

Explainable Artificial Intelligence for Trustworthy Decision-Making Systems

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Abstract

Artificial Intelligence (AI) is increasingly being used in decision-making systems across healthcare, finance, education, cybersecurity, public services, and business management. However, the growing complexity of machine learning and deep learning models has created significant challenges related to transparency, interpretability, accountability, and user trust. Explainable Artificial Intelligence (XAI) addresses these challenges by providing understandable explanations of how AI systems generate predictions or recommendations. This paper examines the role of XAI in developing trustworthy decision-making systems and explores how explainability can improve transparency, reliability, fairness, and human oversight. The study discusses prominent explanation approaches, including feature importance, rule-based explanations, local and global model interpretation, and model-agnostic techniques. It also considers important challenges such as explanation accuracy, interpretability, computational complexity, privacy, algorithmic bias, and the trade-off between model performance and explainability. Furthermore, the paper highlights the importance of involving domain experts and end users when designing explanations so that AI outputs can be effectively understood and evaluated. A conceptual framework is proposed in which explainability, fairness, robustness, and human oversight collectively contribute to trustworthy AI-based decision-making. The study concludes that XAI can play a significant role in increasing confidence in AI systems when explanations are accurate, meaningful, and appropriate to the intended users and application context. The findings emphasize the need for transparent and responsible AI development to support informed human decision-making.

Keywords: Explainable Artificial Intelligence, Trustworthy AI, Decision-Making Systems, Machine Learning, Interpretability, Transparency, Algorithmic Fairness, Human-AI Interaction.