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Special session 2: Learning and Intelligent Optimization for Physical Systems

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Abstract: Several critical challenges arise when operating with physical systems contrary to theoretical models, simulated environments, or static datasets. Firstly, reducing the up-time of experimenting with the systems is essential. Experimenting extensively on a physical system might lead to hardware failures that are expensive to replace. Secondly, the algorithm should never produce behaviors that might harm the humans around it or the system itself (e.g., we do not want to break a robot that costs 2M euros). Therefore, to develop effective Machine Learning or Intelligent Optimization methods on physical systems, one has to consider the above challenges during the process of designing the algorithms. Learning and data-driven methods can learn very complex models/controllers and improve over time which is useful when operating with physical systems. However, such methods require a prohibited amount of samples to work reliably, and providing formal guarantees on the obtained solutions is challenging. On the other hand, traditional mathematical optimization is more often used in physical systems since it can operate with no or little data and provide solid theoretical foundations, but it is not easy to make an algorithm that can improve the performance over time. This special session welcomes submissions on "Learning and Intelligent Optimization for Physical Systems", where the goal is to find novel methods that effectively combine data-driven/ML approaches with mathematical optimization to solve tasks on physical systems. Examples are robot learning for control, sensors, embedded systems/mobile phone algorithms, real-time systems/applications, and human-computer interaction.