AI-Enhanced Team Formation in Online Learning Environments

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ABSTRACT

The transition to online education during the COVID-19 pandemic has significantly disrupted traditional pedagogical interaction, especially in non-verbal cues such as facial expressions and body language, which are crucial aspects of collaborative learning. Traditional indicators of team synergy play a role in student engagement and are often lost in virtual environments. This loss can impede communication, hinder team rapport, and adversely affect student motivation and academic outcomes.

To address these challenges, our project proposes an innovative AI framework to enhance team formation and collaboration in online learning. Central to this framework is the use of the Upper Confidence Bound (UCB) algorithm, which optimizes team composition by considering academic strengths and student preferences, thereby fostering more dynamic and effective collaborative learning environments.

UCB's role involves balancing two critical aspects of student team formation: the preference for familiarity and addressing academic diversity among students to enhance the learning experience. The UCB algorithm takes input from the Non-Dominant Sorting Genetic Algorithm (NSGA) and achieves its objectives by iteratively evaluating and updating strategies based on student feedback. It calculates the upper confidence bound for each potential team composition, which includes a measure of both the expected success of the team and the degree of uncertainty or exploration. This approach ensures the repetition of past successful formations and the exploration of new combinations, potentially uncovering more effective team dynamics.

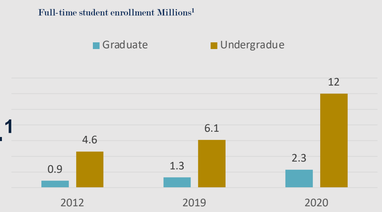
Online Education Surge: A Statistical Overview

In 2026:
The global market share will **reach $336.98 billion.**[1]

In 2027
The number of students is expected to be **1 billion worldwide.**[1]

Between 2019 to 2020
Full-time student enrollment **increased 100%.**[1]

90% of Students
will successfully reach higher levels, but only if given enough attention, as face-to-face learning is the best approach to providing these levels of attention.[2]



40% to 80% of Students Drop out during online courses, a significant contrast to traditional classroom settings. This disparity highlights underlying challenges in virtual learning environments, including motivational issues that stem from students' perspectives.[3]

[1]Diaz-Infante et al., 2022 McKinsey & Company.
[2]University of the Potomac, online-learning-vs-traditional-learning
[3]Papia Bawa et al., 2016. Retention in Online Courses: Exploring Issues and Solutions—A Literature Review

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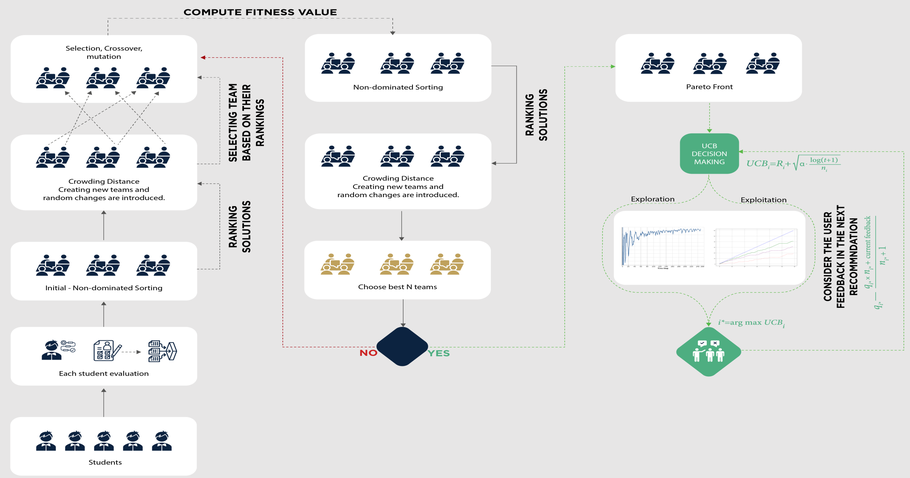
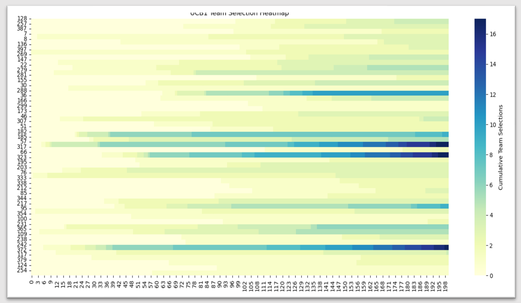
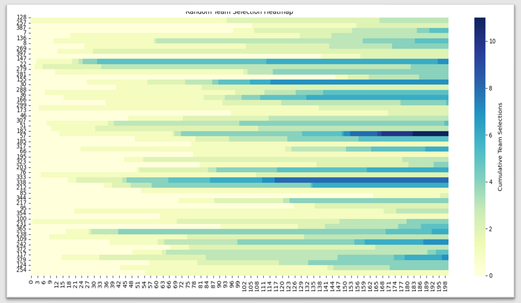
Enhanced Engagement and Collaborative Learning



Preliminary Results



Heat-map demonstrates that the UCB algorithm consistently recommends high-reward teams to the user. It's clear from this visualization that the algorithm has identified a distinct pattern.



To contrast with the UCB algorithm, this plot illustrates the teams recommended to the user on a random basis. It's evident that there's no discernible pattern in these random recommendations.

The chart reveals that the UCB algorithm outperforms random selection in terms of cumulative rewards. We can observe that in the beginning both of random and UCB approach are exploring up to 15 teams selected, then we clearly see that the UCB started creating pattern to choose the most reward team.