Paper ID: 53647
oral
student

17th IAA SYMPOSIUM ON SPACE DEBRIS (A6)
Orbit Determination and Propagation (9)

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HIGH-PRECISION DETECTION AND HIGH-SPEED TRACKING ALGORITHM FOR SPACE DEBRIS

Abstract

With the continuous rapid development of the human space industry, a steady stream of spacecraft has been sent to space. The collision between the retired spacecraft and the spacecraft has directly led to the explosive growth of the number of space debris. Clearing space debris has become the most urgent for mankind. One of the space missions. At present, the relative visual navigation of non-cooperative targets of spacecraft mostly adopts the method of combining single-binocular vision system and ranging laser to obtain the shape and relative pose information of spatial non-cooperative targets. However, at present, this method does not realize real-time detection and tracking of spatial non-cooperative targets within the observation distance. In this paper , the real-time detection and tracking of space debris in space environment is studied . By combining Mask-RCNN target detection and KCF high-speed target tracking algorithm , the pre-built satellite whole , structural components and simulated space Debris modeling database for deep learning training, in the training process by extracting the shallow features of the target and the deep features for joint training , to achieve high-precision detection and marking of space debris , and then high-speed real-time tracking of the detected targets, here Process detection and tracking are performed synchronously . This paper overcomes the contradiction between positioning and identification in the detection process. It proposes to apply singular value decomposition technology to convolution feature compression processing , reduce the computational and storage requirements of the model , and adopt multi-scale training method to adapt to the change of space non-cooperative target scale. This technology will promote the maturity of " Visual Navigation Based " (VBN) technology . On-orbit satellites will be able to implement navigation algorithm on-board processing to achieve near real-time rendering of the trajectory of non-cooperative targets in space , which can form a complete " identification tracking" . Motion Analysis - Capture - Off-track " means of space debris removal .