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SPACEBORNE ARTIFICIAL INTELLIGENCE (AI) FOR VESSEL DETECTION APPLICATIONS

Abstract

Traditional methods of earth observation involve satellites capturing either raw or processed data through spacecraft, with object detection and classification typically performed on ground due to availability of resources. However, transmitting large volumes of data can sometimes become difficult due to satellite link time constraints. The future of the space industry features satellite platforms equipped with onboard data processing and object detection capabilities. This will enable the transmission of only pertinent and useful information to ground stations.

This paper presents the latest results on the algorithm developed under the Artificial Intelligence (AI) rideshare program with STAR.VISION, a Newspace satellite company. The vessel detection algorithm developed by students of Sultan Qaboos University Oman, is set to be tested real time onboard WonderJourney 1A satellite. The satellite is China's premier artificial intelligence satellite, featuring advanced on orbit AI processing capabilities with up to 80 Trillion of Operations Per Second (TOPS) and an intelligent operating system. The satellite consists of a flexible on-orbit over-the-air (OTA) protocol with 150+ AI algorithms processing applications.

The vessel detection algorithm developed under the AI rideshare program to be deployed on board the WonderJourney 1A satellite has undergone ground level testing with promising results. It incorporates three crucial stages which include pre-processing, YOLOv8 algorithmic processing, and post-processing stages. The pre-processing stage addresses the challenges related to identification of surface and sea areas thereby providing better input data for the next stage. The algorithm stage utilizes the training of YOLO models for vessel object detection with the need for further training, and finally the post-processing stage refines and optimizes the detection results based on the YOLO algorithm outputs. The training and test results of the proposed algorithm along with the on orbit results shall be presented.

Overall, the proposed paper offers valuable insights into the development and testing of a vessel detection algorithm, showcasing its relevance and potential impact in the context of satellite-based AI applications onboard small satellites.