IAF SPACE EXPLORATION SYMPOSIUM (A3)
Interactive Presentations - IAF SPACE EXPLORATION SYMPOSIUM (IP)

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# A NON-GPU INSTANCE LEVEL SEMANTIC ACQUISITION METHOD FOR COMPUTING RESOURCES LIMITED SCENARIOS

**Abstract**

As the space mission is becoming more and more complex and the environment faced by the space mission is increasing more and more harsh, many space missions have to rely on autonomous robots to assist human beings to fulfil the tasks. Vision-based simultaneous localization and mapping (SLAM) is the core technology of autonomous robot to achieve localization and navigation in unknown environment, and it has always been a research hotspot. However, the traditional visual SLAM only enables robots to understand the surroundings from the geometric respect, so it is difficult for robots to implement higher-level autonomous tasks. The vision-based instance level semantic SLAM can not only improve the accuracy and robustness of the traditional visual SLAM, but also make robots recognize the surrounding environment from two aspects of geometry and instance level semantic objects, thus improving the autonomy of the robot. At present, there is only a small number of works related to instance level semantic SLAM and these works require high energy consumption GPUs to provide computing resources to extract semantic information from the images, which greatly limits some space missions scenarios, such as lunar base service robots and robotic surface operation missions which have energy consumption and volume constraints. To solve this problem, this paper proposes an instance segmentation method based on the combination of edge segmentation and lightweight semantic segmentation neural network, which avoids the object candidate box regression process that consumes too much computing resources. In particular, a binary edge map is generated first via normal edge analysis method to serve as the masks of objects in the images, which will omit the regression process of object candidate box. Then, the masks are used to intersect with corresponding semantic segmentation results. Finally, instance level semantic segmentation

is realized. In the scope of my knowledge, this is the first approach which can achieve near real-time instance level semantic information acquisition in CPU hardware environment while merely reducing a small amount of segment accuracy respect to GPU based methods. Therefore it can provide an effective solution for application scenarios with computing resources and volume constraints. In addition, the accuracy and speed of the segmentation method can meet the need of environmental modeling for mobile robot SLAM.