Invited Talk Abstract

ICOML 2026 | July 27–29, 2026

Approximation Theory of Laplacian-Based Neural Operators for Reaction-Diffusion Systems

Jenn-Nan Wang

National Taiwan University

Date	July 29, 2026
Time	17:00–17:30
Session	Session 8
Venue	S102, Lecture Hall, Gong-Guan Campus, NTNU

Abstract

In this talk, I would like to discuss neural operators applied to the solution mapping from initial conditions to time-dependent solutions of some reaction-diffusion equations, in particular, generalized Gierer-Meinhardt reaction-diffusion equations, a prototypical model of nonlinear pattern formation. Our main results establish explicit approximation error bounds in terms of network depth, width, and spectral rank by exploiting the Laplacian spectral representation of the Green's function underlying the PDE. We show that the required parameter complexity grows at most polynomially with respect to the target accuracy, demonstrating that Laplacian eigenfunction-based neural operator architectures alleviate the curse of parametric complexity encountered in generic operator learning. Numerical experiments on the Gierer-Meinhardt system support the theoretical findings. This talk is based on the joint work with Furuya and Ryo.