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Deep learning for scientific data compression

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The increasing power of the available supercomputing infrastructure and forthcoming exascale performance enables rapidly more accurate physical simulations, such as detailed high-fidelity CFD simulations or simulations from astrophysical codes. However, as the accuracy of simulations increases, the requirements for storage space also increase quickly. Results from large-scale transient simulations are typically on the order of tens of terabytes to units of petabytes. Supercomputing systems generally increase computational power much faster than the increase in storage space. The standard user space quota is in the order of tens of terabytes. An important issue is the possibility of compressing extensive 3D volumetric data so that, in some cases, simulation results can be stored, transferred and visualised even on infrastructures with limited storage and memory capacity. We present a modified version of Fourier mapping functions for learning the mapping from 3D coordinates space (x,y,z) to an output space containing, in our use cases, simulation variables. We use dynamic Fourier features mapping to (i) decrease the input size in the learning process and (ii) enable dynamic learning of the optimal distribution of features mapping. Results will be shown in several use cases.

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