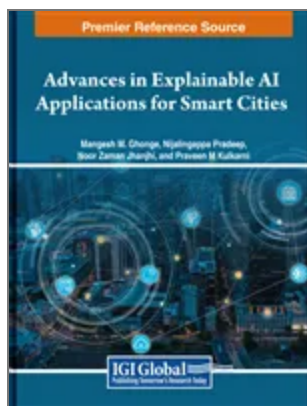


Open Challenges and Research Issues of XAI in Modern Smart Cities ⊗

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Abstract

The increasing use of AI in modern smart cities calls for explainable artificial intelligence (XAI) systems that can improve the efficiency and effectiveness of city operations while being transparent, interpretable, and trustworthy. Developing a unified framework for XAI that can handle the heterogeneity of data and systems in smart cities is the first challenge, considering the need to incorporate human factors and preferences in AI systems. The second challenge is developing new XAI methods that can handle the complexity and scale of smart city data. Addressing ethical and legal aspects is also critical, including ensuring that AI systems are fair and unbiased, protecting citizens' privacy and security, and establishing legal frameworks. Evaluating the effectiveness and usability of XAI systems is also crucial in improving city operations and stakeholder trust apart from XAI research for smart cities: improved visualization, human feedback, integration.

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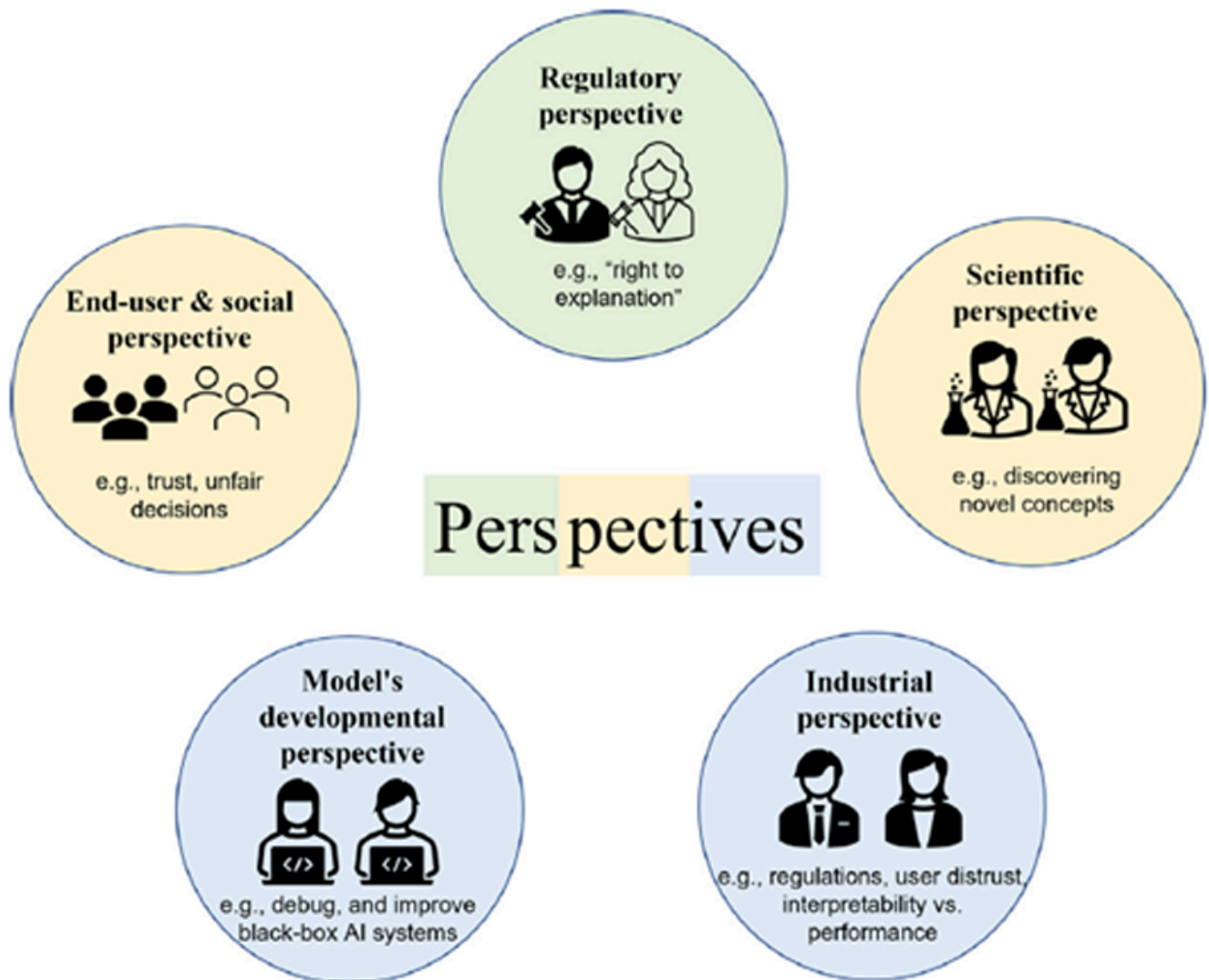


I. Introduction

• Brief overview of XAI and smart cities

As depicted in Fig 1.0 there are essentially five perspectives on why XAI matters in the context of smart cities as well. In recent years, the emergence of advanced technologies, such as the Internet of Things (IoT) (Prabakar et al., 2023) and artificial intelligence (AI) (Priyadarshini et al., 2022), has transformed urban environments into modern smart cities. These cities are characterized by the integration of digital technologies into various systems, such as transportation, energy, and security, to improve the quality of life for citizens. However, the complexity of these systems and the vast amount of data they generate pose significant challenges for decision-making and management. This is where XAI comes in. XAI, or explainable artificial intelligence, is a subset of AI that seeks to make machine learning models more transparent and understandable to humans. XAI can help decision-makers and managers better understand the inner workings of AI models (Jayakumar, Brohi, & Jhanjhi, 2021), enabling them to make informed decisions and identify potential biases or errors.

Figure 1. Why XAI matters: The five essential views



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Source: Saeed & Omlin (2023)

• Importance of XAI in smart cities

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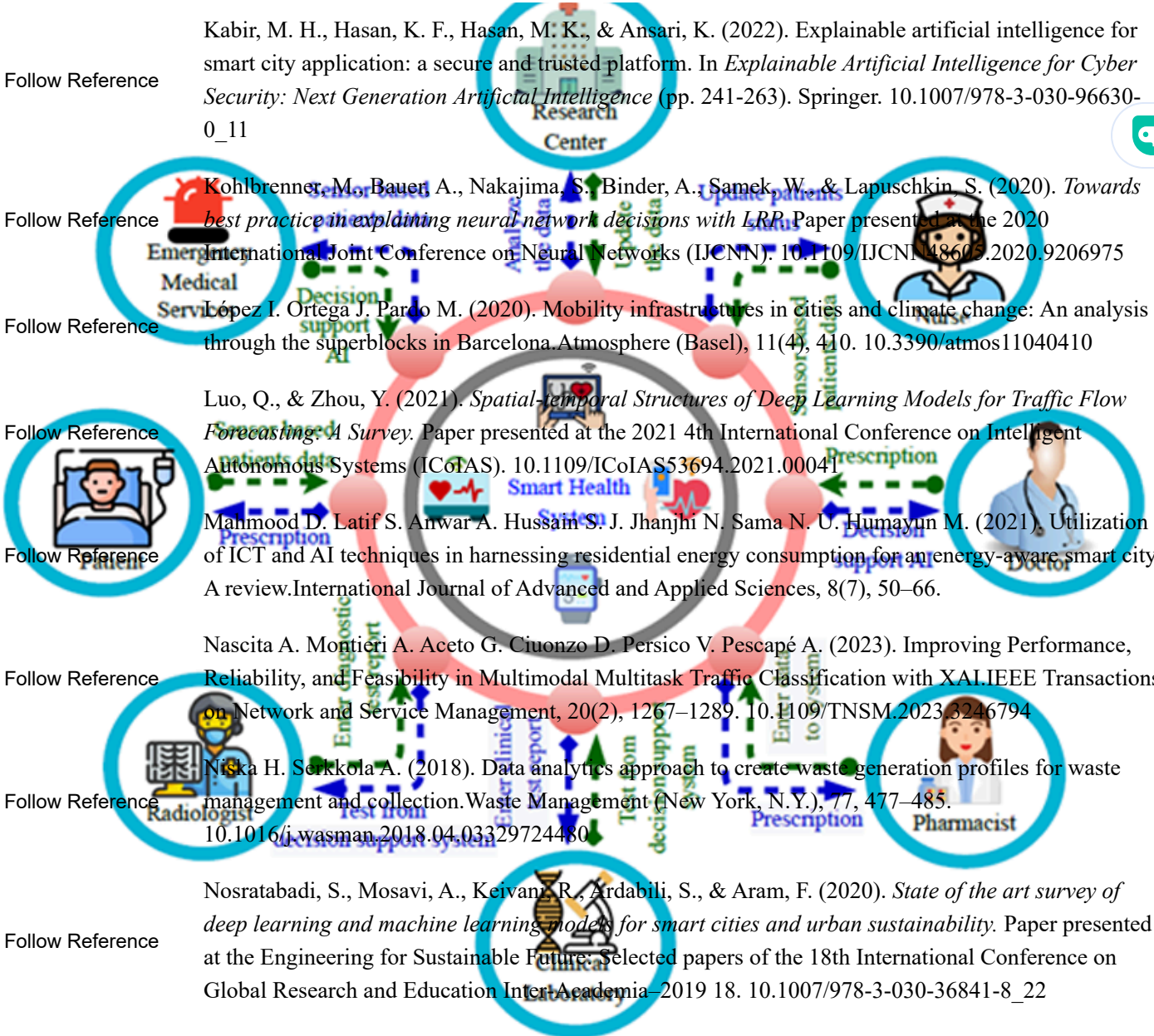
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The importance of XAI in smart cities stems from the fact that these cities generate an enormous amount of data from various sources such as sensors, cameras, social media, and other digital devices (Pandya et al., 2023). The volume, variety, and velocity of this data make it difficult for humans to process and make sense of it, which is where XAI can help. XAI models can analyze this data and provide actionable insights to city authorities, enabling them to make data-driven decisions that improve the efficiency, sustainability, and livability of the city with smart medical services to the inhabitants of the city as depicted in Fig 3.0 (Javed et al., 2023; Mahmood et al., 2021).

Figure 3. Smart medical services for urban communities



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