

OR-DRPD-AI2020: Fair AI Responding to Online Education (FAIR_EDU)

Online education has received great popularity in K-12 and higher education (Wong et al., 2019). The closing of physical schools around the world due to the COVID-19 has further aroused people's attention to online learning (Carter Jr et al., 2020). However, the online delivery format and the potentially large number of students enrolled in each course raise methodological difficulties for instructors as they try to identify academically at-risk students remotely and provide in-time interventions (Mayer, 2019).

There is a need to find efficient and effective methods to help instructors detect online at-risk students of dropout or fail in the class. The emerging fields of learning analytics (LA) and artificial intelligence in education (AIED) seem to offer promising alternatives. LA and AIED enable analyzing the large low-level digital trace data (students' interactions with an online learning platform and with other students) using machine learning techniques to automatically infer students' motivation and engagement, two of the most important factors that influencing online students' learning outcomes (Xing et al., 2019). Relying on these factors, a prediction model can be further constructed to forecast students' academic performance in advance (e.g., predict whether a student might succeed or fail a course in the mid of a semester, Xing et al., 2015, Xing & Du, 2019) in order to inform educational decision-making (e.g., intervention).

While the ways to build engagement factors from the log data are mature and with high fidelity (Toro-Troconis et al., 2019), the methods and performance of motivation detection in online learning is not consistent and varies widely (Leony et al., 2015). Moreover, limited attention has been paid to the fairness of prediction with machine learning in educational settings (Tsai et al., 2020). For example, a student course grade prediction model is twice as likely to incorrectly predict African American students as high risk of failure than their Caucasian classmates.

This project aims to **build machine learning models for Algebra Nation, an online learning platform co-owned by UF College of Education that can (1) precisely detect online students' motivations from textual data and (2) fairly predict students' grades without being biased with demographic factors.**

Algebra Nation is designed to support online learning of algebra for K-12 schools with **8,835,359** students. The data set consists of both their learning and communication records such as clickstream, discussion posts, and assessments. More than **1.64 billion** log data taking 137 GB disk space were recorded and roughly 20 million discussion posts/replies were created. The short-term impact of this study is directly on the almost 9 million students using Algebra Nation by providing accurate motivation detection application and fair student grade detection for teachers to design early intervention and by serving as an exemplar machine learning project for other online learning platforms. The long-term impact of this project is to enhance the scientific understanding of motivation detection in online learning and effects of applying machine learning for education bias reduction.