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Tracking rapid intracellular movements: a Bayesian random set approach. (English)

Summary: We focus on the biological problem of tracking organelles as they move through cells. In the past, most intracellular movements were recorded manually, however, the results are too incomplete to capture the full complexity of organelle motions. An automated tracking algorithm promises to provide a complete analysis of noisy microscopy data. In this paper, we adopt statistical techniques from a Bayesian random set point of view. Instead of considering each individual organelle, we examine a random set whose members are the organelle states and we establish a Bayesian filtering algorithm involving such set states. The propagated multi-object densities are approximated using a Gaussian mixture scheme. Our algorithm is applied to synthetic and experimental data.

MSC:
62P10 Applications of statistics to biology and medical sciences; meta analysis

Keywords:
multi-object Bayesian filtering; cardinalized probability hypothesis density; Gaussian mixture implementation; monitoring intracellular movements; random finite set theory; finite set statistics

Software:
ImageJ

Full Text: DOI Euclid

References:


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