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Artificial Intelligence for 3D Building Modeling

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The research explores the use of Artificial Intelligence (AI) to advance building information extraction and its 3D modeling through innovative computer vision techniques applied to 3D remote sensing. The primary goal is to enable detailed building information extraction and reconstruction from satellite imagery, supporting a wide range of applications such as enhancing OpenStreetMap (OSM) and CityGML data, updating cadastral information, and rapidly generating accurate 3D city models. These advancements contribute significantly to urban management, with applications in urbanization impact control, environmental planning, and building energy consumption analysis.

Our current focus is on RGB and DSM super-resolution techniques using large-scale, low-resolution data sources like Sentinel-2 and Cartosat. This approach facilitates global building information extraction and reconstruction. Additionally, we are developing foundation models leveraging both RGB imagery and Digital Surface Models (DSMs). By incorporating the latest in generative self-supervised learning, we employ masked image modeling to train a dual-encoder foundational model—one for RGB and one for DSM data—targeting urban scene understanding tasks. Our results demonstrate that incorporating DSMs improves performance in tasks such as building footprint extraction, height estimation, and roof classification. Models with separate encoders for each modality generally outperform shared-encoder architectures, and feature concatenation between encoders further enhances learning across modalities.

These innovations position AI as a key driver for more effective and scalable urban modeling solutions, facilitating smarter urban management and planning worldwide.

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