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SMARTSAT COOPERATIVE RESEARCH CENTRE

UNSW SYDNEY

Pre- and Post-disaster Building Information Extraction using Lidar

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Introduction

After natural disasters, a rapid response is important to mitigate injuries and casualties. Both pre- and post-disaster building information plays an important role in facilitating swift disaster responses. However, current Light Detection and Ranging (Lidar)-based deep learning (DL) methods for disaster-related building information extractions have some limitations: (1) There is little evidence of applying DL models for building-related classifications considering data sources related to either before or after natural disasters; (2) The large-scale scenarios are rarely discussed or tested in well-known DL methods in Lidar applications; (3) Most current post-disaster studies lack proper multi-level building damage classifications in the remote sensing field.

Aims

To address the above issues, this research aims to propose novel DL models to classify buildings with large-scale datasets considering both pre- and post-disaster periods.

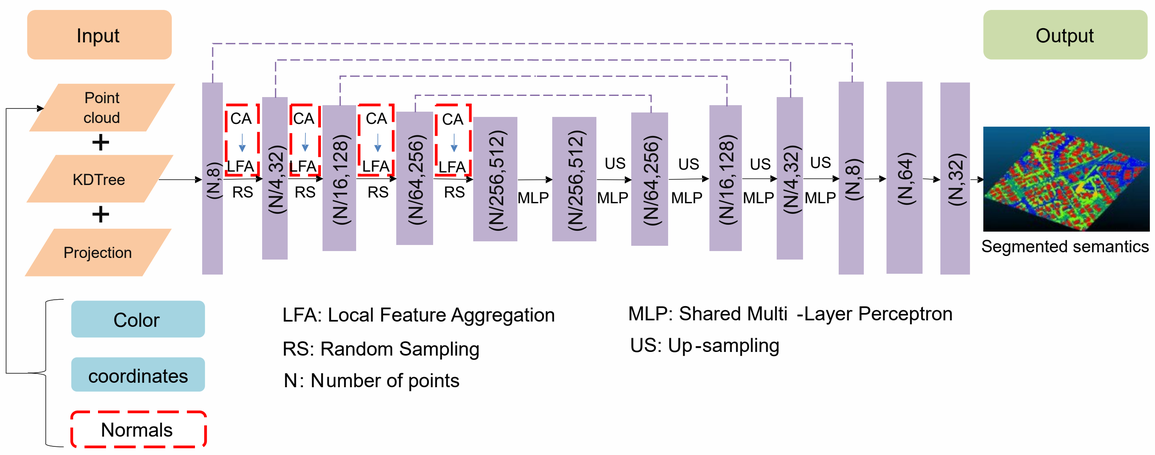
The **pre-disaster** analysis focuses on building footprint extraction, and the **post-disaster** analysis focuses on multi-level building damage classification.

Methods

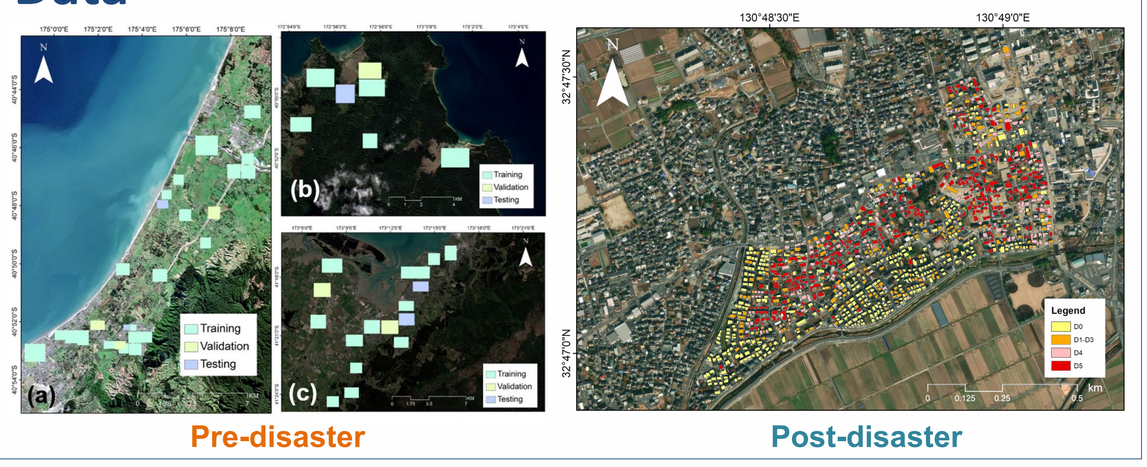
Main steps:

1. To build in-house labelled Lidar datasets.
2. To propose a DL-based pre-disaster building footprint extraction method with large-scale Lidar data validated in case studies at locations prone to natural disasters.
3. To propose a DL-based post-disaster multi-level BDLC method using large-scale Lidar data.

Proposed DL network



Data



Pre-disaster | Post-disaster

Results

Pre-disaster: Building footprint extraction

Post-disaster: Multi-level building damage classification

Damage level	D0	D1-D3	D4	D5	Mean
Ground truth	41	23	15	21	/
Description	No/minor damage	Partially collapsed	Totally collapsed	Story failure	/
TP of the proposed model	31	5	2	13	/
Accuracy of the proposed model	0.76	0.22	0.13	0.62	0.51

Implication

- To allocate resources for rapid rescue decisions
- To allocate resources for recovery plans
- Benefit to developing countries, such as the Pacific Islands

Humanitarian-related purposes:

- To contribute to the resilience and sustainability of cities and human settlements
- Aligning with the United Nations Sustainable Development Goal (UN SDG) 11 'Sustainable Cities and Communities'

References

Liu C, Zhang Q, Shirowzhan S, Bai T, Sheng Z, Wu Y, Kuang J, Ge L*, 2023. The Influence of Changing Features of Point Clouds on the Accuracy of Deep Learning-based Large-scale Outdoor Lidar Semantic Segmentation, *In 2023 IEEE International Geoscience and Remote Sensing Symposium (IGARSS)*, Pasadena, U.S., pp. 4443-4446.

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