Estimating parametric expectations through Bayesian quadrature

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We propose a novel approach for estimating parametric expectations through the framework of probabilistic numerical methods such as Bayesian quadrature. Unlike competitors such as least-squares Monte Carlo, this allows us to incorporate prior information about the integrands through a Bayesian prior. As a result, our method provides a way of quantifying uncertainty, and leads to a fast convergence rate which is confirmed both theoretically and empirically on challenging tasks in Bayesian sensitivity analysis, computational finance and decision making under uncertainty.