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(57) Abstract :

The present invention provides a development of an adaptive Machine Learning (ML) framework designed for dynamic curriculum generation and pedagogical optimization in higher education environments. The framework integrates learner analytics, content intelligence, institutional learning objectives, and real-time performance metrics to autonomously generate, update, and recommend personalized learning paths. By leveraging hybrid ML models including deep neural networks, reinforcement learning agents, and knowledge graph–driven semantic engines the system continuously evaluates learner progress, instructional effectiveness, and content relevance. The invention further employs predictive modeling to forecast knowledge gaps, suggest remediation strategies, and optimize instructional resource allocation. A novel multi-layer feedback integration module aggregates cognitive, behavioral, and engagement signals to refine curriculum structure dynamically. Additionally, a scenario-based curriculum simulator predicts learning outcomes for alternate pedagogical strategies. The framework ensures enhanced academic performance, improved learning efficiency, and scalable curriculum adaptability, thereby enabling higher educational institutions to transition toward intelligent, data-driven academic ecosystems. FIG.1

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