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Evaluating the Influence of Gender and Age Factors on Subjective Perceptions of Streetscapes

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Background

The subjective perception of urban streetscapes plays a crucial role in how individuals interact with their environment, influencing their sense of safety, comfort, and overall satisfaction. Understanding these perceptions is essential for effective urban planning. The perception of streetscapes, however, is not uniform. It can vary significantly across different demographic groups, for example, by gender and age. Females may perceive streetscapes differently than males due to concerns about safety, while older adults may prioritize accessibility and comfort in ways that differ from younger individuals. Yet, there has been limited quantitative analysis of how subjective perceptions of streetscapes vary across gender and age groups.

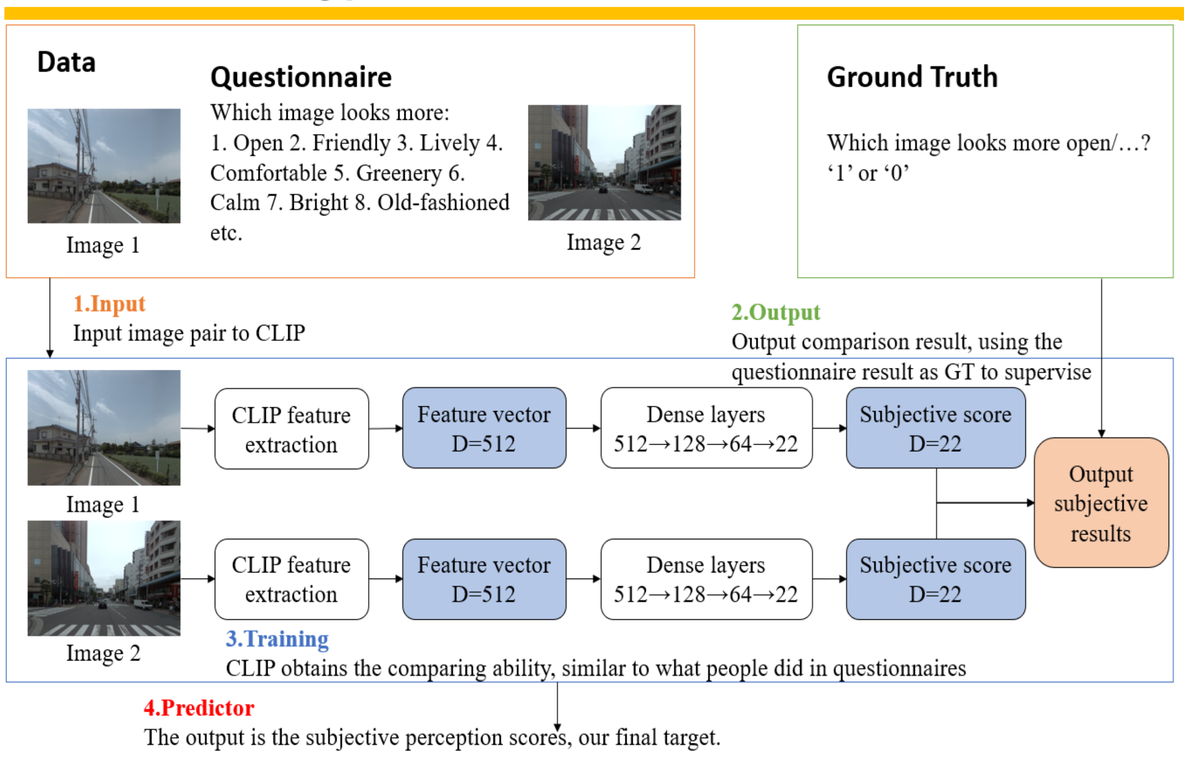
Objectives

- Examining the quantitative variations in subjective perceptions of streetscapes based on gender and age groups
- Employing CLIP model to more effectively analyze both visual and semantic features

Data sources

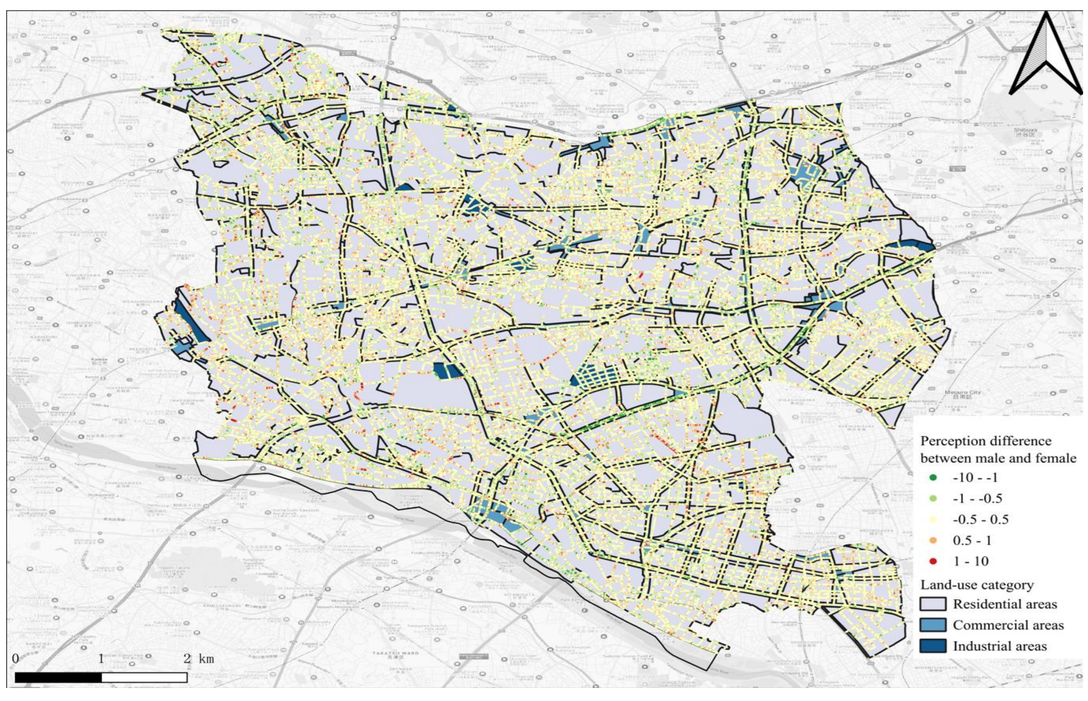
- 241,912 street-view images from Setagaya Ward, provided by Zenrin Corporation (2013). These images were captured at 2.5-meter intervals using a 360° roof-mounted camera on a moving vehicle.
- Questionnaire data of 10,000 image pairs and 8.8 million responses

Methodology



The model was designed to be trained on pairs of street images and predict subjective perception scores of 22 different types. This task was approached as a multilabel classification problem, requiring the model to predict relative perception scores for each image pair. The CLIP model receive input of two images to extract 512-dimensional feature vectors. These were then processed into 22-dimensional subjective perception scores. By subtracting the scores of one image from another, the model determined relative perceptions like "image 1 is more beautiful than image 2." The CLIP model is chosen because it is efficient and performs well in tasks involving the relationship between text and images.

Results



The distribution of perception differences between the demographic groups can be categorized to 4 types: "(1) basically the same", "(2) moderately different", "(3) negative difference concentrated on main roads", and "(4) positive difference concentrated on main roads". Perception 1 (open) and Perception 5 (greenery) accord with Type 1, meaning that people's subjective perceptions about openness and greenery will not vary significantly with gender or age. Perception 2 (friendly) and Perception 19 (interesting) etc. accord with Type 2, meaning that these subjective perceptions will vary significantly among people with different experience and cultural backgrounds. Moreover, main roads have an evident impact on subjective perceptions.

Conclusion

We reveal that part of the perceptions show a large difference between demographic groups, while others show a relatively small difference. The results can support urban designers on a more inclusive urban planning.