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DeTeCt planetary impact detection project - frequency estimations and big data set secondary results

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Abstract

The DeTeCt project has been running for 5 years, aiming at not only detecting impact flashes on Jupiter (and Saturn), but also estimating their frequency. Although no impact has been detected yet, a frequency of 4.7 impacts per year on Jupiter could be estimated (as of 2017.05.08), thanks to continuing participations of amateurs to the project and refinement of the processing. Additionally, analysis of the large data set from the 67 thousands of videos analysis brought some information about amateur astronomers habits in planetary imaging. This can even help improving the impact frequency estimation.

1. Introduction

A software was developed by the UPV/EHU Bilbao team to automatically detect impacts (http://pvol2.ehu.eus/psws/jovian_impacts/, [1], [2]), on Jupiter amateur videos. Based on it, the DeTeCt project was launched by the author (http://www.astrosurf.com/planetessaf/doc/project_detect.shtml). By logging date information of the videos analyzed and collecting them, it aims at estimating the impact frequency on Jupiter and Saturn, using negative as well as positive detections ([3], [4]). Work has been done to improve the quality of this estimation in the post processing phase by improving the date information.

Furthermore, all these analysis logs from the big number of 67 198 videos can be analysed to derive interesting information about participating amateurs' habits.

2. Improvement of analysis

The log files generated by the DeTeCt software and collected include start and end date information, duration, fps (frames per seconds) of the videos, filename, detect software version, and capture software version if the acquisition log generated by the capture software is available. Unfortunately, in a certain number of logs, the date information is not standardized, exact, or accurate. The processing log analysis algorithm has hence been improved:
- to transform all local times into universal times (from observer location information, or from cross-checking different date information)
- using the filename of the file to derive date information if missing from the logs
- using a default duration for the videos (set-up at 20s initially) when it is not known
- correcting duration when it is incoherent
- correcting simultaneous acquisition dates for the same observer.

This allowed a more accurate estimation of the total duration of videos analysed, changing the value from 71.905 days of Jupiter videos analysed to 77.258 days (7.4% increase), bringing the frequency estimation from 5.08/year down to 4.73/year.

3. Log data set analysis for identifying amateur habits or trends

The number of amateurs and videos analyzed growing steadily over the years built a large set of data (36100 videos from 48 different observers since 2015 – limited to analyze only the most recent information). This can be used to derive other results about planetary amateur astronomers' usages.

3.1 Duration of acquisitions

Using the duration of the videos for each observer, we get an average duration of 98s per observer for acquisitions. This stays below the admitted limit of 120s per video to have the rotation of the planet compensated by the multipoint alignment method use by Autostakkert, the standard stacking software used by all amateurs (http://www.autostakkert.com/). Only 4 observers (8%) have an average video length between 200 and 600s, showing as they use the video derotation function implemented in the WinJupos software (http://www.grischa-hahn.homepage.t-online.de/index.htm).

This showed that the previous assumption of setting to 20s the duration of DeTeCt processed videos which duration was not known was really underestimated. Correcting that value to 98s refines the frequency estimation from 4.73/year to 4.69/year.

3.2 Acquisition formats

DeTeCt support multiple acquisition formats (ser, avi, fit, jpg, png, etc.). Out of those, the fit format was hardly used since 2015, the avi format used by 35% of the observers and the ser format, created for planetary imaging, is used by 65% of the amateurs.

3.3 Capture softwares

For the 40 observers whose acquisition software could be identified, 3% use PLXcapture (dedicated for one brand of camera), 3% SharpCap, 13% Genika (software under license/provided with cameras bought from the Airylab company https://airylab.com/genika-astro/ , with a version existing also for the professional market) but the vast majority (83%) use FireCapture (http://firecapture.de/), clearly the leader of acquisition software.

This confirm that would we work on implementing a detect functionality in capture softwares, we should concentrate on FireCapture, as discussed during a workshop in January 2017 in Toulouse about the future possible DeTeCt improvements.

In 2017, only 10% of the FireCapture users used not the latest version of the software available, which proposes to update itself when a new version is available (usually once a year). Still, for 43% of the observers, the acquisition software logs are not available. This is a way for improvement as having them would greatly increase the accuracy of the date and duration information from the videos

3.4 DeTeCt software

In 2017, for the first 15 observers who participated to the project, 21% did not use the latest version 2.0.4 (they used earlier versions 2.0.1, 2.0.0 or even 1.2.2 which is 4 years old). DeTeCt version usage is clearly fragmented, probably due to the fact that the software does not detect itself that it is not up-to-date and hence do not propose, like FireCapture, to update itself.

This confirm the interest of this possible functionality identified during the January 2017 DeTeCt workshop.

4. Future improvements

On top of the improvements identified above, a DeTeCt users survey conducted by the author identified the strengths and weaknesses of the software, and possible improvements.

The robustness of the automatic detection algorithm as well as a friendly graphical user interface were hence developed in a new DeTeCt version 3 ([5]).

5. Conclusion

Through this project and software, science results are obtained from amateur's data to estimate the rate of impacts on Jupiter (4.7/year in May 2017) and on Saturn (7.1 days of videos analyzed without any flashes). These science results could be improved by bigger participation of amateurs in analyzing their Jupiter and Saturn videos, thanks to an improved software and a better usage of capture software.

Additionally, the data obtained permits to understand the trends and usages of planetary amateur astronomers, hence potentially taking this into account for scientific projects.

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