Variational Monte Carlo Methods for Classical Solution of Hamilton Jacobi Bellmann Equations

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Suppose the PDE is cast in a variational form, in Variational Monte Carlo we replace the original objective functional by an empirical functional in a similar way as for the quadratic loss functions in regression and statistical learning. We want to provide an error analysis proofing error estimates holding with high probability.
As an application computing an approximation a classical solution of the non-linear and high-dimensional (stationary) Hamilton Bellmann equations subordinated to an infinite horizon feedback control problem. Variational Monte Carlo method are used to solve an inhomogeneous backward Kolmogorov equation inside a policy iteration step. We use multi-polynomial ansatz-functions and HT tensor product to represent the solution and circumventing the curse of dimensions (deep neural networks and other tools from ML may be used alternatively). In our example the spatial dimension was $d = 34$. We show improvement over LQR (linear quadratic regulator) used in engineering.

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