Geophysical Research Abstracts
Vol. 21, EGU2019-16934, 2019
EGU General Assembly 2019

Automated Near Earth Asteroids discovery from Astronomical Images using the NEARBY Platform

Teodor Stefanut (1), Victor Bacu (1), Constantin Nandra (1), Denisa Copandean (1), Dorian Gorgan (1), and Ovidiu Vaduvescu (2)

(1) Technical University of Cluj-Napoca, Department of Computer Science, {teodor.stefanut, victor.bacu, constantin.nandra, denisa.copandean, dorian.gorgan}@cs.utcluj.ro, (2) Isaac Newton Group of Telescopes (ING), Santa Cruz de la Palma, Canary Islands, Spain, ovidiu.vaduvescu@gmail.com

The survey of the nearby space and continuous monitoring of the Near Earth Objects (NEOs) and especially Near Earth Asteroids (NEAs) are essential for the future of our planet. Recent research efforts focused on estimating the size and orbital distribution of the population of NEAs has concluded that there are about 1000 NEAs larger than 1 km, up to approximately 7 $\times$ 104 NEAs larger than 100m and near 4 $\times$ 108 smaller objects that have trajectories passing by less than 30 million miles of Earth at certain times. Out of all these, in the present astronomers are tracking about 18.000 objects, which count as 25% of possible hazardous asteroids.

The NEARBY platform [1] proposes an implementation of the MOPS pipeline for automated NEAs discovery, making use of Kubernetes and Docker Containers technology for parallel processing and scaling over Cloud infrastructures. Large volumes of astronomical data can thus be processed in a timely manner and with minimum user interventions. After the input parameters for the entire observation night have been specified (bias and flat images, pixel size, etc.) the NEARBY application [2] automatically processes all provided images applying necessary corrections, extracting all sources and identifying potentially moving objects. Due to the limited contextual information available in the astronomical images series NEARBY is making use of a custom developed algorithm that looks for objects that are asteroids candidates, assuming that an asteroid, during the entire observation window (from the first to the last image), moves with constant speed and on a trajectory that is perceived as being linear. As a final processing step, the astronomers can use the dedicated tools provided in order to analyse the results and eliminate any false positives reported.

Testing the NEARBY platform in real survey scenarios has shown that even if the validation process needs to be carried out by humans it takes little time even for tens of candidates, thanks to the NEARBY optimizations in user interaction and data visualization techniques. The presentation highlights and analyzes the main aspects of the NEARBY platform development, and the results and conclusions on the EURONEAR surveys.

The NEARBY platform has been developed and experimented through a collaborative research work between the Technical University of Cluj-Napoca (UTCN) and the University of Craiova, Romania, using observing infrastructure of the Instituto de Astrofisica de Canarias (IAC), and Isaac Newton Group (ING), La Palma, Spain. The NEARBY Project (Visual Analysis of Multidimensional Astrophysics Data for Moving Objects Detection) [3] is funded by the Romanian Space Agency (ROSA).

References

[1] Bacu V., Sabou A., Stefanut T., Gorgan D. and Vaduvescu O., NEARBY Platform for Detecting Asteroids in Astronomical Images Using Cloud-based Containerized Applications. 2018 IEEE 14th International Conference on the Intelligent Computer Communication and Processing (ICCP), pp.371-376.

[2] Stefanut T., Bacu V., Nandra C., Balazs D., Gorgan D. and Vaduvescu O., NEARBY Platform: Algorithm for Automated Asteroids Detection in Astronomical Images. 2018 IEEE 14th International Conference on the Intelligent Computer Communication and Processing (ICCP), pp.365-369.

[3] NEARBY project Visual Analysis of Multidimensional Astrophysics Data for Moving Objects Detection, http://cgis.utcluj.ro/nearby/