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Near-Earth Object (NEO) Discovery

Updated Digest2 – the NEO classification code

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ABSTRACT

Near-Earth Objects (NEOs) have traditionally been discovered due to their remarkable rate of motion and the immediate follow-up analysis allowing rapid orbit determination and second-night recovery. Moreover, in the era of wide-fields asteroid surveys and optimization of valuable follow-up time, it is mandatory to separate the uninteresting background population of main-belt objects from those characteristic of NEOs. For almost two decades, the digest2 classification code [1] has been utilized by the Minor Planet Center and the NEO community to score short-arc unidentified tracklets and post the objects to the Near-Earth Object Confirmation Page for an immediate follow-up. The input for this fast classifier is MPC's 80-character astrometry format[1] of astrometric positions of NEO candidates. The code works as a binary NEO classifier, but there are known disadvantages that lead to occasional cases where digest2 fails to flag NEOs as interesting [2]. Among the most prominent problem is the usage of tracklet endpoints (first-last detection), which results in both the loss of information embedded in the apparent motion if more than two positions are provided and the assumed astrometric errors that are fetched from the lookup table for a short list of observatory codes.

In this work, we present our an updated digest2 that ingests astrometry in the new astrometric format - ADES [3] - allowing the submitter to communicate astrometric uncertainties with each measured astrometric position. We also describe how we have added tracklet curvature computation for tracklets with at least 3 detections and astrometric uncertainties. A statistically significant deviation from the great circle fit of a short-arc tracklet means the object is very close to Earth regardless of its rate of motion and thus its digest2 NEO score should be increased.

We compare the performance of the updated digest2 with the previous version on a set of known NEO tracklets submitted to MPC and also on a subset of NEO tracklets that had low digest2 score.

[1] https://minorplanetcenter.net/iau/info/ObsFormat.html

References

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