FACS-CHARM: A Hybrid Agent-Based and Discrete-Event Simulation Approach for COVID-19 Management at Regional Level

I. Summary

The paper "FACS-CHARM: A Hybrid Agent-Based and Discrete-Event Simulation Approach for COVID-19 Management at Regional Level" introduces a hybrid simulation model for managing COVID-19 at the regional level. The model combines two approaches: Flu and Coronavirus Simulator (FACS), an agent-based simulation (ABS) predicting the spread of infections, and dynamiC Hospital wARd Managemt (CHARM), a discrete-event simulation (DES) of intensive care unit (ICU) patient flow.

Key Points of the Paper:

Objective: The model aims to predict the impact of public health measures on population health and healthcare services, focusing on ICU bed capacity management.

FACS Model: It simulates the temporal and spatial progression of COVID-19, considering factors like public health measures, emergence of new virus variants, and the impact of amenities distribution in a region.

CHARM Model: This model focuses on ICU patient flow and dynamically reconfigures hospital wards to manage COVID-19 patient admissions and regular hospital operations.

Hybrid Approach: The integration of FACS and CHARM allows for a comprehensive understanding of both the spread of infection in a community and its impact on local healthcare facilities.

Application and Future Work: The paper discusses the model's potential for regional COVID-19 management and future plans to include healthcare staff resources in the model and implement it as a distributed simulation.

The paper highlights the need for multiple simulation methods in tackling complex problems like pandemics and describes the structure and function of both FACS and CHARM in the hybrid model. This model is part of the STAMINA project, with case studies being developed in Turkey, Romania, and Lithuania.

II. Limitations

The paper "FACS-CHARM: A Hybrid Agent-Based and Discrete-Event Simulation Approach for COVID-19 Management at Regional Level" presents a novel simulation model integrating two methodologies, Flu and Coronavirus Simulator (FACS) and dynamiC Hospital wARd Management (CHARM), to manage COVID-19 at a regional level. FACS uses agent-based simulation to predict infection spread, considering public health measures and virus variants, while CHARM employs discrete-event simulation for ICU patient flow, focusing on ward reconfiguration in response to COVID-19 cases.

Despite its innovative approach, the model has limitations:

ICU Bed Resources Only: The model currently focuses only on ICU bed resources, not considering the crucial factor of healthcare staff shortages in hospital capacity management.

Scope for Future Work: The paper indicates plans to extend the model to include healthcare staff resources and to implement the hybrid model as a distributed simulation using a message broker interface.

Implementation Challenges: As the model is complex and combines different methodologies, its implementation and validation in real-world scenarios can be challenging.

Specific Use Case Limitation: The paper does not study specific use cases or present experimental results but plans to do so in future publications.

Overall, the paper provides a framework for managing COVID-19 at a regional level but acknowledges the need for further development to address its current limitations.