Explainable AI for Autonomous Management in 5G/6G Networks: Towards Trustworthy Zero-Touch Operations

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***Abstract*—The transition toward 5G and emerging 6G networks introduces unprecedented complexity in network management, driven by dynamic resource demands, heterogeneous services, and stringent quality requirements. While AI-driven automation promises efficient operations through zero-touch management, the opaque nature of complex machine learning models raises critical challenges in trust, transparency, and regulatory compliance. This research explores novel Explainable AI (XAI) methodologies integrated within Distributed Management and Orchestration (DMO) systems to enable interpretable and trustworthy autonomous network operations. Our approach focuses on developing temporal-aware explanation techniques that provide actionable insights into AI model behavior and prediction rationale. By bridging the gap between AI decision-making and human understanding, the framework facilitates auditable autonomous corrections while maintaining operational efficiency. This work aims to establish foundational principles for self-healing networks that are both intelligent and interpretable, paving the way for trustworthy zero-touch management in next-generation networks.**

***Index Terms*—Explainable AI (XAI), 6G Networks, Distributed Management and Orchestration (DMO), Zero-Touch Management, Autonomous Networks, Trustworthy AI.**

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