

Beyond the Kalman Filter: Particle Filters for Tracking Applications¹

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Abstract - *Target tracking is an important element of surveillance, guidance or obstacle avoidance, whose role is to determine the number, position and movement of targets. The fundamental building block of a tracking system is a filter for recursive state estimation. The Kalman filter has been flogged to death as the work-horse of tracking systems since its formulation in the 60's. In this talk we look beyond the Kalman filter at sequential Monte Carlo methods, collectively referred to as particle filters. Particle filters have become a popular method for stochastic dynamic estimation problems. This popularity can be explained by a wave of optimism among practitioners that traditionally difficult nonlinear/non-Gaussian dynamic estimation problems can now be solved accurately and reliably using this methodology. The computational cost of particle filters have often been considered their main disadvantage, but with ever faster computers and more efficient particle filter algorithms, this argument is becoming less relevant. The talk is organized in two parts. First we review the historical development and current status of particle filtering and its relevance to target tracking. We then consider in detail several tracking applications where conventional (Kalman based) methods appear inappropriate (unreliable or inaccurate) and where we instead need the potential benefits of particle filters.*

¹ The paper was written together with David Salmond, QinetiQ, UK.