Abstract

Jiangnan gardens exemplify traditional Chinese landscape design, blending natural aesthetics with architectural innovation. While extensive research has been conducted on these gardens, a comprehensive spatial analysis of their complex landscapes remains lacking. This research aims to enhance the understanding of historic landscapes through advanced spatial analysis of Jiangnan traditional gardens using object detection and image depth estimation. The primary objective is to develop and apply an improved object detection algorithm, tailored for the intricacies of Jiangnan gardens, to identify and catalog key visual elements like pavilions, rockeries, and plants. This research introduces enhancements to the YOLOv8 algorithm, including the Diverse Branch Block (DBB), which optimizes feature extraction across different scales; the Bidirectional Feature Pyramid Network (BiFPN), enhancing feature integration from multiple layers; and Dynamic Head Modules (DyHead), which dynamically adjust the detection heads for better object recognition performance. Concurrently, the research seeks to analyze the depth and complex spatial relationships within the gardens to understand their design and functional aesthetics better. Employing the enhanced YOLOv8 for object detection and the Marigold algorithm for depth estimation, the study has provided exceptional insights. YOLOv8 effectively cataloged various elements, while Marigold mapped their spatial interactions with high precision, revealing the interplay between architectural and natural features and enhancing understanding of the gardens' historical and cultural contexts. This integration of object detection with depth mapping offers a novel methodology for exploring complex cultural landscapes. The findings suggest substantial implications for enhancing virtual tours and educational programs, promoting broader access to these cultural heritage sites. Overall, this research not only enriches our understanding of Jiangnan traditional gardens but also advances methodologies for preserving and interpreting complex heritage sites, promising innovative solutions for challenges in historic landscape conservation.

Keywords:

Jiangnan Traditional Gardens, Space Analysis, Object Detection, YOLOv8, Image Depth, Marigold Algorithm