# From ANaGRAM to AMStraMGRAM, from AMStraMGRAM to RATATAM: Adaptive cutoff regularization for efficient natural gradient training of PINNs

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Physics-Informed Neural Networks (PINNs) often face instability and slow convergence when solving PDEs. We start with ANaGRAM [1], an empirical natural gradient method that uses a fixed cutoff for regularization. However, this fixed cutoff limits performance, as it may not adapt to the evolving training dynamics. To address this, we introduce AMStraMGRAM [3], which adaptively selects the rank truncation using the Reconstruction Error (RCE). This approach exploits the two-phase training dynamics—feature development followed by flattening—avoiding early overfitting to undertrained features.
We also present RATATAM [2], a work-in-progress extension that further refines this idea by using test-driven rank selection and direction-specific learning rates. While still at the proof-of-concept stage, RATATAM demonstrates the potential of adaptive methods to improve the robustness and efficiency of PINN training.

[1] N. Schwencke, C. Furtlehner. *Anagram : A natural gradient relative to adapted model for efficient pinns learning.* In *The Thirteenth International Conference on Learning Representations*, 2025.

[2] N. Schwencke, C. Rousselot, A. Shilova, C. Furtlehner. *Ratatam : Residual adaptation by tangent approximation translation, anagram's modification.*

[3] N. Schwencke, C. Rousselot, A. Shilova, C. Furtlehner. *Amstramgram : Adaptive multi-cutoff strategy modification for anagram.* arXiv preprint arXiv :2510.15998, 2025.

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