Automatic boulders identification on 67P/C-G with machine learning

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Introduction: Meter-sized boulders are ubiquitous on the surface of comet 67p/C-G as shown by Rosetta's OSIRIS/NAC camera. Their dynamicas however are still unknown, and not enough images have been analyzed to compare boulders across the northern and southern hemispheres, or their temporal evolution.

Methods: We use the Astrophysical CIrcles Detector (ACID), a general purpose quasi-circular objects detector based on the MaskRCNN neural network and trained on a massive craters dataset. ACID proved to be a robust and accurate boulders detector, allowing us to analyse for the first time a large catalogue of boulders detections spanning both hemispheres, and multiple time periods.

Results: We will discuss the location and size distributions of boulders, and compare these between the northern and southern hemispheres of the comet, and track their temporal evolution across the northern hemisphere between years 2014, 2015, and 2016.
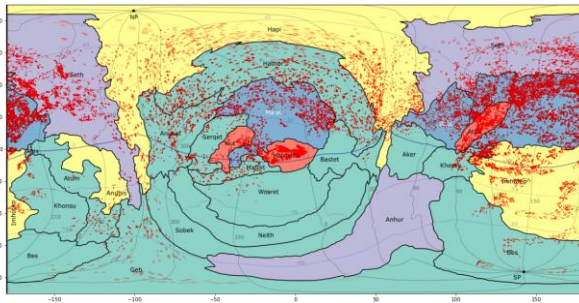

Figure 1: Northern hemisphere boulders detections.

Conclusions:

- Advanced computer vision techniques are crucial to fully leverage the massive amount of data data acquired from space missions such as Rosetta.

- ACID is a robust framework capable of consistently detecting boulders on 67P/C-G.

References:
[1] Ali-Dib, Menou, Jackson et al. (2020), Icarus.
[2] Ali-Dib, Besse, & Kueppers (in prep.)