Title of Paper: Concept Map Value Propagation for Tactical Intelligence

Topics: Track 2, Networks and Networking; Track 1, C2 Concepts, Theory, and Policy; Track 6, C2 Metrics and Assessment

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Abstract

Command and control analysts increasingly apply traditionally unassociated concepts to situation understanding. Techniques are needed to tailor knowledge acquisition resource allocation according to probable value of information, both inferring an answer to a question using knowledge at hand and quickening intelligence efforts to fill in gaps. This paper discusses research into techniques for negotiating and updating Concept Maps, collections of concepts linked by specified relationships, by accounting for both nodal data and links among nodes. Such Maps provide the flexibility to represent contemporary tactical knowledge not lending itself to conventional data structures. In some senses Concept Mapping generalizes the notion of an inference network, a set of propositions organized with rules directing information propagation and combining antecedents to update consequents. We are attempting to develop a mathematical system for organized navigation of a Concept Map, driven by expected variability in the value of a datum and cost to get a new value. We use the CmapTools software associated with the Institute of Human and Machine Cognition as a structural basis for creating and assessing tactical Maps. The paper discusses Map construction, analytical philosophy, and methodology development.

Draft outline

Concept Maps as meaningful diagrams
  Relations: Subsumption, differentiation, …
  Structures: Cyclical, hierarchical, …
Creating tactical knowledge models
  Concept Mapping procedure
  CmapTools
Concept quantification
  Propositional coherence
  Description logic
Propositional grammar
  Noun, adjective, verb, …
  Left concept, link, right concept
Inference nets
  Proposition selection
  Merit propagation
Extension to dynamic Cmaps
  Cluster merging
  Generalized derivatives, chain rule
Future work
  Merit indices for combinations of properties
  Agent-based construction, OWL formalisms