1. Record Nr. UNINA9910739412903321

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Titolo	Sensing, modeling and optimization of cardiac systems : a new generation of digital twin for heart health informatics / / Hui Yang, Bing Yao
Pubbl/distr/stampa	Cham : , : Springer Nature Switzerland : , : Imprint : Springer, , 2023
ISBN	3-031-35952-6
Edizione	[1st ed. 2023.]
Descrizione fisica	1 online resource (x, 88 pages) : illustrations (some color)
Collana	SpringerBriefs in Service Science, , 2731-3751
Altri autori (Persone)	YaoBing (Professor of industrial engineering)
Disciplina	611.120113
Soggetti	Digital twins (Computer simulation) Heart - Computer simulation Heart - Mathematical models Medical informatics
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
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Sommario/riassunto

This book reviews the development of physics-based modeling and sensor-based data fusion for optimizing medical decision making in connection with spatiotemporal cardiovascular disease processes. To improve cardiac care services and patients’ quality of life, it is very important to detect heart diseases early and optimize medical decision making. This book introduces recent research advances in machine learning, physics-based modeling, and simulation optimization to fully exploit medical data and promote the data-driven and simulation-guided diagnosis and treatment of heart disease. Specifically, it focuses on three major topics: computer modeling of cardiovascular systems, physiological signal processing for disease diagnostics and prognostics, and simulation optimization in medical decision making. It provides a comprehensive overview of recent advances in personalized cardiac modeling by integrating physics-based knowledge of the cardiovascular system with machine learning and multi-source medical data. It also discusses the state-of-the-art in electrocardiogram (ECG) signal processing for the identification of disease-altered cardiac dynamics. Lastly, it introduces readers to the early steps of optimal decision making based on the integration of sensor-based learning and simulation optimization in the context of cardiac surgeries. This book will be of interest to researchers and scholars in the fields of biomedical engineering, systems engineering and operations research, as well as professionals working in the medical sciences.