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On empirical interpolation under the tensor t-product algebra

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We present a novel tensor empirical interpolation method operating within the tensor t-product framework. Compared to traditional empirical interpolation, our approach significantly enhances the reconstruction accuracy of tensor-valued datasets by using optimally placed sparse sensor measurements along the dimension of interest. This improvement is achieved by preserving the native tensor structure of the dataset rather than matricizing it, which allows us to leverage the inherent relationships within the data. Moreover, our formulation naturally supports an augmentation that permits us to gather more sensor measurements than the size of the generated tensorial bases set, thereby expanding its applicability to data-scarce scenarios. Numerical results from various large-scale complex systems demonstrate the robustness of our method, which we will illustrate with selected examples.

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