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Data-Driven Solutions to Coupled PDEs using Disjoint Priors

Advances in data acquisition and computational power have led to a rapid increase in high-dimensional (ODE or PDE) modelling. In many applications, especially in biological and ecological modeling, the primary challenge is not data unavailability but the existence of data that is incomplete, making it either useless or the entire data collection effort a waste of resources. Complex phenomena are often described by coupled (or more) variables, yet only a subset is supported by known governing equations, while the remaining variables are available only through data. This mismatch between known physics and observed data creates difficulties for finding solutions to the model, even with the well-known physics-informed machine learning techniques since they typically assume full knowledge of either the system physics or complete data across all variables. In this presentation, I will discuss some ground challenges in modelling partially observed, coupled systems and demonstrate how a neural-network-based approach can effectively solve them even when the variables constrained by physics and those informed by data are mutually exclusive.