Ph.D. in Information Technology
Thesis Defense

September 16th, 2025
At 2:30 p.m.
Aula Seminari Alessandra Alario – Building 21

Martina DONEDA– XXXVII Cycle

ON DATA & DECISION-MAKING: PERSPECTIVES FROM HEALTHCARE APPLICATIONS CONSIDERING REPRESENTATIVENESS AND ANALYTICAL SCOPE
Supervisor: Prof. Giuliana Carello

Abstract:

This Dissertation explores the interplay between data and decision-making in healthcare, focusing on two key dimensions: data representativeness and analytical scope. As healthcare systems increasingly rely on data-driven methods to face newer and complex challenges, it becomes essential to critically appraise how different approaches can influence decision-making.

Structured as a collection of papers, most of which were developed in collaboration with a healthcare provider, this Dissertation examines how data can be used to inform both policy and clinical practice, addressing methodological challenges that may arise when the available information is limited. The nine studies included in this Dissertation lay at the intersection of operations research and data science, and address fundamental questions such as: how is it possible to construct robust solutions when data on uncertain parameters is scarce? How can data science tools be used to design high-level healthcare strategies? In what ways can machine learning enhance clinical decision-making? When extensive data on a particular problem are available, how to best exploit this knowledge? Is it possible to assess the potential impact of a machine learning approach even before developing it?

The works included in this Dissertation employ several techniques, covering a wide range of approaches, from text mining and regression/classification models to simulation, (robust) (mixed) integer linear programming and (mat)heuristics. Two novel methodologies to address uncertain parameters are also proposed herein. Besides, these studies span all the levels of decision-making — strategical, tactical and operational — addressing managerial topics such as primary care network planning and blood donation governance, and clinical applications such as surgical planning and scheduling. All the reported case studies illustrate how data-driven operations research can improve efficiency, enhance patient outcome, and ultimately support decision-makers in navigating uncertainty. This Dissertation offers insights for both researchers and practitioners, emphasizing the applicability and impact of analytical tools in real-world settings.

PhD Committee

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