIONAL PROFILE

Minimum requirements:

Software Engineer or related. Minimum technical skills/knowledge: C++, CMake; Linux; git; writing high-quality, standardised code. English at a level sufficient to interact with the international team.

Merits to be considered:

Desirable technical skills/experience in (not strict requirements): Code optimization, CI/CD tools (Jenkins and SonarQube), virtualization with Docker, DevOps, CORBA standard and/or Distributed Systems; astronomical facilities (especially the ones involved in the project); AI optimization algorithms like Metaheuristic scheduling, Swarm Intelligence, Evolutionary Computation.

WHAT IS OFFERED

Participation in internal review processes of the developed software supervised by local coordinators and the international group leaders of the work area, on-site implementation validation. It is encouraged that this work lead to a doctoral thesis.

Contract conditions:

Indefinite contract for a University Graduate associated with the Momentum Project of 4 years' duration according to Spanish science law. Gross annual salary (37.000 € - 41.000 €).

Start of contract: before 31 December 2024

PRINCIPAL INVESTIGATOR CONTACT

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