Finanziato dall'Unione europea NextGenerationEU | Ministero dell'Università e della Ricerca | Italiadomani PIANO NAZIONALE DI RIPRESA E RESILIENZA | ICSC Centro Nazionale di Ricerca in HPC, Big Data and Quantum Computing

Anomalies in Time Series (ATS)
Senior Research Fellowship

Abstract

In the context of the National Centre for HPC, Big Data and Quantum Computing, funded by the Italian National Recovery and Resilience Plan (PNRR), the *Anomalies in Time Series* project is a joint innovation grant between INAF (the Italian National Institute for Astrophysics) and Intesa Sanpaolo S.p.A, Italy's largest bank.

Anomaly detection identifies rare items, events, or patterns deviating significantly from the majority of data. In Astrophysics, anomaly detection targets rare events and instrumental issues. In the banking sector the targets are suspicious events and data processing issues. The project aims at developing, in both domains, a robust, cross-applicable solution for time series anomaly detection.

Expected results

To create a robust, cross-domains framework for time series anomaly detection and improve algorithmic performances in terms of:

- increasing the number of identified real anomalies compared to previous techniques in anomaly detection,
- better identification of rare objects or events overlooked by other algorithms,
- enhance the interpretability and explainability of anomaly detection results for practical applications.

Expected impact

In general, a unified framework will reduce the friction required to test different solutions in different fields.

In Astrophysics, we can expect a general framework to lead to testing more anomaly detection techniques for data analysis and thus to discover new astrophysical events not present in the available catalogs, e.g., Fermi/GBM or Fermi/LAT catalogs.

In the banking sector, reducing false positive avoids inconveniences related to the interruption of customer operations, and thus increasing customer satisfaction and preventing reputational damage. Moreover, this will help database maintainers to anticipate and focus only on the most critical data flux.

Milestones

First milestone (3rd month): preliminary results on data exploration and how to format the dataset, preprocessing the data (e.g. feature engineering, feature selection). More in detail:

- Collection of specifications and study on the type of data (data exploration);
- Formalization of the problem and study of the state of the art

Second milestone (6th month): first prototype for one use case, in particular with respect to time series preprocessing and standardization.

Third milestone (12th month): Python library and results for all the data available within the project. More in detail:

- Evolution of the prototype into a Python library;
- Process the data as per first and second milestone;
- Release of the Python library versioned on GitHub;
- Publish a scientific paper reporting the solution and the results obtained.

Contract details

Type: 12 months Italian AdR (Assegno di Ricerca). The contract is equivalent to autonomous work: no presence required, no fixed working hours, no ill days, no holidays. Commitment (and evaluation) is solely based on reaching project goals and milestones. The contract contributes to the national pension fund, and is tax-exempt (meaning also that no deductions can be made).

Salary: about 2600 €/month net, all inclusive (no other benefits or extras). Note that a personal laptop is required. Project budget allows for conferences and open-access publications.

Requirements: PhD plus 3 years of work experience, or 6-years work experience.

Home institution: INAF - Osservatorio Astronomico di Capodimonte. Office space also available at INAF - Osservatorio Astronomico di Trieste, and possibly also at Intesa Sanpaolo in Turin.

Duties: besides the milestones listed above, there are two light reports to produce (6th and 12th month, a couple of pages) and to fill the timesheets.

To apply: here, or email stefano.russo@inaf.it for an informal discussion about this opportunity.

People

Project reference person: Stefano Alberto Russo - INAF

Supervisor: Stefano Cavuoti - INAF

Liaison with Intesa Sanpaolo S.p.A: Riccardo Crupi

Other people involved: Rachele Desiante - Intesa Sanpaolo S.p.A, Alessandro Sabatino - Intesa Sanpaolo S.p.A, Paola Barone - Intesa Sanpaolo S.p.A, Fabrizio Fiore - INAF, Giuseppe Dilillo - INAF, Sara Cutini - INFN, Francesco Longo - Università di Trieste, Giuseppe Riccio - INAF, Andrea Adelfio - INAF