Journal of The Franklin Institute

Special Issue on

Machine learning for modelling and control of dynamic complex systems

Call for Papers

Nowadays, the relevance that artificial intelligence has acquired in our lives is indisputable, in applications that range from use in household appliances, personalized assistants, search engines, image processing, language processing, finance, entertainment, to biomedical applications, autonomous vehicles, robotics and many more.

It is well known that use of control systems allows improving productivity, increasing precision, performing more complex tasks, improving the performance of systems, relieving human beings from repetitive and dangerous tasks, among many other tasks. However, the imminent advances in science and technology imply the development of more complex and sophisticated applications such as: chemical processes, robotics, industrial processes, biomedical processes, autonomous navigation, smart grids, among many others; also as a consequence, of the increasing demands of productivity, security, stability and reliability of the system that pose challenging theoretical and technological problems in the modeling and control of complex dynamic systems. On the other hand, most control applications are model-based which faces challenges related to the difficulty of modeling complex systems or the need for control strategies with provably safe and robust performance that have low memory requirements. and online computing.

On the other hand, recent advances in machine learning and artificial intelligence, which have largely been achieved by the increasing availability of data. as well as new computing, sensing and communication capabilities, present interdisciplinary research opportunities to exploit these techniques in many application domains, allowing the development of a completely new set of tools for modeling and controlling complex dynamic systems.

The integration of machine learning with model-based control, for example, in the way of learning the model of a system, the cost function or even the control law directly, poses fundamental challenges related to the properties of the controller, such as the stability, convergence and satisfaction of constraints. and performance under conditions of uncertainty. Therefore, the research activities in this area are aimed at efficiently addressing the modeling and control of non-linear / time-varying behavior of systems in these domains through the development of a fusion of methods of modeling and control dynamic complex systems improved with machine learning. The resulting methods automatically build dynamic models that capture user-specific aspects of system behavior.

With this in mind, the objective of this special issue is to serve as a forum for the latest research advances on the interface between machine learning and the control of complex dynamic systems in order to establish important synergies and contribute to solving arising challenges, with a special emphasis on high-quality articles that contain original research results covering the theoretical foundations and preferably validated with real-world applications.

Topics covered include, but are not limited to the following:

- Machine learning in cyber-physical systems
- Adaptive machine learning control
- Machine learning for model-free control
- Data-driven control with machine learning
- Learning-based controllers
- Deep learning for modeling and control dynamic systems
- Machine learning resilient controllers
- Machine learning fault-tolerant controllers
- Machine learning for modeling and control applied to: renewable energy systems, robotics, vision, biomedical systems, smart grids, complex systems, autonomous systems

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