Health Applications Society
Online Seminar Series

Interpretable Machine Learning for Resource Allocation with Application to Ventilator Triage

Abstract: Rationing of healthcare resources is a challenging decision that policy makers and providers may be forced to make during a pandemic, natural disaster, or mass casualty event. Well-defined guidelines to triage scarce life-saving resources must be designed to promote transparency, trust and consistency. To facilitate buy-in and use during high stress situations, these guidelines need to be interpretable and operational. We propose a novel data-driven model to compute interpretable triage guidelines based on policies for Markov Decision Process that can be represented as simple sequences of decision trees (*tree policies*). In particular, we characterize the properties of optimal tree policies and present an algorithm based on dynamic programming recursions to compute good tree policies. We utilize this methodology to obtain simple, novel triage guidelines for ventilator allocations for COVID-19 patients, based on real patient data from Montefiore hospitals. We also compare the performance of our guidelines to the official New York State guidelines that were developed in 2015 (well before the COVID-19 pandemic). Our empirical study shows that the number of excess deaths associated with ventilator shortages could be reduced significantly using our policy. Our work highlights the limitations of the existing official triage guidelines, which need to be adapted specifically to COVID-19 before being successfully deployed.

Bio: Carri W. Chan is the John A. Howard Professor of Business and the Faculty Director of the Healthcare and Pharmaceutical Management Program at Columbia Business School. Her research is in the area of healthcare operations management. Her primary focus is in data-driven modeling of complex stochastic systems, efficient algorithmic design for queuing systems, dynamic control of stochastic processing systems, and econometric analysis of healthcare systems. Her research combines empirical and stochastic modeling to develop evidence-based approaches to improve patient flow through hospitals. She has worked with clinicians and administrators in numerous hospital systems including Northern California Kaiser Permanente, New York Presbyterian, and Montefiore Medical Center. She is the recipient of a 2014 National Science Foundation (NSF) Faculty Early Career Development Program (CAREER) award, the 2016 Production and Operations Management Society (POMS) Wickham Skinner Early Career Award, and the 2019 MSOM Young Scholar Prize. She currently serves as a co-Department Editor for the Healthcare Management Department at *Management Science*. She received her BS in electrical engineering from MIT and MS and Ph.D. in electrical engineering from Stanford University.

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This seminar series is supported by INFORMS Healthcare Applications Society and organized by Sanjay Mehrotra (Northwestern University), Sait Tunc (Virginia Tech), and Qiushi Chen (Pennsylvania State University). If you have any questions, please contact us at hasseminarseries@gmail.com!