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LIGHTWEIGHT NEURAL NETWORK BASED SMALL SPACE DEBRIS SALIENCY DETECTION IN VIDEO

Abstract

The increasing space activities have resulted in numerous space debris, which greatly threatened the space asserts and astronauts's safety. To ensure the safety of human space operation, space-based space debris surveillance is crucial for the emergency avoidance of spacecraft in advance. With the progress of computer vision technology, space debris detection using visual sensors has becoming a favorable solution. However, detecting space debris in the distance is challenging, due to its slow movement relative to the space-based surveillance platform and various noise caused by statistic nature of photodetection in sensor systems. Therefore, it's difficult to discern the space debris in a static surveillance image full of noise and stars. Since the video images contain not only the spatial information in a static image but also the temporal-related information in sequence images, a convolutional neural network based small space debris saliency detection algorithm (SDebrisNet) is studied in this paper. First, a MobileDets based space debris feature extraction structure is constructed, which makes the overall model more lightweight to match the resource-restricted space-based surveillance devices. In particular, an enhanced spatial feature module is proposed to strengthen the spatial details of small object. Then, on the basis of RCRNet, a non-locally enhanced recurrent (NER) module is applied to output the resulting saliency maps. Finally, a small space debris dataset is constructed for algorithm evaluation. Experiment results demonstrate that the proposed method in this paper is robust for detecting small space debris and can achieve favorable lightweight improvement.