

Invited Talk Abstract

ICOML 2026 | July 27–29, 2026

State-Space Representation of Neural Networks via Implicit Models and Applications**Laurent El Ghaoui***VinUniversity*

Date	July 29, 2026
Time	10:00–10:30
Session	Session 6
Venue	S102, Lecture Hall, Gong-Guan Campus, NTNU

Abstract

Implicit models are generalizations of neural networks, which define hidden states and outputs through equilibrium (fixed-point) equations rather than fixed layer sequences, enabling adaptive depth and feedback loops in the network's computational graph. Such models can always be represented in a "state-space" form that resembles the classical state-space models in control theory, allowing for a rigorous matrix formalism and opening many connections with convex optimization. In this talk, I will review results in this area, including: a) representation of existing networks in the state-space format; hidden-state optimization (HSO), where neural network parameters are optimized while keeping hidden states fixed; neural network inversion; controlling dynamical systems with neural networks; robustness analysis; and so on.