

Dissertation Title	Adaptive Genetic Algorithms for Particle Filtering Improvement
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ABSTRACT

Particle filtering is a scheme under sequential Bayesian framework widely employed to estimate state of desired information from the observation data outputted from non-linear, non-Gaussian systems. We proposed an adaptive genetic algorithm-based scheme to enhance quality of the drawn sample vectors of state variables (called particles). Each low-weight parent pairs with a randomly selected high-weight parent. The newly created offspring particle is allowed to replace its low-weight parent only if the weight of the offspring is higher than the weight of the low-weight parent. The accepted offspring particles with high weights can also be paired with the other low-weight parents in order to promote particle diversity. Simulation results show that the new method is superior to state-of-the-art algorithms in estimating one-dimensional and multidimensional state estimation. The new method is also tested in an application under the multiple-model particle filter (MMPF) framework of spectrum and dispersion curve estimation of a time-varying acoustics propagated through an ocean waveguide. The new method still can perform well in capturing the modal frequency. However, the new method is also sensitive to high-intensity time-domain noise where such severe noise causes false frequency contents to be more likely to be misidentified as modal frequency. Such a pilot study of testing the new method on the MMPF indicates that further research and improvements of GAs still be needed.

Keywords: Genetic Algorithm, Particle Degeneracy, Particle Diversity, Particle Filter, Particle Impoverishment, Resampling, Time-frequency Representation