Advancing Computer Architecture with Empirical Study from Hong Kong Industrialization 4.0 using Machine Learning Techniques

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Abstract:

Since 2022, the Government of Hong Kong HKSASR has announced new measures on re-industrialization (also known as Industry 4.0) as a strategic mission for the Architecture, Engineering and Construction (AEC) sectors. As a result, the real estate transactions of industrial properties including factory buildings and warehouses received a economic boom in Q3 of 2023 by factors such as new demands on advanced manufacturing, logistics, and technology-driven infrastructure. The demand for modern, strategically located industrial spaces has surged, prompting a detailed market analysis to understand the underlying drivers and future trajectories. Consequently, government and stakeholders are increasingly seeking comprehensive insights to facilitate informed investment decisions and strategic planning but there is a sever lack of lack of empirical studies in academic contributions to support.

The construction of new industrial properties has persisted, warranting a detailed market analysis. This research will employ tailored machine learning techniques to predict property prices based on various relevant factors, including location, square footage, floor level, availability of parking spaces, and proximity to mass transit stations. To enhance transparency, the Shapley value will be utilized to assess the relative importance of each factor impacting property prices.

As machine learning continues to gain traction for real estate price prediction due to its effectiveness in modeling complex relationships, the demand for enhanced transparency remains pressing. The investigation and application of Shapley value-based methods, such as SHAP, are essential for addressing transparency concerns and building trust in AI-driven analytics within the real estate industry. A case study focusing on Hong Kong will be conducted, with the potential for the developed model to inform practices related to various property types and regions, as well as optimal architectural design, conservation strategies, and planning policies.

This proposal aims to bridge the existing research gap by examining the industrial property market in Hong Kong, characterized by its unique attributes and atypical market behavior. The Hong Kong industrial property sector is significant economically and features distinctive pricing dynamics, such as the price premium for lower-floor properties, especially ground-floor units, which are favored for their accessibility for logistics. Conversely, higher-floor units typically command lower prices due to increased logistical costs. Understanding these complexities is vital for stakeholders, including property developers, investors, and occupiers, to make informed decisions.

Specifically, SHapley Additive exPlanations (SHAP) will elucidate the influence of different characteristics on price estimates in the real estate market. Previous studies utilizing the Shapley value framework have improved comprehension of how specific features affect property valuations, fostering greater accountability and trust among real estate stakeholders. The ability of SHAP to convert complex model outputs into interpretable insights is vital in bridging the gap between sophisticated machine learning techniques and user understanding.