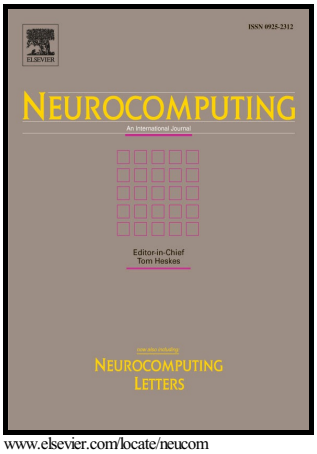

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A new Sampling Method in Particle Filter Based on Pearson Correlation Coefficient

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Abstract

Particle filters have been proven to be very effective for nonlinear/non-Gaussian systems. However, the great disadvantage of a particle filter is its particle degeneracy and sample impoverishment. An improved particle filter based on pearson correlation coefficient (PPC) is proposed to reduce the disadvantage. The PPC is adopted to determine whether the particles are close to the true states. By resampling the particles in the prediction step, the new PF performs better than generic PF. Finally, some simulations are carried out to illustrate the effectiveness of the proposed filter.

Keywords: Particle filter, Pearson correlation coefficient, Importance density

I. INTRODUCTION

Nonlinear filtering is a very active topic in signal processing and control theory. Although the equations of the optimal nonlinear filter have been developed since the middle of the 1960s, the involved integrals are still intractable. Hence, many suboptimal nonlinear filters have been introduced in the literature.

The simplest way but biased to approximate a nonlinear state-space model is extended Kalman filter (EKF), which replaces the state transition and the measurement equations by Taylor series expansions [1]. The unscented Kalman filter (UKF) uses several sigma points to calculate recursively the means and covariances in the Kalman filter [2]. Both filters use the Gaussian distribution to approximate the true posterior distribution.

Recently, particle filtering (PF) also known as sequential Monte Carlo proposed by Gordon et al. for online filtering and prediction of nonlinear and non-Gaussian state space models has

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