3D property valuation – exploring the association between property price and the vertical dimension (3D) using street view data and deep learning method

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SUMMARY

Property valuation plays an important role in the economy and involves stakeholders in diverse sectors. Most previous studies focus on the diverse impact from different locations in a 2D perspective, i.e., on a planar basis. However, the vertical dimension (3D) has not been paid enough attention, which can have a significant influence on the property price in densely-populated urban areas. Traditional data such as satellite imagery and vector files commonly fail to document the spatial variation on 3D (e.g., view, shadow, sky openness). However, with the development of technology and increasing availability of street view images (SVI), it is now more likely to capture the 3D built environment and thus build 3D proxies for a comprehensive representation in the valuation model. This study proposes a 3D property valuation (3DPV) framework and aims to develop an exploratory method using the deep learning method (Transformer) and SVI to understand the relationship between 3D environment and property prices. The results are as below…(1) traditional econometric models can explain the property variation with a convincing R2, and Random Forest (RF) outperforms in most scenarios; (2) Transformer model with only SVI input has a fair fitting of the valuation model; (3) 3D proxies, including street openness and ground, floors, are proved to impact the property prices positively at the significance level of p=0.05. The findings increase the awareness of various stakeholders of the importance of 3D: for more efficient land administration and fair access to 3D cityscape. It should be noted that in addition to accurately estimating property prices, the explainability of the AI algorithms and the localisation of 3D proxies are likewise important.