Edge adaptive methods and machine learning for high-resolution image reconstruction

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Edge-adapted methods have been introduced in the context of image processing [1, 2] to reconstruct high-resolution images from coarser cell averages. In particular, when images consist of piece-wise smooth functions, the interfaces can be approximated by a pre-specified functional class (lines, circle arcs, etc) through optimization (LVIRA [2]) or specific preprocessing (ENO-EA [1]). In this work, we extend the ENO-EA approach to polynomials of degree higher than 1 and compare this algebraic approach to that introduced in [2] as well as to learning-based methods [3] in which an artificial neural network (NN) (or in principle any other non linear sufficiently rich function family) is used to attain the same goal.

Joint work with: Cohen Albert, Dolbeault Matthieu, Mula Olga.

References

[1] F. Arandiga, A. Cohen, R. Donat, N. Dyn, B. Matei. Approximation of piecewise smooth func-tions and images by edge-adapted (ENO-EA) nonlinear multiresolution techniques. Applied andComputational Harmonic Analysis, 24(2), 225250, 2008. doi :10.1016/j.acha.2007.06.009.

[2] J. E. Pilliod, E. G. Puckett Second-order accurate volume-of-fluid algorithms for tra-cking material interfaces. Journal of Computational Physics, 199(2), 465502, 2004. doi :10.1016/j.jcp.2003.12.023.

[3] B. Desprs, H. Jourdren Machine Learning design of Volume of Fluid schemes for compressibleflows. Journal of Computational Physics, 408, 2020. doi :10.1016/j.jcp.2020.109275.