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A ROBUST SPACE DEBRIS TRACKING STRATEGY BASED ON MULTIPLE-MODEL PARTICLE FILTER VIA APOSOS TELESCOPE.

Abstract

An operational satellite or space debris with a small-bodies is one of the challenging problems for ground-based space object observation. Although the primary objectives for the small satellite design to reduce power resources, the position of each space object based on six orbital parameters remains important and should be updated periodically, because the effect of the earth's orbital perturbations is always disturbed. Nowadays, the modern ground-based passive-optical telescopes equipped with Complementary Metal Oxide Semiconductor (CMOS) has been widely used in space object observation and tracking, which is stored in gray-scale image data because of its cost efficiency and easy to maintain. However, the tracking performance of this equipment primarily depends on the size and brightness of space target, which appears on screen. In the real-time observation procedure based on stare tracking mode in short exposure time, the space object and stellar background will similarly appear in point-spread function with difference levels of Signal-to-Noise Ratio (less than 10dB) under the variable conditions of background interference, which is difficult to recognize. To overcome this limitation, we emphasize on robust optical-based space object tracking with small-bodies and dim conditions via states estimation technique, named multiple-model particle filter combined with proposed adaptive running Gaussian average by neural-network algorithm, in order to extract a moving space object from the stellar background and its interference. The effectiveness of the proposed combination algorithm is validation through analyzing real astronomical image by one of the Asia-Pacific ground-based Optical Satellite Observation System (APOSOS) telescope located at NAOC, Beijing, China. The performance of the proposed combination algorithms is experimentally evaluated, and the results showed that the scheme achieved a satisfactory tracking for small satellite and space debris.