Association of intelligence reports

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Abstract

We investigate a problem within Dempster-Shafer theory where simple support functions (SSFs) are clustered into clusters by minimizing the sum of weight of conflict over all clusters. Such clustering is useful when the SSFs concern multiple events, and all SSFs are mixed up. The clustering process is used as the means for separating the SSFs into clusters that should be handled independently. We demonstrate that the weight of conflict can be linearized and mapped to an antiferromagnetic Potts Spin model. This facilitates efficient numerical solution, even for large problem sizes. We further develop a method for clustering belief functions based on attracting and conflicting metalevel evidence and use this for clustering all types of belief functions, in particular non-consonant belief functions. Clustering is here performed by decomposing all belief functions into SSFs and inverse simple support functions that are clustered based on their pairwise generalized weights of conflict, constrained by weights of attraction assigned to keep track of all decompositions. Finally, we develop a particle filtering approach for grouping observations into an unspecified number of clusters. A potential clustering with a specified number of clusters is represented by an association hypothesis. Whenever a new report arrives, a posterior distribution over all hypotheses is iteratively calculated from a prior distribution, an update model and a likelihood function. A set of hypotheses is maintained by Monte Carlo sampling. For each time-step, the posterior distribution is projected into a distribution over the number of clusters [http://www.foi.se/fusion/].