



Adaptive and Data-Driven Engineering for Human and Sustainable Systems

This issue of Big.D highlights the increasing importance of adaptation, computational intelligence, biological inspiration, and data-driven engineering in the development of technologies responsive to human and environmental conditions.

Several contributions demonstrate how artificial intelligence can support more adaptive human-centered systems. Deep-learning approaches to culturally adaptive mental-health assessment, keystroke-dynamics-based interfaces for digital well-being, one-shot learning inspired by human cognition, and reinforcement-learning-supported human – computer interaction all explore systems capable of learning from limited, contextual, or continuously changing information. These studies illustrate an important transition from static digital products toward intelligent systems that can respond to users and environments over time.

The issue also connects computational approaches with physical engineering and biological inspiration. Neuromorphic systems draw upon principles of biological cognition, while biomimetic multilayer nanostructures investigate engineered approaches to improving photovoltaic light absorption. The integration of printing technologies and neural-network modeling for personalized biomechanical design further demonstrates how computational prediction, fabrication, and healthcare engineering can converge within a single design process.

Beyond individual devices, computational methods are applied to collaborative innovation and the analysis of urban environments, illustrating the broader capacity of data-driven approaches to characterize complex cultural and spatial systems.

Across these different scales, a common principle emerges: design increasingly operates as an integrative engineering methodology, connecting computation, physical systems, human behavior, biological principles, and sustainability objectives.

The contributions in this issue therefore reflect the expanding scope of design-enabled engineering—from adaptive interfaces and healthcare technologies to biomimetic structures, sustainable energy applications, personalized manufacturing, and computational urban analysis—and demonstrate how interdisciplinary integration can generate technically grounded approaches to increasingly complex design problems.