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Author: Prof. Zheng Gu
Beijing Institute of Spacecraft System Engieering, China, cascgu@163.com

Prof. Mengfei Yang
China Academy of Space Technology (CAST), China, yangmengfei@cast.casc
Ms. Liping chen
Beijing Institute of Spacecraft System Engineering, China Academy of Space Technology (CAST), China, chenlipingzs@sina.com
Mr. Tong Wang
Beijing Institute of Spacecraft System Engineering, China Academy of Space Technology (CAST), China, wangtong1012@126.com
Mr. Tieying Li
Beijing Institute of Spacecraft System Engineering, China Academy of Space Technology (CAST), China, lty152216@126.com
Dr. Yanhong Zheng
Beijing Institute of Spacecraft System Engineering, China Academy of Space Technology (CAST), China, zhengyhsince2018@hotmail.com

HIGH RATIO IMAGE COMPRESSION FOR DEEP SPACE EXPLORATION

Abstract

Image is the most intuitive form of information obtained in space missions. It is widely used in spacecraft navigation, target tracking, descent guidance, spacecraft estimation and other aerospace fields. Compared with earth orbit satellite, deep space probes are far sway from the earth and have limited communication date rate. Therefore, the images obtained by deep space probes are usually compressed before downlink transmission. The commonly used compression methods include JPEG, JPEG2000, ICER, CCSDS-IDC and so on. Although these algorithms have been applied well in deep space exploration, there are two common problems: (1) limited by the coding efficiency, it is difficult to achieve high-ratio compression; (2) Increasing the compression ratio will produce block effect, compression artifacts and so on, causing serious image distortion. With increasing distance in deep space, the communication rate will be severely limited due to the large long-distance space loss. For example, NASA's Voyager-1 can only fulfil 160bps downlink data transmission rate when it is 22.4 billion kilometers away from the earth. Therefore, there is increasingly strong demand for high-ratio image compression algorithm. To achieve a higher rate of compression while improving the image quality and alleviating image distortion is an urgent problem to be solved. In recent years, deep learning has been widely used in image super-resolution and achieved good results. This makes the information loss caused by the image down-sampling can be well compensated, which provides the possibility for the application of image super-resolution in image compression. So, in this paper, we propose a high ratio image compression method (HRIC) based on deep learning, which combines bicubic down-sampling, JPEG2000 and super-resolution reconstruction based on fusion diversion network (FDN) to obtain high compression ratio compressed image. Extensive experiments are carried out using the on-orbit images of Chang'E-3 and Chang'E-4. The results show that, compared with the traditional compression algorithms, the proposed algorithm can elevate the maximum compression ratio more than 6 times, and can effectively suppress the compression artifacts and provide

better quality of compressed images. Therefore, it can be effectively applied to the image compression of deep space exploration.