Chapter 2
Selecting ML/ DL Algorithms for Gamification of Formative Assessment:
A Framework and Analysis

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ABSTRACT

Gamification in formative assessment is a promising approach to enhance student engagement and learning in AI-era education. Machine learning enables personalized experiences and adaptive feedback, with advancements like Context-Aware

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ML, explainable ML, and self-attention models playing key roles. Determining the best approach for gamification requires careful analysis, as factors like algorithm transparency, adaptability, and educational complexity remain challenges. While reinforcement learning and collaborative filtering have been explored, their application in gamification lacks integration with recent ML developments. Hybrid models that combine multiple algorithms, empirical studies to evaluate effectiveness, and iterative refinement using user data offer potential solutions. This chapter will address these challenges and propose a framework (GOFA) for selecting optimal ML algorithms to enhance gamification strategies in formative assessments.

INTRODUCTION

Games in schools and colleges are now a big deal. They help students learn better and stay interested. Teachers use ongoing tests to see how students are doing and give them tips to get better. Games are great for this kind of testing. They make learning more fun and personal, which helps students do well and keeps them trying to improve. But for these game-based tests to work well, they need smart computer programs. These programs can make the learning just right for each student and give them the right kind of help.

Recent advances in computer technology have boosted the capabilities of these educational programs. They now possess the ability to grasp the student's environment, clarify their inner workings, and zero in on crucial aspects. Some software can adapt its teaching methods based on student life events. Other programs can reveal the reasoning behind their decisions, which builds trust among educators and learners (Gilpin et al. 2018). More recently, AI and machine learning have also entered the education sector, and their usage is growing based on the benefits observed in terms of cost, speed, and ease. There are specific challenges of ML applications in the education sector, such as the availability of computational resources, complexity, and selection of the right machine learning model. Considering the enormous developments emerging to reduce the computation complexity and requirements, the selection of a Machine Learning (ML) model for Game-Based Formative Assessment (GFA) system remains a critical problem. Recent developments such as Objective Function-Based Feature Engineering (OBFE) (Liu et al. 2021) and self and internal attention mechanisms (Vaswani et al., 2017) for sequential ML models can resolve several performance and reliability issues of ML models. OBFE allows the more rigorous features to be selected while training and predicting the given data, and it allows domain-based specific features to be used in the decision-making process, and long-term attention mechanisms ensure long-term dependencies in the sequential data sets are taken care of. With OBFE and efficient long-term at-

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