Paper ID: 23490
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student

SPACE DEBRIS SYMPOSIUM (A6)
Poster Session (P)

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DETECTION ALGORITHM OF SMALL AND FAST ORBITAL OBJECTS USING FAINT STREAKS; APPLICATION TO GEOSYNCHRONOUS ORBIT OBJECTS

Abstract

This paper proposes an algorithm to detect small or apparently fast orbital objects from optical images making use of their faint streaks. In the conventional algorithm, a high signal-to-background-noise-ratio (e.g., 3 or more) is required to detect objects. In our algorithm, we sum signals along the streak direction to improve sensitivity. By applying this algorithm to multi-images, we can detect lower signal-to-noise ratio objects. The algorithm consists of following steps; 1) take local sums of signal intensity on each pixel along preliminarily predicted streak direction, 2) find middle point candidates of streaks on each image, 3) search candidates of a sequence of points aligning in a straight line, and 4) select the candidate with the best linearity and reliability. In this paper, we focus on objects around geosynchronous orbit where most of streaks are oriented to South-North direction. We note that it is not reasonable to apply this algorithm to low Earth orbit objects having no specific streak direction because of limited computational resources. It requires orbit information from other facilities (e.g., space-based sensors). We confirmed that we can detect a streak appeared on images with approximately 1 signal-to-background-noise-ratio with applying the algorithm.