BUILDING AN ECOSYSTEM FOR DIGITAL TWINS IN HEALTHCARE

Liesbet Geris

GIGA In Silico Medicine, University of Liège, Belgium
Biomechanics Research Unit, KU Leuven, Belgium
Virtual Physiological Human Institute, Belgium

Digital twins in healthcare

The use of digital twins in healthcare (DTH) is rapidly increasing . One application area is the personalisation of medical care, where DTH can take the shape of in silico models of organs and organ systems used to test various treatment options, to customise therapy or plan surgery. In the context of the development of medical therapies (drugs & devices), DTH can be used as a tool throughout the entire R&D process to identify knowledge gaps and flaws, obtain a holistic and better understanding of a patient's disease, design novel strategies, optimise therapies, optimise therapy production, increase safety (by providing additional scrutiny) and shorten the time to market. DTH can be used to improve healthcare organisations by driving efficiency, optimising operational performance and enhancing both patient and caregiver experience.

Towards a Virtual Human Twin

Current solutions labelled as DTH are mostly single-scale, single-organ, single disease systems simply because going beyond this is still too complicated and time-consuming, and hence prone to be neither realistic nor reliable. However, the human body is highly entangled: events occurring at one anatomical location at a given time may influence processes occurring at different locations and at different times. Therefore, the number of clinically relevant questions answerable with single-scale, single-organ, single disease models is relatively limited. Including several scales and levels of organisations - even in a question-driven approach - generates huge challenges to modelling, increasingly subject to bottlenecks. To accelerate the adoption of an integrated Virtual Human Twin, it must first become easier to develop them, even when they need to be multi-scale, multi-organ, and multi-disease.

An ecosystem approach

The challenges related to developing a Virtual Human Twin call are too substantial to be handled by any one research group or even research project. They call for an ecosystem approach. The European Commission's Coordination and Support Action EDITH has as its objective to foster such an ecosystem and develop a roadmap towards the integrated Virtual Human Twin. The first step is an extensive mapping of relevant actors and initiatives, available resources (models, data sets, methods), infrastructures, DT-based solutions and services, as well as detecting technical and non-technical barriers to the uptake of DTH. This will allow to focus on the creation of a functional ecosystem bringing together all relevant stakeholders, including solution developers in academia and industry, technology/resource providers, end-users (particularly healthcare professionals and patients), regulatory agencies and HTA bodies.

Leveraging the budding ecosystem, the consortium is working on a roadmap for accelerating the uptake of the DTH-based solutions and their further integration. They will develop a blueprint of the Virtual Human Twin and identify the required (technical) developments, including but not limited to interoperability, computability, and integration of health data. The previously identified stakeholder needs and implementation barriers will be addressed. Additionally, an analysis of areas of applicability will be conducted, targeting especially applications representing high unmet medical needs and/or high societal benefits or clinical values. Finally, instruments such as funding, policies, standards, and specific recommendations will be specified for short and mid-term, taking into account the current legal, ethical, social and regulatory framework and country-specificities.

Summary

In this perspective talk, I will present the first version of the aforementioned roadmap and discuss the vision of the Virtual Human Twin, as well as the identified research challenges, infrastructure needs and policy requirements

Liesbet Geris is professor in Biomechanics and Computational Tissue Engineering at the University of Liège and KU Leuven in Belgium (PhD 2007 @ KU Leuven, h-index 39, 130+ publications, 2 edited books). Her research focusses on the multi-scale and multi-physics modeling of skeletal tissue engineering processes. Liesbet is scientific coordinator of Prometheus, a musculoskeletal Tissue Engineering platform. She has received an ERC starting grant and an ERC consolidator grant to finance her research and has received a number of young investigator and research awards. She is the current executive director of the Virtual Physiological Human Institute.