



## LIST OF AVAILABLE PROJECTS FOR THE JAE-Intro ICU 2021 (MODALITY C) AT IFCA

The IFCA MdM Unit of Excellence is offering scholarships for introduction to research and to follow the Master's Degree in Data Science of the Universidad Internacional Menéndez Pelayo (UIMP) and Universidad de Cantabria (UC) in the 2021-2022 course. As part of the scholarship, the student will join one of the international research groups at IFCA carrying out a research project in a topic to be chosen from the list below. The student can choose up to three different projects in order of priority. For general enquiries about the scholarships, please send an e-mail to [info-masterdatascience@listas.csic.es](mailto:info-masterdatascience@listas.csic.es) indicating in the subject "JAE Intro ICU". For specific questions about the proposed projects, please e-mail the corresponding supervisor.

### 1) **Semantic technologies to manage Data Management Plans in Data Repositories**

Supervisor: Fernando Aguilar Gómez ([aguilarf@ifca.unican.es](mailto:aguilarf@ifca.unican.es))

Data Management Plans (DMPs) are a key element of good data management and describe the data management life cycle for the data to be collected, processed and/or generated by a scientific project. As part of making research data findable, accessible, interoperable and reusable (FAIR), a DMP should include information on the handling of research data during & after the end of the project, data tool be collected, processed and/or generated, etc. Recent developments propose a system adopting data models to enable semantic features on Data Management Plan, evolving from a static document to a semantic tool to identify any single element on a research project. This project aims to adopt the semantic data model proposed by the "Research Data Alliance" working groups in order to be integrated with a Data Repository system, aiming at providing an information system to ensure the reproducibility of a scientific project.

### 2) **Estimating snow covering and depth thanks to remote sensing open data**

Supervisor: Fernando Aguilar Gómez ([aguilarf@ifca.unican.es](mailto:aguilarf@ifca.unican.es))

The Copernicus Programme is a project developed by the European Space Agency (ESA) and the European Union (via the European Environment Agency) that aims at achieving a complete, continuous, high-quality and autonomous Earth Observation capacity, whose results are accessible by the scientific community and any other stakeholders. The goal is to provide exact, reliable and continuous information in order to improve the environment management and to understand and mitigate the global change. Thanks to the remote-sensing instruments deployed, different Earth ecosystems can be monitored, like oceans, wetlands and mountains. Furthermore, climate processes can be analyzed, like the snow

coverage and depth. This is very relevant for river basin authorities, which taking advantage of the data provided by copernicus are potentially capable of estimating the snow volume that will impact the reservoir and river levels. This project aims to exploit open data sources provided by Copernicus and any other service in order to automatically estimate the snow coverage and depth, developing a system that monitors this information.

### **3) Realistic simulations in the context of particle physics using Variational Autoencoders**

Supervisors: Pablo Martínez Ruiz del Árbol (parbol@ifca.unican.es) and Lara Lloret Iglesias (lloret@ifca.unican.es)

Development of a system based on Machine Learning algorithms of type Variational Autoencoders (VAEs), to produce realistic and ultra-fast simulations in the context of particle physics. These simulations are a fundamental part of the New Physics searches at the Large Hadron Collider (LHC) experiments and are currently one of the most critical and limiting factors in the sensitivity of these searches. This work emerges as an option to develop these simulations quickly and effectively using VAEs trained with both traditional systems-based simulations and real data.