UNCERTAINTY QUANTIFICATION IN HEALTHCARE DATA: MODELS FOR A TRUSTWORTHY AI

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Time: 4:00 – 6:00 pm on 02/08/2024

Zoom Link: https://binghamton.zoom.us/j/96412377729

Abstract

The strive for perfection is highly valued in all aspects of human life. However, it is much expected when human life or well-being is in jeopardy. This scenario is present consistently in medicine. The field of medicine relies on a mix of exact science, art, and technology to treat, diagnose, and prevent illnesses and injuries. It relies on efficiency and the ability to provide the best possible outcome in each process and operation because of the heavy repercussions of error. Technology has greatly assisted the medical field; however, adopting machine learning and artificial intelligence is still experimental. The main issue that is halting this leap in medical technology is the trustworthiness of the product of artificial intelligence-powered machines. This research aims to create a framework that reviews and quantifies the uncertainty of machine learning models. For this purpose, healthcare data will be utilized to provide a machine learning and optimization-based solution for a medical-based issue. Multiple branches in healthcare exist that can highly benefit from the integration of machine learning-based automation and decision support. In this research, the focus will be on organ donation and transplant outcomes. The uncertainty estimation will first be integrated into a hybrid machine learning model to process data with different structures and predict a multiclass organ donation outcome based on different donor and medical assessment criteria. As part of the methodology, the major parameters will be optimized using robust metaheuristics to deliver a fully customized machine-learning model for this problem. Moreover, it is intended to understand better the relationship between the predictors and the donation outcome to maximize the transplanted organs and reduce the discard rate. The second part of this research aims to create a robust approacher staff optimization problem based on race, urgency, and travel time matching. The urgency factor is developed as a special constraint of this problem, including an uncertainty parameter.