Visualization of FULU Python library and VALC Python package

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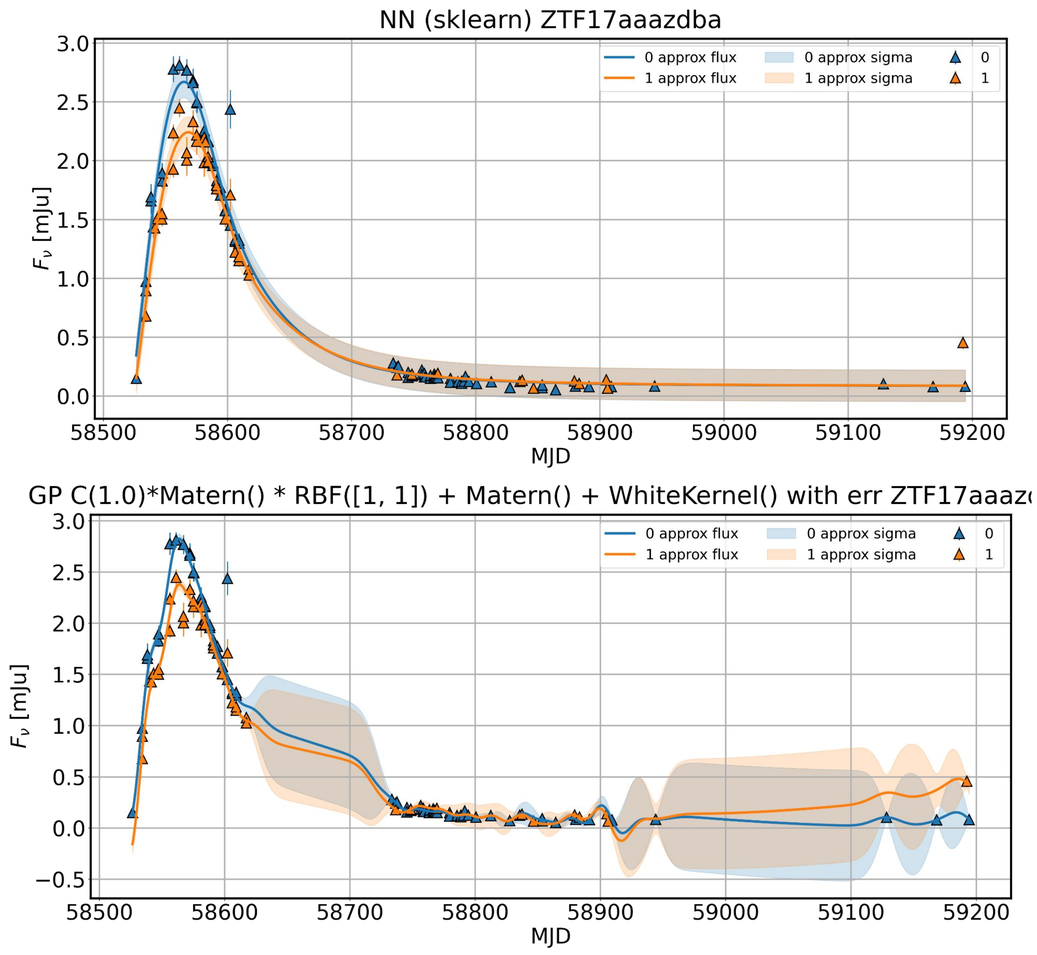
Fulu Python library

FULU is Python library, which is devoted to neural network methods of approximation of astronomical time series. The purpose of this work was to predict the observation and its errors in several photometric bands with uneven time steps. The following models are developed: a multilayer perceptron with one hidden layer, as well as with two hidden layers, a Bayesian neural network, normalizing flows.

Experiments with the Zwicky Transient Facility (ZTF) Bright Transient Survey(BTS) light curves based on FULU were shown that neural network models approximate time series more qualitatively, and also take less computational time than the current best solution --- Gaussian processes with different kernels. To demonstrate this fact, experiments were carried out and regression metrics, quality metrics of observations predicted by models, as well as the quality of subsequent classification and peak estimation were calculated [1].

[1]Demianenko M. et al., “Supernova Light Curves Approximation based on Neural Network Models”, Proceedings of ACAT-2021 conference, 2022.

https://github.com/HSE-LAMBDA/fulu

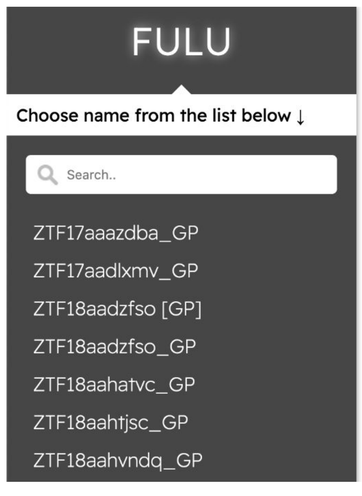


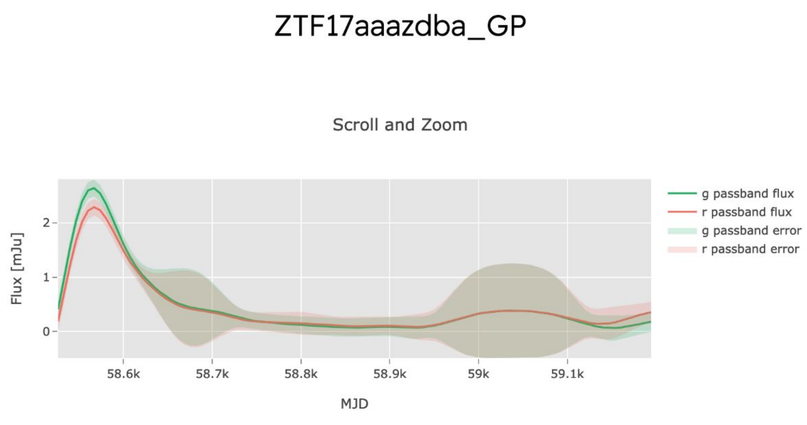
Architecture and goals of http://lc-dev.voxastro.org/

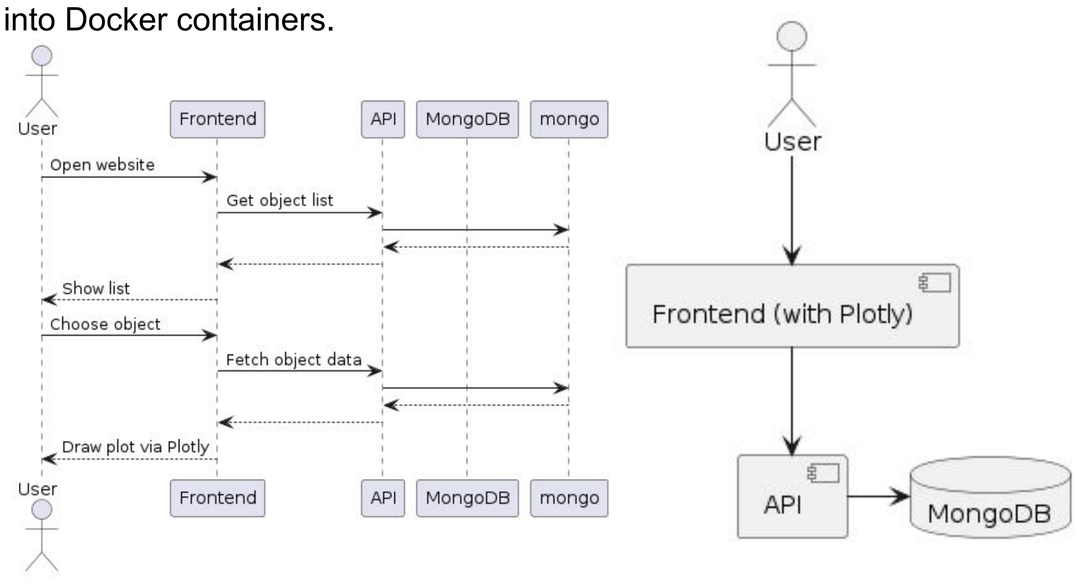
Goals:

- To show the scientific community the capabilities of tools developed in the most popular programming language for the analysis of astronomical time series
- The opportunity to look at the results of our algorithms on each object from real samples of big data
- Open source code in the repository https://github.com/salamantos/FLEX to help implement a similar approach in other projects and publications

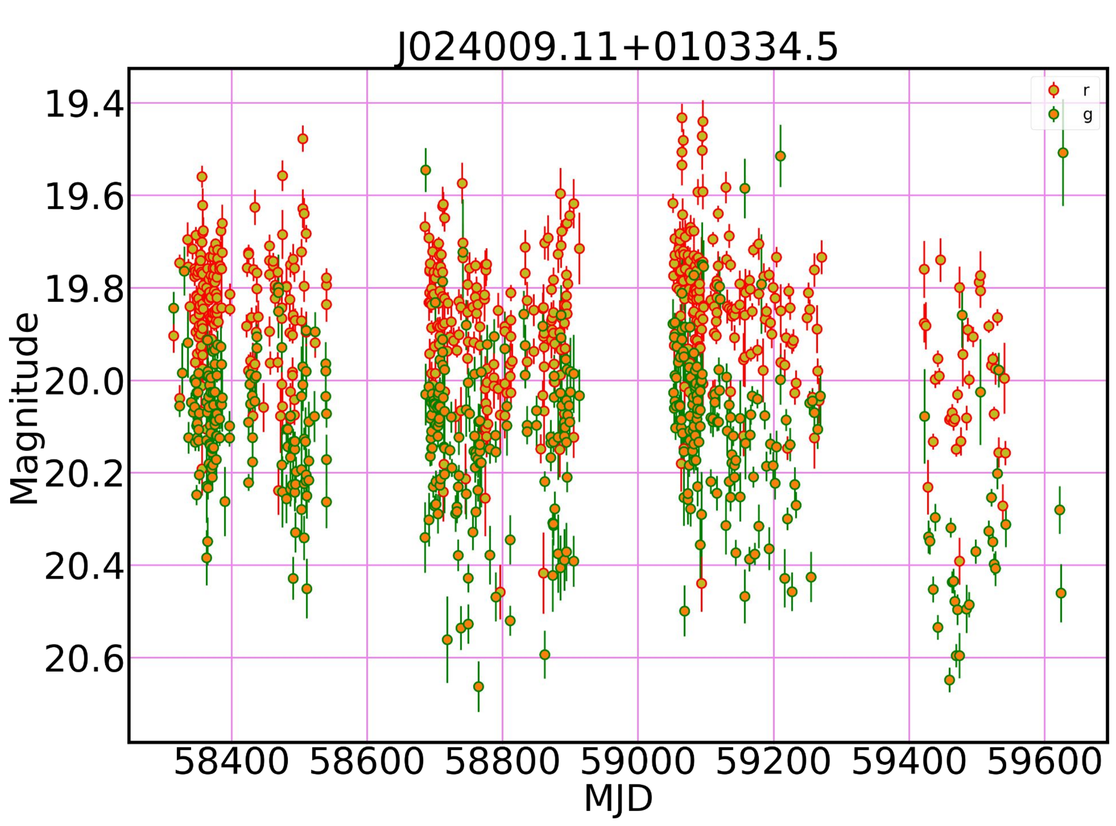
Website with visualizations uses Plotly to show interactive graphics. On server side it is implemented as FastAPI Python application. Data are JSON objects, which are stored in MongoDB. All applications including frontend, backend and database are wrapped into Docker containers.







VALC Python package



VALC is Python package, which is devoted to post-processing of ZTF Forced Photometry light curves and conducting statistical test to reject the hypothesis of a constant with white noise. The purpose of the work in confirmation of the presence of active galactic nuclei (AGN) type-1 in the host galaxies of candidates. Tests of the algorithm was provided on a sample of AGN, powered by intermediate mass black holes (IMBH; M < 2*10^5 M⊙) and low-weighted supermassive black holes (LWSMBH; M < 2*10^6 M⊙).

Post-processing includes outlier filtering, color correction and zero-point correction. The key advantage of the algorithm is the subtraction magnitude of the median comparison star. To do this, in addition to the AGN light curve, the light curves of the 50 nearest non-variable stars are also downloaded from the images used for photometry [2].

[2]Demianenko M. et al., “Optical Variability of "Light-weight" Supermassive Black Holes at a Few Percent Level from ZTF Forced-Photometry Light Curves”, Proceedings of ADASS-2021 conference, 2022.

https://github.com/masha-astro/optical_variability_ztf

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