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Mining archival data from wide-field astronomical surveys in search of hazardous near-Earth objects

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The serendipitous appearances of Near-Earth Objects (NEOs) in a subset of the millions of archival exposures of optical and near-infrared astronomical imaging surveys can improve our knowledge of the orbits and compositions of NEOs. We show how the data processing and data mining of such imaging archives can be exploited to identify new and known NEOs, leading to a re-assessment of the impact probability of hazardous NEOs for the latter. We describe our automatic pipelines that precovers NEO appearances making use of the Astronomical Wide-field Imaging System for Europe (AstroWise). AstroWise is an information system that contains a 10 Terabyte-scale database for data mining that is connected to a Petabyte scale imaging storage archive from various telescopes. As a pilot study, we performed a systematic search for the ESA risk-list NEOs appearances in a decade of archival observations of the OmegaCAM optical wide-field imager at ESO's VLT Survey Telescope. The observatory has been used for several multi-year large surveys (including the Kilo-degree Survey, VST-ATLAS, Fornax Deep Survey and VPHAS+) plus many smaller programs. None of these surveys and programs is dedicated to the detection and surveillance of NEOs. Our current NEO precovery pipeline detects 196 NEO appearances. The NEO precovery can be expanded to other archives of wide-field imaging instruments/surveys thanks to the homogenized metadata interface offered by AstroWise to such archives.

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