

Title	多様な公共空間における感情品質と空間特性の関係に関する研究 マルチタイプデータを用いた機械分類法
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Abstract

A fundamental problem urban public space designers face is evaluating the spaces having been used for many years. They must develop a reasonable plan that meets the needs of citizens. The classification of emotion elicitation and features of public spaces is an effective method to evaluate the quality of public space and support urban design and decision.

Related studies built several samples of user emotion classification models in public spaces. However, these models' application scope and recognition ability could be improved. In addition, these studies did not answer the quantitative relationship between spatial features and user emotions.

The main goal of this study is to analyze the relationship between users' emotional responses and the features of multi-type public spaces. Furthermore, the main goal was divided into three sub-goals: 1) building an emotion-eliciting quality classification model for multi-types of spaces; 2) extracting the main quantitative features of multi-type public spaces with positive emotional responses; 3) comparing the similarities and differences in the features of public spaces between Japan and China based on users' emotional response.

The study for sub-goal 1 is to build emotion classification models suitable for multi-type spaces using physiological data. To improve the classification accuracy, we chose the ensemble classifiers. The results demonstrate that the highest recognition accuracy of the binary classification model was 94.29%, and the highest accuracy of external validation was 80.90%. In addition, we introduced the synthetic minority oversampling technique (SMOTE) to solve the dataset's problem of too few negative emotion samples. This technology also improved the model's adaptability and met the basic requirements of multi-type public space evaluation.

The study for sub-goal 2 is to extract the main physical and image features of multi-type public spaces for positive emotions. We perform semantic segmentation on spatial photos by introducing a fully convolutional neural network (FCN). Then we obtained the five clusters with different features by two-step cluster analysis. By comparing the value ranges of these spatial features, we got the main spatial features that affect users' emotions.

The study for sub-goal 3 analyzed the similarities and differences in the features between Japan and China by comparing the data on the public spaces' physical, image, and perceptual features. The results show that 1) the differences between Japan and China are more than similarities in the 25

features; 2) the spatial scale, boundary, and continuity of space were the main features that affect the difference between them.

The study results for sub-goal 1 improved the ability of the emotion-eliciting quality classification model, which might contribute to specific urban design practices. The study results for sub-goal 2 found the quantitative features of multi-types of positive spaces, which might be valuable for urban design. And the results of the study for sub-goal 3 explained the similarities and differences in the spatial features between Japan and China from quantitative physical, image, and perceptual features.

In sum, we not only make it clear that there is an association between the features of public space and the emotional response of users but also that different public spaces will have similar results for users. Furthermore, we improved the classification model sample of the emotion-eliciting quality of public space that might be used in practice. We found the quantitative relationship between user emotions and positive spaces, which provides data-based evidence for understanding the relationship between people and space and designing public spaces suitable for human emotions.

Keywords: Multi-type public spaces, Physiological signals, User emotions, Spatial features, Classification models.