Parameter Estimation Using State-Dependent Copula Particle Filter

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Abstract : This study develops parameter estimation methods for state-space models with latent variables, with a particular focus on stochastic volatility models. A particle filter with Expectation-Maximization (PF-EM) algorithm is developed, integrating particle filtering with the EM algorithm to estimate model parameters based on particles filtered at each time point. This methodology is then extended to address state dependency in both state variables and model parameters. A state-dependent copula particle filter (SD-CoPF) is introduced, leveraging copula functions to model the interdependence among multi-dimensional state variables. By treating both latent variables and model parameters as state variables, the SD-CoPF algorithm employs particles from a posterior distribution incorporating copula functions to capture time-varying model parameters and the correlation structure within multi-dimensional data. This approach offers a robust and adaptive framework for parameter estimation in sophisticated state-space models.

Keywords : state-space model, stochastic volatility, particle filter, expectation-maximization algorithm, copula function
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