Balancing Data Utilization and Privacy Security: A Quadruple Governance Framework for Smart Cities

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Abstract

With the continuous advancement of smart city construction, digital technologies such as big data and artificial intelligence have been widely adopted in urban governance. Multi-source and heterogeneous government data, urban perception data and resident personal data provide crucial support for refined urban governance. However, in the process of regular data collection, cross-subject circulation and large-scale application, security problems including excessive data collection, privacy leakage, illegal abuse and out-of-control authority frequently occur. The conflict between data value mining and privacy security protection has become increasingly prominent, restricting the safe and sustainable development of smart cities. Aiming at the practical shortcomings of imperfect urban data governance system, lagging technical protection capabilities, inadequate supervision mechanism and vague rights and responsibilities division, this paper systematically sorts out data privacy and security risks throughout the full life cycle of urban data. It further constructs a quadruple collaborative governance framework integrating technical defense, institutional standardization, supervision constraint, and responsibility tracing. Combined with hierarchical data management, data desensitization, privacy computing and other technical and institutional measures, this paper explores an optimized path for the coordinated development of efficient data utilization and security protection. This study effectively balances the data empowerment value and privacy security risks in smart urban governance, improves the urban data governance system, and provides theoretical support and practical references for the digital, safe and standardized governance of global smart cities.

Keywords

Smart city, data utilization, privacy security, collaborative governance, governance framework.