A Unified Model for Context-Based Behavioural Modelling and Classification

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Abstract
A unified Bayesian model that simultaneously performs behavioural modelling, information fusion and classification is presented. The model is expressed in the form of a dynamic Bayesian network (DBN). Behavioural modelling is performed by tracking the continuous dynamics of a entity and incorporating various contextual elements that influence behaviour. The entity is classified according to its behaviour. Classification is expressed as a conditional probability of the entity class given its tracked trajectory and the contextual elements. Inference in the DBN is performed using a derived Gaussian sum filter. The model is applied to classify vessels, according to their behaviour, in a maritime piracy situation. The novel aspects of this work include the unified approach to behaviour modelling and classification, the way in which contextual information is fused, the unique approach to classification according to behaviour and the associated derived Gaussian sum filter inference algorithm.