Advancing Artificial Intelligence and Machine Learning for Efficient and Trustworthy Computational Systems

Artificial Intelligence (AI) and Machine Learning (ML) are transforming the landscape of Computer Science and Engineering (CSE) by enabling systems that can learn, adapt, and make intelligent decisions with minimal human intervention. While AI/ML applications are widely deployed across domains such as healthcare, finance, cybersecurity, and autonomous systems, challenges remain in terms of scalability, interpretability, data privacy, and ethical use. This research aims to explore novel AI/ML frameworks that integrate deep learning, reinforcement learning, and natural language processing with an emphasis on explainable and trustworthy AI. The primary objective is to design computational models that balance performance with transparency, making them more applicable for mission-critical systems in real-world environments. The study will focus on three core directions: (1) developing efficient algorithms to handle large-scale and imbalanced datasets, (2) designing interpretable ML models that provide explainability without compromising accuracy, and (3) investigating privacy-preserving learning techniques such as federated learning to ensure data security and compliance. By addressing these issues, the research seeks to contribute to both the theoretical foundations and practical applications of AI/ML in the CSE field. The outcomes are expected to advance the development of robust, ethical, and industry-ready intelligent systems, paving the way for future innovations in automation, human–computer interaction, and decision-support technologies.

Keywords: Artificial Intelligence, Machine Learning, Computer Science and Engineering, Explainable AI, Federated Learning, Deep Learning, Trustworthy AI