Thrice Adaptive Optimized Machine Learning (TRAM) Framework for Patient No-Shows, Rescheduling, Cancellations, Unpunctuality, and Tardiness Prediction

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Abstract

Patient no-shows to scheduled appointments impact the outpatient unit's operational efficiency and revenues, deprive patients of access to care, and lead to poor health outcomes in the communities the hospitals serve. On the other hand, if patients aren't punctual and late for appointments, it increases the wait times for other patients, leading to decreased patient satisfaction and increased overtime costs for the outpatient unit. Similarly, Cancellations and Rescheduled appointments can be significant problems for the outpatient unit as it may be tough to find a patient to accommodate canceled/rescheduled appointment slots. One of the ways clinics handle this problem is through overbooking, but it can lead to increased wait times and overtime costs if not well planned. To solve this problem, this work sought to develop machine learning to estimate the patient's arrival status, punctuality, and delay. The models are developed separately for new and established patients. Another problem is that identifying the right features and hyperparameters can be tedious when developing machine learning models. This work presents a systematic approach using various adaptive optimization techniques for feature selection and discrete and continuous hyperparameter optimization that work in tandem. Since we optimize the machine learning models three times for feature selection, discrete and continuous hyperparameters, This approach is named TRAM (Thrice Adaptive Optimized Machine Learning Model).