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Fast Moreau Envelope Algorithms and Applications

We present a new algorithm (named NEP for NonExpansive Proximal mapping) to compute the discrete Moreau envelope $M_{\lambda,X}(s) = \min_{x \in X}[\frac{\|s-x\|^2}{2\lambda} + f(x)]$ of a function f, where X is a discrete grid and $\lambda > 0$. Numerical comparisons between the NEP and two existing algorithms: The Linear-time Legendre Transform (LLT) and the Parabolic Envelope (PE) algorithms will be shown along with worst-case time complexity, convergence results, numerical comparison, and examples.

The algorithms will be applied to compute numerical solutions to Hamilton–Jacobi equations, and the distance transform of image processing.

References

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[3] _____, *A linear euclidean distance transform algorithm based on the Linear-time Legendre Transform*. In: Proceedings of the Second Canadian Conference on Computer and Robot Vision (CRV 2005), Victoria, BC, May 2005, IEEE Computer Society Press.