Communications on Applied Nonlinear Analysis
ISSN: 1074-133X
Vol 32 No. 10s (2025)

A Study on Fuzzy Network Graph Used for Online Hotel Reservation Using MATLAB

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Article History:

Received: 12-01-2025

Revised: 15-02-2025

Accepted: 01-03-2025

Abstract:

In this paper, customer preference, price, location, user ratings, amenities, and hotel suitability are represented as a fuzzy network graph. In the modern era, online hotel reservation is an essential part of first-come, first-served situations. So during booking, some traffic happened due to overpopulation, so these are handled by a fuzzy network graph to control the seasonal pricing, booking demand, and cancellation policy. By this proposed method, we find the hotel suitability score with the help of MATLAB implementation. This method allows us to make optimal hotel booking decisions.

Keywords: Fuzzy network graph, Triangular fuzzy number, MATLAB, Fuzzy ranking, Defuzzification.

1. Introduction

The hotel sector is in a competitive climate as a result of the new prospects brought about by technology. These days, more customers are enthusiastic about making hotel reservations online from the comfort of their own homes, wherever they may be in the world. Understanding the several elements impacting consumers' decisions when making online hotel reservations is the aim of this conceptual study. The study cites a number of aspects that affect consumers' decisions when making online hotel reservations, including privacy and safety, ease of use and convenience, transactional ease, price, information, website usability, and accessibility. By gaining more customers, the study will help marketers formulate their promotional plans for capturing and surviving the competitive market. Graph theory is an essential field to solve the real-world issues. So, using the fuzzy graph, we can manage the traffic during online booking. Here, both the edges and vertices are represented using a triangular fuzzy number. The goal of this study is to construct a fuzzy network graph-based model and implementation of MATLAB by representing criteria like price, location, ratings, and availability.

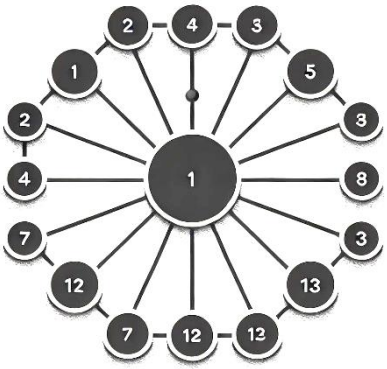
2. Methodology

2.1. Fuzzy Network Graph Model

The price, location, and ratings are represented as triangular fuzzy numbers in the fuzzy network graph. These criteria are represented in the nodes and edges of the fuzzy network graph.

2.2. Steps in the Proposed Model:

3. Graph Model



4. MATLAB Implementation

```
% Create a new Fuzzy Inference System (FIS) for Hotel Selection
fis = newfis('HotelSelectionEnhanced');
% Define Input Variables
fis = addvar(fis, 'input', 'Price', [0 200]);
fis = addmf(fis, 'input', 1, 'Low', 'trapmf', [0 0 50 100]);
fis = addmf(fis, 'input', 1, 'Medium', 'trapmf', [50 100 100 150]);
fis = addmf(fis, 'input', 1, 'High', 'trapmf', [100 150 200 200]);
fis = addvar(fis, 'input', 'Location', [0 10]);
fis = addmf(fis, 'input', 2, 'Poor', 'trimf', [0 0 5]);
fis = addmf(fis, 'input', 2, 'Average', 'trimf', [3 5 7]);
fis = addmf(fis, 'input', 2, 'Good', 'trimf', [5 10 10]);
```

```
 fis = addvar(fis, 'input', 'UserRating', [1 5]);
fis = addmf(fis, 'input', 3, 'Bad', 'trapmf', [1 1 2 3]);
fis = addmf(fis, 'input', 3, 'Average', 'trimf', [2 3 4]);
fis = addmf(fis, 'input', 3, 'Excellent', 'trapmf', [3 4 5 5]);
 fis = addvar(fis, 'input', 'Amenities', [0 10]);
fis = addmf(fis, 'input', 4, 'Few', 'trimf', [0 2 4]);
fis = addmf(fis, 'input', 4, 'Moderate', 'trimf', [3 5 7]);
fis = addmf(fis, 'input', 4, 'Many', 'trimf', [6 8 10]);
 fis = addvar(fis, 'input', 'SeasonalPricing', [0 10]);
fis = addmf(fis, 'input', 5, 'Low', 'trimf', [0 2 4]);
fis = addmf(fis, 'input', 5, 'Moderate', 'trimf', [3 5 7]);
fis = addmf(fis, 'input', 5, 'High', 'trimf', [6 8 10]);
 fis = addvar(fis, 'input', 'BookingDemand', [0 10]);
fis = addmf(fis, 'input', 6, 'Low', 'trimf', [0 2 4]);
fis = addmf(fis, 'input', 6, 'Medium', 'trimf', [3 5 7]);
fis = addmf(fis, 'input', 6, 'High', 'trimf', [6 8 10]);
 fis = addvar(fis, 'input', 'CancellationPolicy', [0 10]);
fis = addmf(fis, 'input', 7, 'Flexible', 'trimf', [0 2 4]);
fis = addmf(fis, 'input', 7, 'Moderate', 'trimf', [3 5 7]);
fis = addmf(fis, 'input', 7, 'Strict', 'trimf', [6 8 10]);
 % Define Output Variable
fis = addvar(fis, 'output', 'HotelSuitability', [0 10]);
fis = addmf(fis, 'output', 1, 'NotRecommended', 'trimf', [0 2 4]);
fis = addmf(fis, 'output', 1, 'Fair', 'trimf', [3 5 6]);
fis = addmf(fis, 'output', 1, 'Good', 'trimf', [5 7 8]);
fis = addmf(fis, 'output', 1, 'HighlyRecommended', 'trimf', [7 9 10]);
 % Define Fuzzy Rules
ruleList = [
    1 3 3 3 2 1 1 4 1 1;  % Low Price, Good Location, Excellent Rating, Many Amenities, Moderate Season, Low Demand, Flexible Cancellation -> Highly Recommended
```

```
    3 1 1 1 3 3 3 1 1 1;  % High Price, Poor Location, Bad Rating, Few Amenities, High Season, High Demand, Strict Cancellation -> Not Recommended
    2 2 2 2 2 2 2 2 1 1;  % Medium Price, Average Location, Average Rating, Moderate Amenities, Moderate Season, Medium Demand, Moderate Cancellation -> Fair
    3 3 3 3 1 1 1 4 1 1   % High Price, Good Location, Excellent Rating, Many Amenities, Low Season, Low Demand, Flexible Cancellation -> Highly Recommended
];
 fis = addrule(fis, ruleList);
 % Evaluate the Fuzzy Model with Sample Inputs
inputValues = [120 7 4 5 3 6 2];  % Medium Price, Good Location, Excellent Rating, Moderate Amenities, Moderate Season, High Demand, Moderate Cancellation
hotelSuitability = evalfis(inputValues, fis);
 % Display the Suitability Score
disp(['Enhanced Hotel Suitability Score: ', num2str(hotelSuitability)]);
```

4.1. Output:

Enhanced Hotel Suitability Score: 5

5. Conclusion

This paper mainly deals with how effectively fuzzy network graph is used in online hotel reservations. The usage of fuzzy network graphs helps in decision-making and, further, the proposed method is implemented in MATLAB to get better results. The above MATLAB code enhanced the hotel suitability score for customer preference, cost, location and user-friendliness.

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