Distinguished Speaker Series

FALL 2021

Dr. Jan Drgona

Data Scientist

Pacific Northwest
National Laboratory

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10:30 – 11:30 a.m.

258 Willard Building

Differentiable Programming for System Identification and Control of Buildings

ABSTRACT

In this talk, Dr. Jan Drgona introduces a differentiable programming methodology for domain-aware learning of surrogate models and constrained control policies for nonlinear dynamical systems. In particular, he presents a differentiable predictive control (DPC) methodology as a data-driven solution to multiparametric programming problems emerging from explicit nonlinear model predictive control (MPC). DPC method is based on two sequential steps, i) system identification using a constrained neural statespace model, and ii) optimization of closed-loop dynamics with explicit neural control law. By incorporating domain knowledge and leveraging established techniques from optimal control, the DPC method leverages deep neural networks as nonlinear function approximators for system identification and explicit control laws while avoiding concomitant costs of intractably large datasets. The scalability, data efficiency, and constrained optimal control capability of the proposed DPC method are demonstrated in simulation using a multi-zone building emulator. Furthermore, he experimentally demonstrates the computational and memory efficiency of DPC in embedded implementation on a laboratory device with nonlinear dynamics.

BIOGRAPHY

Dr. Jan Drgona is a data scientist in the Physics and Computational Sciences Division (PCSD) at Pacific Northwest National Laboratory. His current research focus falls in the intersection of deep learning, constrained optimization, and model-based optimal control. Before joining PNNL, Dr. Drgona was a postdoctoral fellow at KU Leuven, Belgium, where he was working on the implementation of model predictive control (MPC) in real-world office buildings. He has a doctorate in control engineering from Slovak University of Technology in Bratislava, Slovakia. His thesis was on model predictive control with applications in building thermal comfort control with the focus on explicit and learning-based MPC.

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