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Learning metriplectic systems and other bracket-based dynamics

The metriplectic formalism is a useful framework for constructing and explaining phenomenological models of physical phenomena. However, general metriplectic equations of motion are highly complicated, relying on delicate compatibility conditions involving the kernels of algebraic brackets. This talk discusses a recent method for machine-learning provably metriplectic dynamics from data in a way that is (1) universally approximating, (2) admits an error estimate, and (3) scales optimally with respect to the number of learnable parameters. Through finite-dimensional benchmark examples, it is shown that the proposed method is fully expressive and capable of reliably learning metriplectic dynamics, even in cases where only partial state data is observed.