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DIGITAL TWINS OF LIVING SYSTEMS: THEORETICAL, IMPLEMENTATION & APPLICATION CHALLENGES

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ABSTRACT

Like in many application domains, digital twins are currently emerging as potential next-generation tools to assess and control living systems [1]. In healthcare, for instance, they could drastically improve diagnosis, prognosis and treatment of various diseases. There are, however, many specificities when dealing with living systems, notably their complexity (e.g., the extreme multiscale and multiphysics nature of the human body); the relatively limited (at least compared to other fields such as natural language on basic image processing) amount of available data, especially annotated/ground truth data, especially for rare diseases; the strong need for interpretability (especially when making clinical decisions); etc [2].

Many approaches to living systems digital twins are currently being developed, all involving some kind of modeling (physics-based or purely statistical) and data assimilation (state or parameter estimation though variational or sequential approaches). Because of the living systems specificities, physics-based approaches, though they require interdisciplinary efforts to develop, are expensive to simulate and prone to modeling errors, are usually favored because they require less data and are more interpretable.

This mini-symposium is dedicated to all aspects of the development, establishment and use of digital twins in life sciences and medicine, including modeling, computation, data assimilation and clinical applications, with a focus on methodological and fundamental aspects as well as practical applications.

REFERENCES

[1] Committee on Foundational Research Gaps and Future Directions for Digital Twins, Board on Mathematical Sciences and Analytics, Committee on Applied and Theoretical Statistics, Computer Science and Telecommunications Board, Board on Life Sciences, Board on Atmospheric Sciences and Climate, Division on Engineering and Physical Sciences, Division on Earth and Life Studies, National Academy of Engineering, & National Academies of Sciences, Engineering, and Medicine. Foundational Research Gaps and Future Directions for Digital Twins. National Academies Press. (p. 26894) 2024 https://doi.org/10.17226/26894

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