

## Commercial Location Model Based on Accessibility and Pythagorean Fuzzy Sets

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### Introduction

The commercial location, one of the complex and challenging decision factors faced by investors, plays a decisive role in operating profits. The distribution of business entities is also a focus of urban development planning. This study establishes an uncertain decision model for selecting investment locations based on spatial accessibility and consumers' emotional analysis by considering their convenience and actual needs.

### Mathematical Formulas

$$PFPWA_{\omega}(a_1, a_2, \dots, a_p) = \left\langle \sqrt[p]{1 - \prod_{k=1}^p (1 - u_{a_j^k}^2)^{\omega_j^k}}, \prod_{k=1}^p (v_{a_j^k})^{\omega_j^k} \right\rangle$$

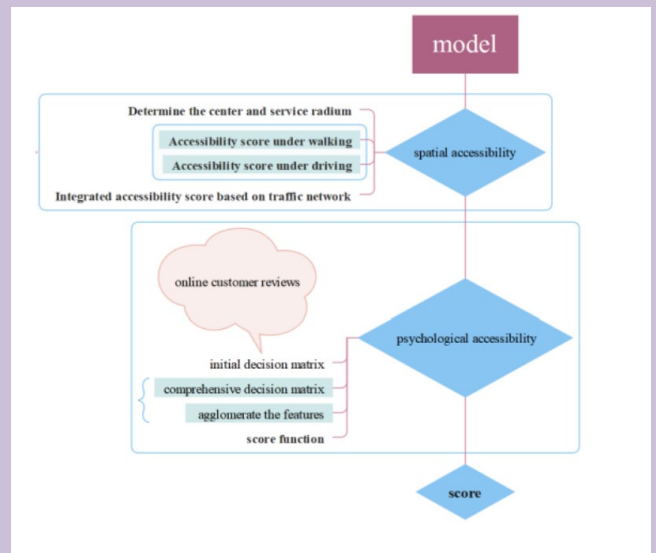
$$PFIWA(b_1, b_2, \dots, b_m) = \left\langle \sqrt[m]{1 - \prod_{j=1}^m (1 - \mu_{b_j}^2)^{\omega_j}}, \sqrt{\prod_{j=1}^m (1 - \mu_{b_j}^2)^{\omega_j} - \prod_{j=1}^m (1 - (\mu_{b_j}^2 + \nu_{b_j}^2)^{\omega_j})} \right\rangle$$

$$S = \mu_{\alpha_i}^2 - \nu_{\alpha_i}^2$$

### Research Questions

This study combines the spatial accessibility of the traffic road network and the psychological accessibility based on OCR to obtain the commercial location evaluation information and uses the Pythagorean fuzzy set theory to build the evaluation model.

### Figure



### Methodologies

The road network-based accessibility model is established to obtain the location score from the objective perspective.

The customers' personal emotional information is extracted from the online review information and described with the Pythagorean fuzzy linguistic variables.

The optimal choice method combines the abovementioned factors to identify the ideal location.

### Table

Table 1. Accessibility of different evaluation

Alternative	Spatial	OCR	Accessibility ranking
A1	3	4	4
A2	4	2	3
A3	1	3	2
A4	2	1	1

### Conclusion

Taking four representative business districts in D city as the research object, each business district's advantages and disadvantages in terms of accessibility are obtained through the established investment location model. The results of the illustrative example show that the designed method can assist the decision-making of investment location to a certain extent.

The competitive relationship between multiple business districts in the same jurisdiction has not been involved, and future research will introduce the competitive relationship into the evaluation of business location.