

Entropy Stable Conservative Flux Form Neural Networks

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We propose an entropy-stable conservative flux form neural network (CFN) that integrates classical numerical conservation laws into a data-driven framework using the entropy-stable, second-order, and non-oscillatory Kurganov-Tadmor (KT) scheme. The proposed entropy-stable CFN uses slope limiting as a denoising mechanism, ensuring accurate predictions in both noisy and sparse observation environments, as well as in both smooth and discontinuous regions. Numerical experiments demonstrate that the entropy-stable CFN achieves both stability and conservation while maintaining accuracy over extended time domains. Furthermore, it successfully predicts shock propagation speeds in long-term simulations, *without* oracle knowledge of later-time profiles in the training data.

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