Chapter 2
Explainable Artificial Intelligence and Fuzzy MCDM Approach in Location Selection of Roadside Units in Vehicular Networks With Economic Efficiency

A. P. Pushpalatha
https://orcid.org/0000-0002-0799-7961
Velammal College of Engineering and Technology, India

Sakshi Taaresh Khanna
https://orcid.org/0009-0006-2936-8708
Ram Lal Anand College, New Delhi, India

Utpal Saikia
https://orcid.org/0000-0003-0235-6871
Silapathar College, India

Sulbha Raorane
St. Francis Institute of Management and Research, India

Y. Monikarchana
Mohan Babu University, India

Chitra Ramaprakash
Dayananda Sagar College of Engineering, India

ABSTRACT

Decision-making on the selection-based problem of the location of Roadside units (RSU) in vehicular networks is complicated. This intricate problem shall be resolved with the intervention of Explainable Artificial Intelligence (XAI) and fuzzy-based

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multi-criteria decision-making methods (MCDM). This research proposes the integrated decision-making approach in making optimal location selection considering different criteria and economic aspects. The decision-making problem discussed in this chapter considers location selection of roadside units as the choice-making of the location is very significant in enhancing vehicular efficiency. This decision problem considers the criteria of coverage area, traffic density, accident frequency, infrastructure availability, environmental impact, energy efficiency, and cost components such as cost effectiveness, revenue competence, and investment returns. The integrated approach is leveraged to make an optimal choice of the RSU locations.

1. INTRODUCTION

The field of smart transportation systems is gaining intense advancements with the integration of robust technologies to foster and regulate traffic congestion and ensure safety and efficacy on the roadways. The vehicular efficiency is influenced by the location of roadside units (RSU). These components play a critical role in bridging the vehicular elements in a communication network. The vehicular network performance is also persuaded by the RSU locations and at the same time it facilitates economic efficiency. The decision-making on the location selection is a complicated kind of problem and it demands integrated and competent decision methods. In general, a decision-making process is more challenging as it is characterized by multiple alternatives and criteria. In addition, the existence of uncertainty also intensifies the complexity of the problem. To resolve such intricated problems fuzzy-based multi-criteria decision-making methods are the optimal choices. On the other hand, machine learning algorithms are applied in making optimal decisions, especially regarding vehicular efficiency. Machine learning and Deep learning are algorithm-based approaches and they are the subsets of artificial intelligence. These are characterized as the traditional approaches. However, these days these conventional trends are replaced by the techniques of Explainable Artificial Intelligence (XAI).

XAI refers to the advanced methods and techniques in artificial intelligence that are potent in enabling the decision-making process more comprehensive. These contemporary tools provide more insights into the modalities of making decisions and they aim in dealing with the 'black box' of the problem. These techniques of XAI are preferred as they possess the attributes of transparency, interpretability and reliability. There are several algorithms of XAI such as LIME (Local Interpretable Model-agnostic Explanations), SHAP (Shapley Additive explanations), Anchors, Saliency Maps, Partial Dependence Plots (PDP), Individual Conditional Expectation (ICE) Plots, Counterfactual Explanations, Gradient-weighted Class Activation Mapping (Grad-CAM), Explainable Boosting Machines (EBM), Rule-based Ex-

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