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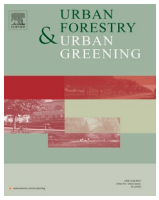

High or low? Exploring the restorative effects of visual levels on campus spaces using machine learning and street view imagery

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ABSTRACT

According to the Attentional Restoration Theory (ART), cognitive restoration (e.g., Fascination) may occur when the physical environment exhibits high restorative quality. However, these studies usually ignore the effect of different levels of visual features on restoration quality, and small-scale questionnaires are difficult to use to comprehensively evaluate the restoration quality of a space. In this study, we propose a machine learning based method for high-resolution, large-scale assessment of the restoration quality of campus environments using Street View Images (SVIs). First, visual features are extracted from campus SVIs using computer vision method. Second, an online survey using the PRS-11 questionnaire (containing four indicators: Being-away, Coherence, Scope, and Fascination) was conducted to label the images. Finally, we developed a regression model to predict campus restorative quality and to model the non-linear relationship between the visual features of SVIs and this quality. We studied 1088 SVIs in the Lihu campus of Jiangnan University (JNU) to verify the feasibility of our method, and the results showed that SVIs can accurately help us predict the restoration quality of the campus environment on a large scale ($R^2 = 0.726$). Next, we examined the variance in visual features between campus spaces with different levels of restorative quality, and investigated the effect of different levels of visual features on restoration quality. We found that contributions of high-level visual features to restoration, such as trees, are robust (Adj $R^2 = 0.504$) compared to low-level visual features (Adj $R^2 = 0.032$) that included such as color information. This provides a new perspective for assessing recovery environments and designing healthy campus environments. The code is shared at: https://github.com/MMHHRR/Restorative_Quality

1. Introduction

Reports from universities and colleges around the world indicate that college students are suffering from mental health problems (Karyotaki et al., 2020). According to statistics from the Institute of Psychology of the Chinese Academy of Sciences' 2022 Survey Report on College Students' Mental Health,[1] nearly 80,000 college students in China between the ages of 15 and 26 have experienced varying degrees of mental health issues as a result of the stress of studying and pursuing higher education. 21.48% of college students may be at risk for depressive disorders and 45.28% of college students may be at risk for anxiety, and they have higher levels of anxiety and poorer sleep quality than before. Despite the availability of mental health classes and mental health counseling services in schools, stigma (e.g., shame about attending mental health counseling center appointments) and avoidance (e.g., social anxiety) persist (Cuijpers et al., 2019). Therefore, there is an urgent need to provide students with effective ways to adequately alleviate mental fatigue.

Restoring focus through contact with the environment is an effective way to deal with this condition (Hipp et al., 2016). According to previous studies, students who frequent green places tend to be less stressed and have better moods overall (Holt et al., 2019a). A campus space with a natural environment can create an enjoyable experience and increase students' willingness to learn and actively participate on campus (Hajrasouliha, 2017; Carrus et al., 2015). This can improve students' attention span and academic performance (Kweon et al., 2017;

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