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LARGE SCALE COASTAL MARINE DEBRIS MONITORING IN THE COAST OF JAPAN ISLANDS
USING SATELLITE AND DRONE OBSERVATIONS**Abstract**

Marine debris has been a serious problem for the marine ecosystem and aquatic industries. Preservation of marine life and promoting the sustainable product manufacturing system are very important for 'Sustainable Development Goals'. Many studies have been conducted so far to characterize marine debris but most of them only focused on heavily contaminated regions due to the difficulty of acquiring accurate ground truth data. They did not consider more practical situations to apply their approach to real scenes. Understanding the debris migration and deposition on coastal region is the essential requirement to mitigate the economic impact and environmental pollution aspects. Thus, this study aims to demonstrate to quantitatively analyze and evaluate the debris accumulation in coastal region for practical situations.

We initiated a pilot project to evaluate this concept cooperating with drone operators, local research institution and data management company. We also associated with a local government and acquired in-situ measurements of debris amounts during the cleanup activities. This is the crucial data used as a ground truth of the debris accumulation. We also amassed a large number of remote sensing data roughly coincident with the in-situ measurements including satellite images from various platforms and drone pictures. We developed a novel approach to estimate debris concentration in coastal areas from very high resolution satellite images (WorldView images provided by MAXAR corp.) using machine learning techniques. Then, we extended our analysis procedure to satellite images from different platforms and different areas using domain adaptation techniques. Additionally, we also performed detailed debris characterization using drone photos with object detection framework. This enables to estimate the detailed classification of debris components followed by the rough estimation of debris accumulation using satellite images. We demonstrated its capability to apply our data system to estimate the debris deposition in various beaches in Japan.

In conclusion, this paper presents the summary of this pilot project and the analytical overview using various remote sensing products combined with ground truth data. Our large scale data management system makes it possible to build multi-modal analysis model to visualize the temporal evolution of the debris deposition in Japan. We hope to extend this pipeline and evaluate the feasibility in different coastal regions in the entire the world.