

Landscape Design Utilizing Visual Communication Technologies

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ABSTRACT

Global urbanization has surged alongside economic growth. Cities now drive productivity and well-being but often at the expense of nature, escalating resource depletion, environmental degradation, and public health risks. Urban parks, crucial as “second nature,” mitigate these issues through green interventions. Current research on park design, focusing on aesthetics and ecology, lacks systematic methodologies, relying on subjective approaches like AHP, SBE, and SD. This paper integrates digital technologies and computational methods to enhance plant landscape design's scientific rigor. It explores using computer vision and machine learning to automate visual data extraction from images, aiming to reduce subjectivity and improve objectivity in landscape evaluation. It argues that integrating humanities into design fosters meaningful visual communication, vital for sustainable urban development. Ultimately, the paper proposes a framework merging computational techniques with design sensibilities to elevate urban park ecological and aesthetic qualities.

KEYWORDS

Visual Communication, Landscape Layout, Landscape Planning and Design

INTRODUCTION

The 21st century has been marked by an unprecedented surge in global urbanization, a phenomenon driven by rapid economic growth and social development. By the end of 2020, the urbanization rate of China's permanent population exceeded 60%, indicating a significant shift in demographic patterns and urban living (Prus et al., 2021). Cities have emerged as critical hubs for economic output and social welfare, serving as engines of productivity and innovation. However, this rapid urban expansion has not come without its challenges. The increasing density of urban populations has led to significant issues, including resource depletion, environmental degradation, and public health risks. These challenges threaten the stability of ecosystems and the quality of urban living environments, creating a pressing need for effective urban planning and landscape design strategies (Kalambet et al., 2020; Marwan & Anwar, 2020; Sitepu et al., 2020).

Urban parks play a vital role in addressing these challenges, acting as essential components of urban infrastructure. They provide green spaces that contribute to ecological balance, enhance biodiversity, and improve the overall quality of life for urban residents (Buana & Sahabuddin, 2020). As “second nature,” urban parks serve as critical interventions that mitigate the adverse effects of urbanization, offering recreational opportunities and promoting mental well-being. However, despite

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their importance, current research on park design often lacks systematic methodologies and tends to focus primarily on aesthetics and ecological benefits. This reliance on subjective approaches, such as analytic hierarchy process, subjective Bayesian estimation, and semantic differential methods, can introduce bias and limit the objectivity of landscape evaluations (Kazantsev et al., 2020; Mukherjee et al., 2021; Palazzo & Wang, 2022).

The existing literature reveals a significant research gap in the integration of digital technologies and computational methods into landscape design. Although advancements in technology have transformed various fields, the application of these innovations in landscape architecture remains underexplored. In this study, we aim to fill this gap by proposing a framework that leverages digital tools and computational techniques to enhance the scientific rigor of plant landscape design. Specifically, our research focuses on the automation of visual data extraction from images, which can significantly reduce the subjectivity inherent in traditional evaluation methods. By employing computer vision and machine learning algorithms, we seek to create a more objective basis for assessing landscape designs, thereby improving the overall quality and effectiveness of urban parks.

Moreover, this research emphasizes the importance of incorporating humanities into design practices. The integration of cultural and historical contexts into landscape design fosters meaningful visual communication, which is vital for sustainable urban development. By understanding the cultural significance of urban spaces and the emotional connections that people have with their environments, designers can create landscapes that resonate with the community and enhance the sense of place. This approach not only enriches the aesthetic experience but also promotes social cohesion and community engagement.

In summary, in this paper, we address the critical challenges posed by rapid urbanization and the need for effective landscape design strategies. By integrating digital technologies and computational methods, we aim to enhance the objectivity and scientific rigor of landscape evaluations. Furthermore, we advocate for the incorporation of humanities into design practices to foster meaningful visual communication. Ultimately, this research proposes a comprehensive framework that merges computational techniques with design sensibilities, aiming to elevate the ecological and aesthetic qualities of urban parks and contribute to sustainable urban development.

THEORETICAL BACKGROUND

The rapid urbanization of the 21st century has brought about significant challenges in urban planning and landscape design. As cities expand, the need for sustainable, functional, and aesthetically pleasing outdoor spaces becomes increasingly critical. Landscape design, as a discipline, plays a vital role in addressing these challenges by creating environments that harmonize with nature while meeting the needs of urban populations. However, the effectiveness of landscape design is often contingent upon the ability to communicate design intentions clearly and effectively to stakeholders, including community members, planners, and decision-makers. This is where visual communication comes into play. Furthermore, advancements in technology, particularly in the field of computer vision, offer new opportunities to enhance both landscape design and visual communication (Wang, R., 2021). This theoretical background explores the interconnections between landscape design, visual communication, and computer vision, proposing a comprehensive framework that integrates these disciplines to improve urban landscapes.

Landscape Design

Principles and Practices

Landscape design is an interdisciplinary field that encompasses various aspects of planning, ecology, aesthetics, and functionality. It involves the arrangement of natural and built elements to

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