

Reflections on Concepts of Employment for Modern Information Fusion and Artificial Intelligence Technologies:

Situation Management, Decision Making Under Varying Uncertainty and Ambiguity,
Sequential Decision-Making, Learning, Prediction, and Trust

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Abstract

Information Fusion (IF) is fundamentally an estimation process that attempts to automatically form a best approximated state of an unknown true world situation, typically from both observational and contextual data. To the degree possible, this process and its algorithms and methods also employ any deductive knowledge that model the evolutionary dynamics of the focal elements of interest in this world. Artificial Intelligence (AI) technologies are often directed to similar goals, and employ similar informational and knowledge components. For many modern problems of interest, there are factors that result in observational data whose quality is unknown, and for which the a priori deductive knowledge models are non-existent or weak. Moreover, even for conventional IF applications where uncertainties of interest are known or estimable, the Concepts of Employment that involve sequential estimation and decision-making dynamics have not been very well studied and integrated into the frameworks of understanding for the use of such IF capability. This talk will review a number of interrelated topics that bear on the thinking of how IF technologies will be used in these stressful and critical environments. It will review a previously-proposed overarching Situation Management process model, the modern (and controversial) literature on decision-making under severe uncertainty, aspects and implications of sequential operations on decision-making, as well as Learning and Prediction dynamics as they bear on IF applications. Some remarks will also be included on the dynamics of human trust in automated systems, a topic under current study at the Center for Multisource Information Fusion at Buffalo.