Response to Reviewer 1 Comments

Point 1: Page 1 line 41: high resolution is definitely not a general SSS characteristic – it depends on sonars frequency (and therefore range), which is very different for different application (marine, inland, shallow water etc.)

Response 1: Thank you for pointing this out. The resolution of the SSS image depends on the sonars frequency and the slant range. So it is definitely not a general SSS characteristic. Therefore, we make changes as follows in P1, Line 41: "Due to the complex underwater environment and interference from its own equipment, SSS images have the following characteristics: 1) intensity inhomogeneity 2) poor image contrast 3) serious noises including reverberation, reflection, acoustic loss, scattering, ambient noise and so on"

Point 2: Conclusions: how authors see further development and research on segmentation of SSS images in RT?

Response 2:

Under the influence of the complex underwater environment and interference from its own equipment, SSS images contain various noises, which directly affect the segmentation and recognition of targets. Moreover, in the real-time process, as the flow of sonar data received from SSS sensor is continuous, highest requirements are placed on the computational performance of the image segmentation algorithm. Therefore, designing a fast and efficient algorithm for SSS image segmentation has become a challenge and is now the key factor to realize real-time detection and recognition of underwater targets.

With the development of intelligent computing platforms, more and more Deep Convolutional Neural Networks (DCNNs) will be applied to the process of side-scan sonar images. In particular, semantic segmentation algorithms, based on pixel-level image segmentation, makes the class of each pixel meaningful in real world. Compared with the traditional side-scan sonar segmentation, semantic segmentation can not only better extract features from targets, but has also great advantages in computational performance and memory requirements. By reducing the number of parameters and floating point operations，the semantic segmentation of SSS images can meet the real-time requirements, and with further development, it will be applied to specific applications on embedded mobile devices. But the label annotation of raw images is remains one of the bottlenecks of the semantic segmentation task.

The core technology in the new generation of autonomous underwater vehicles (AUVs) is the autonomous ability with high environmental adaptability. This kind of persistent autonomy is manifested in the autonomous navigation, as well as in the ability to perceive the environment and the ability to dynamically plan path

based on the environmental changes.According to the results of real-time SSS image segmentation in our paper, AUVs can own the capabilities of autonomous navigation, environmental awareness and path planning, further promoting the development of intelligent underwater robots, which will greatly assist marine exploration and development.