COMPUTATIONAL DOOB'S H-TRANSFORMS FOR ONLINE FILTERING

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We consider the task of online filtering by approximating the fully adapted auxiliary particle filter. Our approach is based on Doob's h-transforms that are typically intractable. We propose a computational framework to approximate these h-transforms by solving the underlying backward Kolmogorov equations using nonlinear Feynman-Kac formulas and neural networks. The methodology allows one to pre-train a locally optimal particle filter before the data-assimilation procedure. We present some numerical experiments to illustrate that the proposed approach can be orders of magnitude more efficient than state-of-the-art particle filters in the regime of highly informative observations, when the observations are extreme under the model, or if the state dimension is large.