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Prioritisation of Near-Earth Asteroid Follow-Up Observations

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ABSTRACT

A systematic method for determining the priority of Near-Earth Asteroids for follow-up observations is needed in order to optimise the impact of the limited telescope time we have to observe them. Such an optimisation can enable better informed decisions to be made about which targets to observe, and may help prevent Near-Earth Asteroids from becoming lost. Currently, objects for targeted follow-up are selected depending on the judgement of the observer, often solely based on their current ephemeris uncertainties. This may lead to the loss of targets that have small uncertainties, but will not be observable for a long time.

When automating the prioritisation, whether or not a target is recommended for observation will depend on the following:
1. The importance of the target: this may depend on its size, minimum orbit intersection distance, potential for human spacecraft access, ephemeris uncertainty and orbital arc length.
2. The timeliness of the observation: this in simple cases is a function of airmass, but in more complex cases may also take future observability and weather conditions into account.
3. The optimisation algorithm, which selects the targets with the best possible combination of the above two parameters. This can range from a simple ‘greedy’ algorithm to a more complex genetic algorithm.

We examine each of the parameters that determine the importance of the target and observation time, and describe the advantages and limitations of using these criteria for determining the desirability of an observation. We discuss the results and implications of applying an automated routine for aiding a human observer.

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