

A case study on 3D measurement of underwater structure by using digital image data taken with a digital camera

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In recent years, it is possible to handle 3D reconstruction of various objects by using images from multiple viewpoints due to improvement of image processing (Structure from Motion = SfM). The SfM technique is used in geographical and archaeological researches to reconstruct topographical maps using UAV images or to record historical remains. This technique is also applied to record war remains and coral reefs in underwater study, though the examples are not enough to discuss the accuracy of 3D model. Kochi University and JAMSTEC (Japan Agency for Marine-Earth Science and Technology) launched a underwater geoarchaeological research to discover “Kurodagori”, which is a village at coastal area of Kochi Prefecture submerged under water by 684 Hakuho Earthquake. Shape and size of underwater materials must be recorded and measured from seafloor survey, and these data can be obtained by a sonic survey and a direct measurement by divers. However, when the target object is very small located at very shallow depth, these methods are very useless. On the contrary, SfM technique has a potential to solve these problems.

Therefore, in this study, we applied SfM technique for 3D reconstruction of underwater objects by using underwater photo during Kurodagori project. Compact digital camera (TG series, Olympus Corporation) was used to take photos. A commercial software Metashape (Agisoft) was used to construct the 3D models. We succeeded to construct the geographical data at a local spot of Nomi-bay by using about 30 photos. On the contrary, we failed to construct the 3D model of octopus trap pot, probably due to low visibility of undersea.

In this study, we compare 3D models of the pillars at Tsumajiro area and the octopus pot at Nomi-bay by using underwater photo to those by using photo at surface. We also improve the method to construct 3D models that original photo data is difficult to take due to high reflectivity of sunlight from the surface of the objects.

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