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Asteroid Shape Reconstruction by Structure-from-Motion Method with Bundler and PMVS2

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Here we report results on application of open source shape reconstruction tools to an asteroid image data set. We test two tools that cooperatively work to reconstruct an object shape from images. Bundler is an open source implementation of a stereo shape reconstruction method called Structure from Motion (SfM). PMVS2 gives a more dense shape model, since Bundler only estimates 3D locations of a limited number of feature points. A global image data set of the asteroid Itokawa taken by AMICA on board the Hayabusa spacecraft is employed to our test data set. An obtained model satisfies that most requirements from the Hayabusa-2 mission on the shape model that used during the mission phase. An important advantage of these new tools compared to previous ones is its short processing time. This advantage will be effective in quick evaluation of observation data and decision making during the mission operations. More precise and high definition models will be reconstructed by other method such as shape-from-shading or photometric stereo.

Keywords: Asteroid, shape reconstruction, bundler, PMVS2, Structure-from-Motion, Hayabusa-2