

HIGHER LEVEL FUSION FOR SITUATION MANAGEMENT, Galina L. Rogova, Encompass

Consulting

Situation management is a collection of methods and tools aimed at helping decision makers to monitor, understand and control dynamic situations, and act effectively to mitigate their impact.

One of the critical enabling technologies of situation management is higher level fusion (situation and threat assessment). The core purpose of higher level fusion is to infer and approximate the characteristics and critical events of the environment in relation to specific goals, capabilities and policies of the decision makers. The higher level fusion processes utilize fused data about objects of interest, dynamic databases, maps, and expert knowledge and opinions for context processing to produce a coherent composite picture of the current and predicted situation. Situation and threat assessment processing for situation management is complicated by highly dynamic environment, uncertainty of observations, relationships and behavior, and variable quality of the data and information sources. Threat can be unknown, or even unimaginable. Therefore the higher level fusion processing has to be adaptive to resource and time constraints, new and uncertain environments, and reactive to uncertain heterogeneous inputs. An important component of situation and threat assessment is detection of this unknown, unconventional, or unimaginable based on abnormal characteristics and behavior of situational items along with discovery of underlying causes of such characteristics and behavior.

The presentation will discuss major challenges, specific requirements, and approaches to designing situation and threat assessment processes as applied to the problem of casualty mitigation operations during the initial response phase after an earthquake. During the initial phase

following the primary shock, multiple reports about observed individual casualties and structural damage of buildings, roads, and critical facilities are received at emergency operation centers. These reports -- initiated by emergency responders, public safety personnel and civilians -- are characterized by various levels of reliability and uncertainty. The reports are continually associated and fused to generate uncertain estimates of the identity, attributes and properties of report subjects, which are then used as input to the situation and threat assessment processes. The specific purpose of situation and assessment for casualty mitigation is to build current and predicted situational pictures of the disaster scene in relation to the ultimate goals of the decision makers, which are to service the maximum number of casualties with minimum service times, and further to reduce risk of additional casualties. Situation assessment is performed by analyzing spatial and temporal relations of the casualties and casualty aggregations at different levels of granularity and their dynamics within the overall situational context. This assessment process includes a dynamic hierarchical "any time" clustering, reasoning about uncertain dynamic characteristics of aggregates and their relation as well the process of discovery of unreported events.