

Novel tensor framework for model reduction and neural networks

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Most real-world information is inherently multi-dimensional in its correlation structure. However, such multi-dimensional interactions tend to remain latent by virtue of traditional matrix-based learning algorithms. In this talk, we first present a novel tensor framework that is based on the notion of tensor-tensor product, which inherits matrix mimetic properties. We then show how the framework can be adapted for model reduction of nonlinear PDEs, and develop new neural network formulations for learning representations of high-dimensional data and dynamic graphs. The new constructs represent and manipulate natively high-dimensional entities, while preserving their multi-dimensional integrity. Lastly, with numerical experiments, we demonstrate the intrinsic advantages of the proposed tensorial architectures.