Data Science for Space Weather Services in Argentina

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Data Science refers to the interdisciplinary field that obtains insights from the data by combining domain expertise, programming skills, and math and statistical tools. This approach includes the methodology and a series of techniques especially important when dealing with a large amount of data for real-time processing and for machine learning modelling.

We present in this work the main data pipeline design, and implementation details, for the Tucumán Space Weather Center - TSWC (https://spaceweather.facet.unt.edu.ar/), a new web-based system for Space Weather services in Argentina. TSWC provides real-time products from locally installed instrumentation and from remote data sources with the aims of study, monitoring, and forecasting Space Weather conditions.

A data pipeline process allows tracing the data flow and the transformations that it suffers from the acquisition stage to the final product. This strategy enhances modularity, robustness, and interoperability. Moreover, it allows to easily add new functionalities without risking the already tested products. The data pipeline consists of a chain of stages focused on the data transformation along the process.

We describe each stage of the overall data pipeline such as the acquisition, pre-processing, persistent storage, analysis/processing, and visualization main stages. We include implementation details such as computing infrastructure, languages, and libraries, tailored APIs, database management system, cleansing techniques/strategies, real-time processing, machine learning modelling, among others. We show also a case of study for a product based on Machine Learning to forecast ionospheric conditions.

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