



BISP8

Eighth Workshop on  
BAYESIAN INFERENCE IN STOCHASTIC PROCESSES

## Bayesian Inference From Vague Data With An Application To Particle Tracking

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Fuzzy set theory and its derivative, fuzzy Bayesian inference, effectively constitute a monopoly on methodologies for the processing of and drawing inference from “vague” or “fuzzy” data. Vague/fuzzy data refer to information which is not of point-quantitative form but rather encompasses a *set* of possible point observations to which the information could refer (for example, “the vehicle was close to point  $x$ ”). We present an alternative methodology that addresses the limitations identified with the fuzzy Bayesian paradigm which typically refer to the hermeneutics of the input/output and how to interpret fuzzy posterior distributions. We introduce an alternative means of describing vague or fuzzy data in terms of a probability distribution over the space of possible observations (rather than a membership function) and introduce the related concept of a *semantic information distribution function* (SIDF) from which the posterior is computed. We then implement the above theory into a particle filter and discuss some simulated results.

### Keywords:

Bayesian Inference; Particle Filter; Fuzzy Set; Fuzzy Data;  
Proximity Operator; Membership Function

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**ABSTRACT  
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