Decision Support for Complex Networks

Gonzalo Barbeito
University of the Federal Armed Forces, Munich
gonzalo.barbeito@unibw.de

Wolfgang Bein
University of Nevada, Las Vegas
wolfgang.bein@unlv.edu

Stefan Pickl
University of the Federal Armed Forces, Munich
stefan.pickl@unibw.de

1. Introduction

The mini-track "Decision Support for Complex Networks" invited contributions in the area of complex decision support under multiple criteria and where a multitude of variables have to be considered under significant uncertainty. Typically, such systems are used for crisis and risk management in diverse contexts and reachback situations, example applications in health care, transportation, energy grids, and security can be directly or indirectly found in the following papers. Common techniques run the gamut from heuristics, game theory, mathematical programming, and statistical methods to big data techniques.

This mini-track sought to showcase novel techniques or new interactions among existing techniques. Specifically, approaches used in the contributions published here include Stochastic Modeling, Agent-Based Modeling, Discrete Event Simulation, System Dynamics, Simulation-based Optimization and Geographical Information Systems. Furthermore, these papers demonstrate the pervasiveness and value of data in most analyses and for a broad set of domains. It is worth noting that all contributions of this mini-track tackle currently relevant topics and open challenges and adopt a pragmatic approach to them, whether proposing concrete improvement strategies or opening interesting discussions.

2. Contributions

The paper "Risk-Based Decision Support Model for the Optimal Operation of a Smart Energy Distribution Company for Enabling Emerging Resources" by Bagher Sadati *et al*. presents a new risk-based model for the operation of a Smart Energy Distribution Company. The aim of this contribution is to maximize stakeholder's profit through the optimization of operational control variables.

In order to do so, the developed model builds upon stochastic variables such as renewable energy sources and the future adoption of electric vehicles, among others, to assess future scenarios and determine the strategy with the highest return under acceptable risk levels.

In "Advancing Spatiotemporal Modeling of Access to Healthcare – A Methodological Perspective", Nasser Sharareh *et al*. propose an algorithm to augment traditional System Dynamics (SD) modeling with Geographical Information Systems (GIS). The main benefit of combining SD with GIS is found in the potential for enriching datasets, with spatial information outside the scope of the original problem. The authors demonstrated their methodology with a case study on healthcare access in the state of New York, USA, and found new insights that could prove useful to improve the healthcare system on a wider level.

In the third and final contribution, "In-Depth Behavior Modeling of Transportation Networks: Description and Preliminary Results of a Subway Network Model", Gonzalo Barbeito describes the conceptual ideas behind a new transportation network model and presents preliminary simulation results. The methodology used for this model combines Agent-Based Modeling with Discrete Event Simulation in a bottom-up approach, where physical properties of the system are modeled in detail and the emerging behavior is analyzed and contrasted with real data. The goal of this research is to support decision making for both passengers and network operators by stochastically assess network loads and train delays, and to provide a sandbox-like platform where new strategies can be developed to improve operations.

As a final note, this mini-track reflects an emerging and relevant area of research, requiring a unique amalgamation of theoretical and practical developments, as can be seen in the papers included. These contributions should spark thought-provoking discussions and bring to the spotlight new and interesting ideas.