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A Survey on the Application of Artificial Intelligence in Urban Governance

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Abstract: With rapid urbanization, cities face growing challenges in resource allocation, public safety, and administrative efficiency. Traditional governance models struggle to keep pace with complex urban dynamics. This study explores the application of weak AI technologies—such as machine learning and computer vision—in urban governance. Focusing on four scenarios: smart government, public safety, traffic management, and community services, it conducts a systematic review of 158 English articles from the past five years. Using a four-dimensional framework (technology, application, bottlenecks, and trends), the study outlines how AI enhances governance efficiency and identifies key implementation challenges. Real-world cases from Hangzhou and Shenzhen demonstrate AI's potential to optimize urban operations. The research offers insights into building inclusive, adaptable, and tech-driven urban governance systems.

1. Introduction

The global urbanization process is facing significant governance challenges. The United Nations 2024 World Cities Report highlights that 60% of cities prioritize high-speed networks for AI deployment, as AI applications like smart transportation and public safety depend on real-time data transmission. In China, the urbanization rate is expected to reach 70% by 2030, according to the State Council's Five-Year Action Plan. This growth brings challenges such as uneven resource distribution, rising public security risks, and administrative inefficiency. Traditional bureaucratic governance struggles with the dynamic complexities of urban systems due to slow information flow and reliance on experience-based decision-making. In this context, AI, leveraging machine learning, natural language processing, and computer vision, plays a key role in addressing these issues. For example, Hangzhou's "urban brain" uses AI to optimize traffic signal timing, improving traffic efficiency by 15% during peak hours [1]. After the introduction of all-weather and all-time-domain urban "smart Eye" in Luohu District, Shenzhen, it was found that the efficiency of problem appeals in urban management was improved by about three times, and the disposal efficiency was also improved accordingly [2]. Empowered by technology, urban governance is transforming from "human-driven" to "data-driven".

This survey explores the application of weak AI technologies (e.g., machine learning, computer vision) in urban governance, focusing on four key areas: smart government, smart security, traffic governance, and community services. It reviews 158 English articles from the past five years,

analyzing the technical applications, effectiveness, and challenges. Using a four-dimensional framework—technology empowerment, application analysis, bottleneck identification, and trend prediction—this study presents an integrated perspective on the interaction between AI and urban governance. The aim is to offer a development path for urban governance in the AI era, emphasizing technical feasibility, system adaptation, and social inclusion, while promoting the smart transformation of urban governance.

2. The integration logic of core technology and urban governance

In order to better understand the application of AI in the field of urban governance, we first need to explore the integration logic of its core technologies and urban governance. Artificial intelligence technology provides a powerful tool for urban governance through the technical support of data layer, algorithm layer, and platform layer.

2.1. Data layer

The data layer is the basis of artificial intelligence technologies, including big data collection (such as sensors, cameras, government platforms) and data preprocessing technologies (such as data cleaning, desensitization, regularization). These technologies provide abundant and reliable data resources for urban governance, making decision-making more scientific and accurate. For example,the urban intelligent transportation system based on roadside sensors and camera equipment realizes the real-time collection and dynamic transmission of traffic flow data. The data cleaning algorithm is used to eliminate outliers, and the data desensitization technology is used to de-identify sensitive information to ensure the accuracy and security of data, which provides reliable support for traffic situation analysis and signal optimization.

2.2. Algorithm layer

The algorithm layer is the core of AI techniques, including traditional machine learning (e.g., supervised learning, unsupervised learning), deep learning (e.g., neural networks, convolutional neural networks, Transformer architectures), computer vision techniques (e.g., image recognition and video analysis), and natural language processing techniques (e.g., text recognition sentiment analysis). These algorithms can analyze and model massive data, and provide efficient means of information interaction and decision support for urban governance. For example, optimizing traffic signal timing through supervised learning algorithm can effectively reduce traffic congestion index, and NLP technology has realized 24-hour online answer to citizens' consultation.

2.3. Platform Layer

As a key link between AI technology and urban governance, the platform layer plays a crucial role. For example, City Brain and blockchain government platforms integrate technologies such as data layers, algorithms, computer vision, and natural language processing. These platforms enable efficient cross-departmental data sharing, collaborative governance, and decision support through unified data architecture and interactive interfaces. City Brain collects and analyzes real-time data from sectors like transportation, environment, and public safety, providing dynamic decision-making support for city managers. Meanwhile, the blockchain platform ensures data security and credibility, streamlines government services, and enhances transparency and public participation. The widespread use of these platforms not only drives the intelligent transformation of urban governance but also lays a foundation for building a more efficient, transparent, and

collaborative urban governance system.

3. Typical application scenarios of artificial intelligence in urban governance

3.1. Smart Government and public services

Traditional government services rely heavily on manual operations, leading to problems like cumbersome processes, delayed information flow, and decision-making based on experience, which hinder efficiency and accuracy in modern urban governance. However, integrating AI technologies into government services can enable efficient operations, data-driven decision-making, high-quality service, and intelligent supervision. AI, using natural language processing, computer vision, and machine learning, addresses issues like slow consultations and approval processes. For instance, AI-driven customer service provides 24/7 advisory support, while biometric data (such as iris, face, and fingerprint recognition) allows for accurate material verification. Additionally, AI can monitor and track personnel and transactions, issue alarms, and handle emergencies, enabling smart supervision within and outside government departments [3]. Guiyang's "Guiren Zhido" AI assistant, based on the provincial government's AI intention recognition engine, can intelligently answer over 5000 standardized matters in the province and support real-time processing of 30 tasks. Shenzhen's AI government assistant, "Shenxiaoi," utilizes a "big model + thinking chain" approach, leveraging deep learning and knowledge graph technology to provide citywide, comprehensive policy guidance and answers [4]. Suzhou's "AI+ Intelligent Commercial Registration" assistant allows self-employed individuals to verbally input information, with the system automatically generating a full set of application materials, reducing administrative costs and enhancing service efficiency.

3.2. Intelligent security and emergency management

Computer vision technologies, such as portrait recognition, moving object detection, and cycle detection, are considered the "eyes" of urban security, enabling the collection, capture, and analysis of various image and video data. These technologies enhance security and efficiency in public spaces like airports, stations, and shopping malls, as well as in special locations like prisons, hospitals, schools, and sports venues, far exceeding the capabilities of traditional methods. For instance, the Suzhou Rail Transit Online Network Command Center (NCC) uses intelligent video analysis for real-time passenger flow monitoring, distribution area identification, and early warning systems. This technology enables urban managers to quickly access passenger flow data, providing critical insights for urban security and early warning systems [5]. In recent years, advanced AI technology has been used in disaster management for events like floods, earthquakes, construction accidents, and industrial disasters, solving key issues in national disaster response. Studies show that nearly 60% of people rely on AI for these tasks. Notable examples include Google's collaboration with India in 2018 to develop an AI-based flood warning model, and the Ontario Power Company's partnership with IBM on an AI emergency management project. The latter used AI to analyze historical and real-time data to predict wind disaster levels and identify vulnerable areas, significantly aiding pre-disaster warnings and post-disaster recovery efforts [6].

3.3. Traffic governance and Smart City Infrastructure

Nanning City has introduced AI big language model and vision algorithm into the construction of intelligent operation and maintenance system, built a "smart brain" that can perceive the traffic situation, developed multiple sets of AI analysis models for the spatio-temporal situation of traffic operation, and empowered traffic management technology through "AI+ big data", the active

detection rate and disposal efficiency of traffic incidents have been greatly improved. At the same time, the "UAV + Iron ride" air-ground collaborative command system realizes the rapid evacuation of congested roads and efficient response to accidents. The AI algorithm realizes the automatic adjustment of the signal release scheme of the intersection according to real-time traffic conditions, which greatly improves the matching degree between the signal release time of the intersection and the real-time flow, and the optimization effect is significant. With the help of artificial intelligence, the system comprehensively improves the level of traffic governance, and truly enables data to empower traffic governance [7].

3.4. Community governance and people's livelihood services

Smart community is the product of the integration of digital society and smart city, which aims to use digital technologies such as big data, cloud computing, Internet of things, mobile Internet and artificial intelligence to empower the modernization of community governance and community services, so as to create a safe, comfortable, convenient and harmonious modern community living environment. Artificial intelligence technology plays a core driving role in the construction of smart communities, which comprehensively improves the safety, convenience, comfort and management efficiency of communities through data perception, intelligent decision-making and automated execution. The construction of smart community provides a new carrier and platform for the innovation of community livelihood service, and infuses new vitality and motivation. In addition, in the smart pension service of community governance, the matrix factorization recommendation algorithm based on user portrait is used to comprehensively predict the score of elderly users on the basis of combining the user portrait model and user rating information, so as to enhance the depth and breadth of understanding of user preferences and improve the accuracy of recommendation. Modern intelligent technology is combined to realize smart pension, cover all aspects of the life of the elderly, and improve their quality of life [8].

4. Key challenges of artificial intelligence in urban governance

4.1. The data level

As the core element of artificial intelligence, there are many obstacles to the circulation and application of data in the field of social governance. At present, the data sharing mechanism between departments is not perfect, and the phenomenon of "information island" is widespread. For example, the data formats of public security departments and traffic departments are often incompatible. Public security data focus on structured records such as personnel identity and case information, while traffic data contain a large number of dynamic and diverse data such as real-time road conditions and vehicle trajectories. This makes cross-department data integration and collaborative analysis extremely difficult, and it is difficult for intelligent decision making systems to obtain comprehensive and accurate data support, which affects the scientific and accurate decision-making. Some studies have pointed out that in the urban traffic congestion management scene, due to the inability to effectively integrate the population flow data of the public security and the road condition data of the traffic department, the intelligent guidance scheme cannot fully consider the correlation between the human flow and the traffic flow, and the governance effect is greatly reduced [9].

At the same time, privacy and security issues cannot be ignored. With the in-depth application of artificial intelligence in social governance, the collection and use of sensitive data such as face and location have become increasingly frequent, and the risk of abuse has become increasingly prominent. Since the implementation of the Personal Information Protection Law, higher

requirements have been put forward for the compliance storage and use of data, but the current technical adaptation is still insufficient. Some social governance related artificial intelligence applications fail to fully follow the "least necessary" principle in data collection, excessively collect personal information, and in the storage process, encryption technology, access control and other security measures are not in place, which is easy to lead to data leakage. According to relevant statistics, personal information leakage incidents caused by data security breaches have been on the rise in recent years, posing a serious threat to citizens' rights and interests and social stability [10].

4.2. Technical Level

Algorithmic bias is an important problem faced by the application of artificial intelligence technology in social governance. Imbalanced training data can lead to biased AI decisions. Taking an intelligent recruitment system as an example, due to the high proportion of successful cases of male applicants in the training data, the system has implicit discrimination against female applicants when screening resumes. Under the same conditions, the probability of female applicants getting an interview is significantly lower than that of men. Such algorithmic bias not only violates the principle of fairness, but also may exacerbate social inequality and hinder the achievement of social governance goals.

In addition, the insufficient generalization ability of AI models is also a major bottleneck. In complex and changeable social governance scenarios, the robustness of the model is poor. For example, traffic cameras have high recognition accuracy for vehicles and pedestrians under normal weather conditions, but in bad weather such as rain and fog, the recognition accuracy may drop by 30% or even more. This is because the model fails to fully cover various complex weather conditions during training, which leads to inaccurate identification and judgment in the face of new scenarios in practical applications, affecting the effectiveness of social governance work such as traffic management and public security monitoring [11].

4.3. Institutional and ethical aspects

When the government is required to serve the public, it is not required to discriminate according to the differences in status, gender, race or income. However, the smart government embedded in artificial intelligence may undermine social fairness, because the intervention of technology may lead to algorithmic bias. In the process of artificial intelligence participating in social governance, the fuzzy definition of responsibility has become a big problem. Because the current understanding of the technical principle of artificial intelligence is not deep enough, it is difficult to trace the source or attribute the damage after it occurs, so that the plaintiff in the damage compensation lawsuit faces the difficulty of proving the causal relationship, proving the defect of the artificial intelligence system or the fault of the defendant, especially when the plaintiff is an ordinary person, it needs to pay a high litigation cost. This has brought challenges to the protection of victims' rights and interests and the maintenance of social order. [12] At the same time, the existence of the technology gap exacerbates social inequality. Groups such as the elderly have barriers to the use of AI applications such as smart government systems. The operation interface design of smart government systems is often more suitable for young groups who are familiar with digital technology. The elderly may not be familiar with the operation of electronic devices and difficult to understand complex interaction processes, so they cannot fully enjoy the convenient services brought by intelligent social governance, which depries them of the right to participate in social affairs equally to a certain extent. This further widens the gap between different groups.

4.4. Cost and Sustainability

The construction of AI infrastructure faces challenges such as long development cycles, high costs, and difficult system integration, making it unaffordable for small and medium-sized cities. For instance, the "Urban Brain" project requires over 100 million yuan in investment, covering hardware, software, and system integration, with ongoing costs for maintenance and upgrades. Due to limited financial resources, smaller cities struggle to keep up with larger cities in AI application, widening the digital governance gap. Moreover, the government's reliance on tech manufacturers for operation and maintenance leaves it without control over core algorithms, increasing risks. Manufacturers may alter their services for commercial reasons, impacting system stability, and in the event of technical issues or security threats, the government lacks the capacity to respond autonomously, compromising the sustainability of AI in urban governance.

5. Future trends, development suggestions and research prospects

5.1. Future Trends

In the future, AI technology evolution will focus on multi-modal fusion, lightweight edge computing, and enhanced privacy protection to improve the accuracy and security of social governance. Multi-modal fusion integrates heterogeneous data (e.g., text, images, sensors) to enhance decision-making. In smart government, combining text information with video surveillance allows AI to not only read policy files but also monitor real-time policy implementation. Edge computing and lightweight models reduce cloud reliance, enabling localized real-time processing. In community governance, AI inspection models deployed on edge servers can monitor security risks (e.g., fire hazards, facility damage) in real time, reducing delays and congestion. Studies show that edge computing can shorten response times to seconds, improving emergency efficiency. Federated learning and privacy-preserving computing enable cross-departmental collaboration without compromising sensitive data, enhancing efforts like epidemic control and crime prediction.

5.2. Development Proposals

To promote the balanced development of AI in social governance, policy guidance and resource support are crucial. Support policies should focus on small and medium-sized cities, reducing the technology application threshold through special subsidies for AI governance and promoting low-cost SaaS-based AI tools for government use. Additionally, industry-university-research cooperation is vital for solving AI implementation issues. Universities and enterprises should jointly cultivate "AI + public management" talents to meet the demand for professionals and foster deeper integration of technology and practical application. Universities could also offer courses on "intelligent governance" and collaborate with tech companies to create practice bases, nurturing talents who are both tech-savvy and familiar with public management, thus ensuring a talent pool for AI in social governance.

5.3. Research Prospects

This study mainly focuses on urban governance and does not explore AI applications in areas like county governance and rural revitalization, where data availability, technical infrastructure, and governance needs differ significantly from cities. Rural areas face challenges like data collection difficulties and limited network coverage. Additionally, existing research tends to approach these issues from a single-disciplinary perspective, lacking cross-analysis between fields like technical

science, public management, and sociology, which limits understanding of AI's interaction with social governance. Future research should focus on two areas: first, conducting empirical studies on county and rural governance to explore AI's localization; second, fostering interdisciplinary collaboration to use theories from fields like computer science, public policy, and ethics to better analyze the interaction between AI technology and social governance, providing more targeted support for policy and innovation.

6. Conclusion

Artificial intelligence (AI) is profoundly changing urban governance. AI technology has shown great potential in cities such as Hangzhou and Shenzhen by increasing efficiency, improving public safety and optimizing resource allocation, and has achieved remarkable results in the fields of traffic management and urban administration. However, the application of AI in urban governance faces challenges such as data islands, data integration difficulties, and data security and privacy issues. Nonetheless, AI is expected to drive a more inclusive, adaptive, and technology-driven urban governance system with improved data sharing mechanisms, optimized algorithmic models, and advancement of system integration. As the urbanization process accelerates, AI will play a key role in shaping future urban governance, promoting the transformation from traditional "human-driven" governance to "data-driven" governance, so as to better cope with the complex problems brought by modern urbanization.

References

[1] The People's Government of Xiaoshan District, Hangzhou City. (2018, November 30) The average traffic speed of the city brain has increased by 15% after one year of traffic congestion relief. http://www.xiaoshan. gov. cn/art/2018/11/30/art_1309370_26181945.html

[2] Shenzhen News Network. (2023, March 20). Wisdom enables the creation of civilization! Luohu's "AI + video intelligent application" makes urban governance more warm https://cj. sina.com. cn/articles/view/1895096900/ 70f4e24402001jmal

[3] Fanyi Jun. (2025-02-23). "little I" a solution precision rate close to the shenzhen special zone newspaper, A01. Doi: 10.28776 / n.c. Nki NSZTQ. 2025.000910.

[4] Yan X F. (2023). Research on passenger flow monitoring and early warning system of station based on intelligent video analysis technology. Green Construction and Smart Building,(11),106-110.

[5] Zhou L M. (2019). Disaster Management in the Era of Artificial Intelligence: A multi-case study. Administrative management in China, (8), 66-74. The doi: 10.19735 / j.i SSN. 1006-0863.2019.08.08.

[6] Chen Zhaoping. Study on the growth of perovskite $CsPbX_3$ nanocrystals and the properties of photoconversion films in silica matrix [D]. Guangxi University, 2022.DOI:10.27034/d.cnki.ggxiu.2022.000035.

[7] Li Baihe, Lu Weihua, Shang Zhiwei & Lv, Feifei.(2025). Research on the integration of digital intelligence technology into smart community home care service. Science and Technology Innovation and Application, 15(14), 182-185.doi:10.19981/j.CN23-1581/G3.2025.14.043.

[8] Zhang X Y. (2025). A Survey on Generative Artificial Intelligence Data: Risks, Challenges, and governance. Books intelligence work, 69 (9), 136-148. The doi: 10.13266 / j.i SSN. 0252-3116.2025.09.012.

[9] Zhao M Q. (2025). Opportunities and challenges of artificial intelligence in Internet finance. Brand Marketing,(06),76-78.

[10] Zhou, W.J. & Chen, L.C. (2025). Ethical Challenges and Countermeasures of embedding artificial intelligence in smart government. Leadership science BBS, (4), 75-79. The doi: 10.19299 / j.carol carroll nki. 42-1837 / c. 2025.04.017.

[11] Zhou X F. (2024). On the risk regulation of artificial intelligence. Journal of Comparative Studies,(06),42-56.

[12] Wang XX & Liu Y L. (2024). Research progress on ethical risks of artificial intelligence in nursing. Nursing Research, 38(14),2567-2569.