

## Measuring Human Perception and Negative Elements of Public Space Quality Using Deep Learning: A Case Study of Area within the Inner Road of Tianjin City

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**Abstract :** Due to a lack of data sources and data processing techniques, it has always been difficult to quantify public space quality, which includes urban construction quality and how it is perceived by people, especially in large urban areas. This study proposes a quantitative research method based on the consideration of emotional health and physical health of the built environment. It highlights the low quality of public areas in Tianjin, China, where there are many negative elements. Deep learning technology is then used to measure how effectively people perceive urban areas. First, this work suggests a deep learning model that might simulate how people can perceive the quality of urban construction. Second, we perform semantic segmentation on street images to identify visual elements influencing scene perception. Finally, this study correlated the scene perception score with the proportion of visual elements to determine the surrounding environmental elements that influence scene perception. Using a small-scale labeled Tianjin street view data set based on transfer learning, this study trains five negative spatial discriminant models in order to explore the negative space distribution and quality improvement of urban streets. Then it uses all Tianjin street-level imagery to make predictions and calculate the proportion of negative space. Visualizing the spatial distribution of negative space along the Tianjin Inner Ring Road reveals that the negative elements are mainly found close to the five key districts. The map of Tianjin was combined with the experimental data to perform the visual analysis. Based on the emotional assessment, the distribution of negative materials, and the direction of street guidelines, we suggest guidance content and design strategy points of the negative phenomena in Tianjin street space in the two dimensions of perception and substance. This work demonstrates the utilization of deep learning techniques to understand how people appreciate high-quality urban construction, and it complements both theory and practice in urban planning. It illustrates the connection between human perception and the actual physical public space environment, allowing researchers to make urban interventions.

**Keywords :** human perception, public space quality, deep learning, negative elements, street images

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