Semantic Segmentation-based Study of Solar Panel Footprints in Hong Kong

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Key words: Access to land; Geoinformation/GI; Photogrammetry; Remote sensing; Optical Remote Sensing, Aerial Image, Orthophoto; True Orthophoto; Convolutional Neural Network; UNet; Deep Learning; Semantic Segmentation; Computer Vision; Solar Panel

SUMMARY

Objective

The rapid growth of human activities has led to increased energy demands and environmental concerns, necessitating the exploration of sustainable energy sources. Solar energy, in particular, has gained significant attention due to its renewable and clean nature. Hong Kong is increasing solar panel adoption due to its renewable and clean nature. The Government in Hong Kong has also introduced the Fee-in-Tariff (FiT) Scheme and “Solar Harvest” to help encourage the private sector to participate in small-scale distributed renewable energy generation. Therefore, the number of solar panels has risen significantly in recent years.

Data and Methodology

Earth observation data is commonly used to identify land features such as solar panel. However, the radiometric quality of optical imagery data varies due to different image acquisition conditions like atmospheric conditions, flying height and shadows on ground etc. In this study, very high-resolution aerial orthophotos were employed to label a large amount of imagery data for solar panels. The UNet architecture and post-processing techniques were then used to identify the location of solar panels and overcome the radiometric variation of the images, mapping the solar panel footprint across Hong Kong.

Result

This study demonstrated that the formulated workflow adapted well to varying radiometric conditions and successfully identified the footprint of the solar panels with a minimum mapping

unit of one solar panel size. Solar panels were commonly found on the rooftop of village houses, industrial buildings and schools as well as floating within water ponds and on bus top in Hong Kong. The weighted mIoU and F1 Score of solar panel were 89% and 94% via an independent check, respectively, both proving the feasibility of the workflow.

Conclusion and Significance

The study identifies the existing distribution of solar panels within the city area of Hong Kong, highlighting their prevalence on specific rooftops and buildings. This not only contributes to the development of a hierarchical land cover map, but also enables the identification of newly added or demolished solar panels by comparing different years of capture. Furthermore, the study provides spatial information of existing solar panels to policymakers to make informed decisions regarding sustainable energy infrastructure, supporting Hong Kong in achieving the UN's Sustainable Development Goal.