

AN ETHICAL AND SECURE ARTIFICIAL INTELLIGENCE FRAMEWORK FOR SMART LEARNING SYSTEMS USING QUANTUM SECURITY AND PREDICTIVE DATA ANALYTICS

Karan Malhotra, Meera Joshi & Sandeep Reddy

Department of Computer Science and Engineering, Amity University, Noida, Uttar Pradesh, India

ABSTRACT

Artificial intelligence (AI) has transformed modern education by enabling personalized learning, intelligent tutoring, automated assessment, and data-driven decision-making. Despite these advancements, concerns relating to data privacy, cybersecurity, algorithmic bias, transparency, and ethical governance continue to hinder the widespread adoption of AI-powered smart learning systems. This study proposes an ethical and secure artificial intelligence framework that integrates quantum security mechanisms with predictive data analytics to improve the safety, reliability, and effectiveness of smart learning environments. The framework combines ethical AI principles, quantum-based cryptographic techniques, and machine learning models to ensure secure data transmission, protect sensitive student information, and support accurate prediction of students' academic performance and learning behaviours. Predictive analytics is incorporated to identify at-risk learners, recommend personalized learning pathways, and assist educators in making timely instructional decisions. The proposed framework also emphasizes transparency, accountability, fairness, and human oversight in AI-driven educational systems, ensuring that technological innovations remain aligned with educational objectives and ethical standards. A quantitative research approach is adopted to evaluate the effectiveness of the framework using data collected from higher education institutions. The findings are expected to demonstrate that integrating quantum security with ethical AI governance and predictive analytics significantly enhances the confidentiality, integrity, and availability of educational data while improving learning outcomes and institutional decision-making. The study contributes to the growing body of knowledge on artificial intelligence in education by presenting a comprehensive framework that addresses both technological and ethical challenges associated with smart learning systems. It also provides practical recommendations for policymakers, educational institutions, AI developers, and researchers seeking to implement secure, trustworthy, and learner-centred artificial intelligence solutions in higher education.

KEYWORDS: *Artificial Intelligence, Smart Learning Systems, Quantum Security, Predictive Data Analytics, Ethical AI.*

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