Uncertainty evaluation of data and information fusion within the context of the decision loop

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Abstract:
In this paper, the principle taxonomy of the fusion process, the decision loop, is unified with uncertainty quantification and representation. A typical flow of information in the decision loop takes the form of raw information, uncertainty modelling, combination, and decisions, which corresponds closely with Boyd's Observe, Orient, Decide and Act or OODA loop. The uncertainty associated with modelling during fusion system design was considered in previous works by the authors of this paper. Here, the uncertainties in the combination and decision parts of the information flow are considered. The objective of this paper is to make explicit how uncertainties that arise during design, combine with uncertainties during runtime, as well as the effect these uncertainties have on the ultimate decisions. The uncertainty representation and reasoning framework (URREF) ontology can only be meaningfully used for evaluation when the subjects of evaluation within the fusion system, and more broadly the decision loop, are defined explicitly.