Refinement of Large-scale Vegetation Height Map with Self-Supervised Learning

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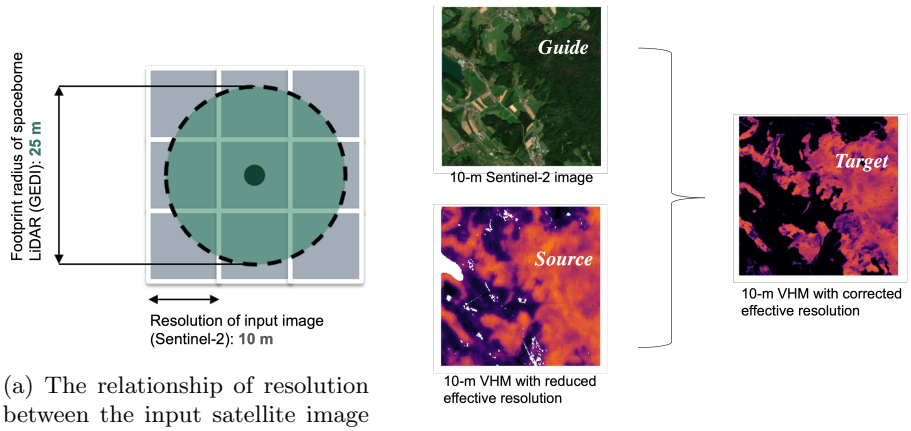
1 Description



(a) The relationship of resolution between the input satellite image (Sentinel-2) and the reference data (GEDI)

(b) Formulating the refinement problem as a super-resolution problem

Figure 1: The general idea of the proposed method

Although traditional field measurements combined with airborne laser scanner (ALS) can produce accurate vegetation height map (VHM) with fine details, it is infeasible to generate a global map with ALS due to its high time and labor cost. The recent satellite mission with spaceborne LiDAR instruments (GEDI [Dubayah et al., 2020]) provides sparse vegetation height measurement across a large part of the earth and enables the generation of global VHM. Recent works [Lang et al., 2022a,b] have successfully used deep learning techniques to generate global VHM with 10-meter resolution based on Sentinel-2 images and GEDI data. However, the discrepancy of resolution between the input image and the reference data poses a problem (check the relationship of resolution between input and reference data in Figure 1a): models trained on GEDI reference data with 25-meter footprint yield a reduced effective resolution. Therefore, we aim

to use a self-supervised method to recover the small texture details omitted in the current global VHM map.

As shown in Figure 1b, we plan to formulate this problem as a guided super-resolution problem: use the 10-meter Sentinel-2 image as a guide and the coarse VHM as a source image to produce a refined VHM that retrains more high-frequency details. The refined map should contain the vegetation height information from the source image and inherit the fine texture details from the guide image.

2 Goal

- Get acquainted with our self-supervised baseline;
- Literature review for self-supervised learning and super-resolution methods;
- Implement or adapt selected state-of-the-art methods on our dataset;
- Perform detailed evaluation on the refined map based on high-resolution countrywide vegetation maps produced by ALS;

3 Requirements

- intermediate skills of Python
- knowledgeable in deep learning (e.g. completed relevant courses or projects) and have experience with frameworks (e.g. PyTorch)
- experience with satellite data is a plus

4 Contact Details

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References

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