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A Tensor Gradient Cross for Hamilton-Jacobi-Bellman equations

S. Dolgov[1], D. Kalise[2] and L. Saluzzi[3]

[1] Department of Mathematical Sciences, University of Bath, North Rd, BA2 7AY Bath, United Kingdom, sd901@bath.ac.uk, https://people.bath.ac.uk/sd901

[2] Department of Mathematics, Imperial College London, South Kensington Campus, SW7 2AZ London, United Kingdom, dkaliseb@imperial.ac.uk, https://www.dkalise.net

[3] Department of Mathematical Sciences, University of Bath, North Rd, BA2 7AY Bath, United Kingdom, ls2498@bath.ac.uk, https://sites.google.com/view/lucasaluzzi

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Hamilton-Jacobi-Bellman (HJB) equation plays a central role in optimal control and differential games, enabling the computation of robust controls in feedback form. The main disadvantage for this approach depends on the so-called *curse of dimensionality*, since the HJB equation and the dynamical system live in the same, possibly high dimensional, space. In this talk, I will present a data-driven method for approximating high-dimensional HJB equations based on tensor decompositions. The application of tensor methods to the resolution of the HJB equation has been already study in [2] via the application of the Policy Iteration Algorithm. The approach presented in this talk is based on the knowledge of the value function and its gradient on sample points and on a tensor train decomposition of the value function. The collection of the data will be derived by two possible techniques: Pontryagin Maximum Principle and State-Dependent Riccati Equations. The numerical experiments will demonstrate a linear complexity in the dimension and a better stability in presence of noise. Finally, I will present an application to an agent-based model and a comparison with a Deep Learning technique [1].

REFERENCES

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