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AInstein, atlas architecture vs embedding architecture

Monday 8 December 2025 14:00 (30 minutes)

A numerical scheme based on semi-supervised machine learning, “AInstein”, was recently introduced (see https://iopscience.iop.org/article/10.1088/3050-287X/ae1117) to approximate generic Riemannian Einstein metrics on a given manifold. Its versatility stems from encoding the differentiable structure directly in the loss function, making the method applicable to manifolds constructed in a “bottom-up” fashion that admit no natural embedding in Rˆn.
After a brief review of the original AInstein model, we focus on a new architecture, adapted to the special case of real (n-1)-dimensional manifolds that can be embedded in Rˆn; this has the advantage that the neural-network ansatz is automatically globally defined. We present novel preliminary results obtained with the new architecture, concerning two open problems: the Kazdan–Warner (prescribed curvature) problem on Sˆ2 and the existence of negative-curvature metrics on Sˆ4, Sˆ5. Finally, if time permits, we will briefly comment on a further ongoing extension of AInstein to Lorentzian metrics and black holes.

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