2024 Fink Collaboration Meeting

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IJCLab, Orsay

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Anomaly detection in Fink

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I would like to talk about recent updates on Fink AD module, including our last discoveries ZTF23aalftv and AT2023awt, their spectroscopic and photometric follow-up.

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Enhancing the Infrastructure of Fink Project: A Kubernetes-based Approach

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This talk will present a summary of recent activities within Fink, an alert broker research platform. The primary focus of this contribution has been on preparing the production environment using Kubernetes as the target platform.

`Software Stack Packaging`

The initial goal was to package the entire software stack of Fink. This involved packaging key components (fink-broker, fink-alert-simulator, and finkctl), ensuring their readiness for deployment within a Kubernetes environment. This entailed creating Docker containers for individual components and defining necessary configurations.

`Integration with Kafka, Minio-S3, and Spark for Kubernetes`

Following successful software stack packaging, efforts were directed towards integrating essential technologies such as Kafka, Minio-S3, and Spark, all critical for Fink's operation. This integration facilitated seamless communication between components and streamlined the validation of the Fink software pipeline.
Implementation of an OpenStack Runner for Scalable Builds
To ensure the efficient scalability of Fink, collaboration with the IJClab team led to the implementation of a dedicated OpenStack runner for builds. This infrastructure supported effective scalability, enabling comprehensive testing of Fink with machine learning algorithms, which represent approximately 10GB of code.

`Future Projects`

For future endeavors, two key aspects are planned:
a. Continuous Deployment with ArgoCD: Implementation of continuous deployment using ArgoCD, a famous deployment management tool used by LSST. This will ensure seamless and secure software updates. Collaboration with IJCLab team is also planned to enhance the software release creation

system.
b. Telemetry: Focus will shift towards traces and metrics monitoring, involving the setup of tools and dashboards to monitor the performance and availability of Fink.
Conclusion
During this period, several significant milestones were achieved for Fink, including software stack packaging, integration with key technologies, automated testing setup, build process optimization, and the preparation of a Kubernetes-based production environment. In 2024, further contributions will be made to the project, with an emphasis on continuous deployment and telemetry. These efforts aim to enhance the efficiency and reliability of Fink's operations on the CC-IN2P3 cloud platform.

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Search for orphan GRB afterglows in Rubin LSST data with FINK

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Rainbow: a colorful approach on multi-passband light curve estimation

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Rainbow is a physically motivated framework which enables simultaneous multi-band light curve fitting. It allows the user to construct a 2-dimensional continuous surface across wavelength and time, even in situations where the number of observations in each filter is significantly limited. Assuming the electromagnetic radiation emission from the transient can be approximated by a black-body, we combined an expected temperature evolution and a parametric function describing its bolometric light curve. These three ingredients allow the information available in one passband to guide the reconstruction in the others, thus enabling a proper use of multi-survey data.

The Vera-C.-Rubin Observatory Large Survey of Space and Time (LSST) will detect 10 million transient events across 6 passbands each night. In this context, Rainbow constitutes a crucial tool to properly and quickly extract meaningful information from the objects. Its ability to exploit measurements from every wavelength allows it to manipulate sparse data and produce much earlier fit than if filters were considered independently. Therefore, feature extractions based on this method create very informative parameter spaces that are the key of good classification.

In this talk I will present the general context, the Fink infrastructure, the Rainbow framework and its advantages for LSST data. Additionally I will show how the method can be used to create/improve photometric classifiers in an efficient way for the Fink broker.

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Multiview Symbolic Regression in astronomy

Auteur: Etienne Russeil[None]

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Symbolic Regression is a data-driven method that searches the space of mathematical equations with the goal of finding the best analytical representation of a given dataset. It is a very powerful tool, which enables the emergence of underlying behavior governing the data generation process. Furthermore, in the case of physical equations, obtaining an analytical form adds a layer of interpretability to the answer which might highlight interesting physical properties.
However equations built with traditional symbolic regression approaches are limited to describing one particular event at a time. That is, if a given parametric equation was at the origin of two datasets produced using two sets of parameters, the method would output two particular solutions, with specific parameter values for each event, instead of finding a common parametric equation. In fact there are many real world applications –in particular astrophysics – where we want to propose a formula for a family of events which may share the same functional shape, but with different numerical parameters
In this work we propose an adaptation of the Symbolic Regression method that is capable of recovering a common parametric equation hidden behind multiple examples generated using different parameter values. We call this approach Multiview Symbolic Regression and we demonstrate how it can reconstruct well known physical equations. Additionally we explore possible applications in the domain of astronomy for light curves modeling. Building equations to describe astrophysical object behaviors can lead to better flux prediction as well as new feature extraction for future machine learning applications.

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Enhancing neutrino alerts for KM3NeT with multi-wavelength correlation

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The study of celestial transient objects relies on the coordination of different observations. As an increasing number of actors join this coordination, the number of alerts grows rapidly, and each experiment needs to maximize the scientific interest of their public alerts.

KM3NeT is a neutrino telescope consisting of two detectors, ORCA and ARCA, currently under deployment in the Mediterranean Sea. The Real-Time Analysis Platform of KM3NeT, currently in the prototype phase, already performs follow-up neutrino searches at the reception of external triggers, and should start sending public alerts within 2024. Neutrino detectors have thus far considered only neutrino properties (energy, probability of astrophysical origin, etc) for the selection of alerts being broadcasted to the astronomy community.

An additional approach is to also consider the properties of the celestial objects inside the provenance region of neutrinos.
By selecting both on neutrino properties and on the multi-wavelength characteristics of the possible sources of origin, one can improve the chances of follow-up observations and of discovery of transient neutrino sources.
This selection would first rely on a correlation with different astronomy catalogs to select the most interestic sources, before refining the selection with the temporal variation of the sources.

As a broker that will process the transient alerts from the Vera C. Rubin Observatory, the Fink broker will be central to retrieve optical lightcurves.
During this contribution, I will present a prototype for this new neutrino selection leveraging the capabilities of Fink.

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Deep dive into asteroid colors and spins in LSST era

Auteur: Benoit Carry[1]

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With the advent of large-scale photometric surveys such as the ZTF and the Rubin Observatory, millions of Solar System objects (SSOs) are surveyed every night. The irregular cadence of these surveys precludes a simple determination of the colors of SSOs, whose photometry constantly varies due to their irregular shape and the ever changing Sun-SSO-Earth geometry.

We extended the phase function model (H, G1, G2, Muinonen+2010) to account for spin effects, which opens the possibility to use these large data sets for the determination of both colors and spins of SSOs from their photometry. We applied it on more than 16 million ZTF photometric measurements from alert data processed by the Fink broker between 2019 and 2023. In this presentation, we will discuss results on colors, spin axis orientations, and shape elongations of about 100,000 asteroids, which constitutes a 10 fold increase in data volume with respect to the current knowledge. We will also discuss the community services in place in Fink to mine the Solar System data collected by ZTF, and the prospects for the Rubin Observatory.

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Desmitifying Fink

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LSST updates

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Oz updates

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Graphs in Fink

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