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Bio-Inspired Intelligence and Data Fusion for Smart AI-Driven Healthcare Systems

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This book focuses on the use of bio-inspired computational approaches such as evolutionary computing, swarm intelligence, and neural-inspired models together with data fusion techniques for advancing the design of AI-driven healthcare systems. The chapters will highlight both theoretical underpinnings and practical implementations, showing how nature-inspired algorithms can be applied to integrate multi-source data for better disease detection, treatment personalization, and health monitoring. The digital transformation of healthcare has resulted in enormous volumes of heterogeneous data from medical imaging, electronic health records, IoT-based monitoring devices, and genomics. Making sense of such complex and diverse data requires models that can learn, adapt, and respond effectively. Special attention is given to explainable and trustworthy AI, as well as to emerging areas like blockchain-based secure health data management, federated learning for collaborative healthcare AI, and small language models (SLMs) for lightweight, resource-efficient clinical decision support. By blending foundational methods with real-world applications, the book aims to serve as a comprehensive reference for the future of intelligent healthcare technologies.

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