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Semantic Information Enrichment to Engender Trust

S&T Campaign: Information Sciences
System Intelligence and Intelligent Systems

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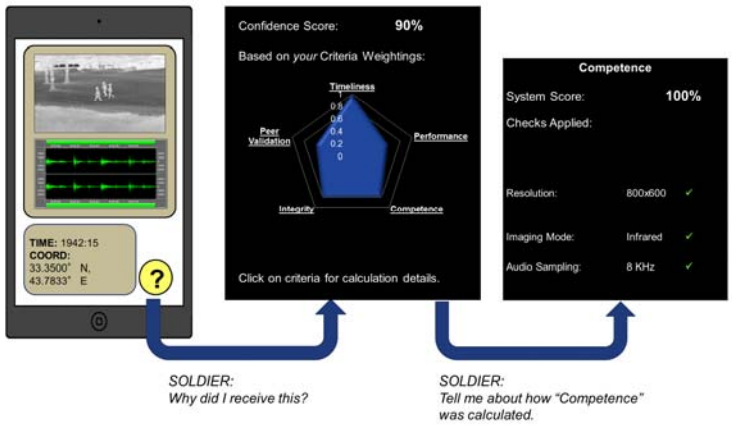
Research Objective

- Helping Soldiers confirm that information received on their personal devices is *actionable* for missions.
- For this, **trust** must be established in the information.

Example: *A squad leader receives an alert of possible militant activity in a remote part of town, consisting of imaging and audio data, and wants to verify the system's information selection strategy.*



Challenges

- Computationally representing factors that contribute to Soldier trust in information, via factors of confidence.
- Enabling semantic assessment of information products against confidence metrics, accounting for mission and environment conditions.

ARL Facilities and Capabilities Available to Support Collaborative Research

- ALC Campus Sensor Network, for both experimental data and sensor descriptions.

Complementary Expertise/ Facilities/ Capabilities Sought in Collaboration

- Design of middleware for tactical-edge dissemination of content. Ongoing collaboration with Florida Institute for Human and Machine Cognition (IHMC).
- Expertise in semantic modeling of sensor networks, using Semantic Web languages including RDF and OWL.
- User experience and HCI expertise for: (I) presenting how confidence factors were applied to content dissemination; (II) enabling soldiers to adjust their confidence factor preferences.

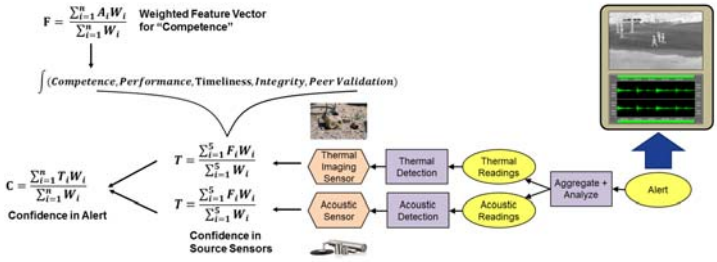
Acknowledgements:
- Niranjan Suri and Robert Winkler, for identification and definition of confidence factors.
- Stephen Russell, Robert Winkler, Niranjan Suri, and Laurel Sadler for their feedback on the poster content.

Calculating Confidence in Information

- Soldier trust in information can be viewed as measuring their **confidence** in the information.
- Applicable to information sources (e.g., sensors) and information products.
- Multiple confidence factors previously proposed:

  Competence: *Are these sensors adequate for environment and mission conditions?*
  Performance: *Have these sensors performed effectively in the past?*
  Integrity: *Has the information product arrived untampered?*
  Timeliness: *Is the information product based on recent data?*
  Peer Validation: *Do our Subject Matter Experts trust the findings?*

- Information products – which can be composed of data from multiple sources – require inspection and traversal of provenance records.
- In-turn, different weightings may be applied to both confidence factors and their attributes.



A provenance record for the transmitted alert. Shape key:

= Sensor = Processing = Data

Semantic Middleware for Confidence Assessment

- Intended to formalize both requirements and process for establishing confidence in information.
- Ontologies applied to represent mission details – goals + tasks, as well as environmental conditions.
- Applicable confidence metrics are composed using known mission details.
- Next, streams of incoming content + provenance are evaluated based on the confidence metrics.
- Content meeting threshold is then transmitted to Soldiers.

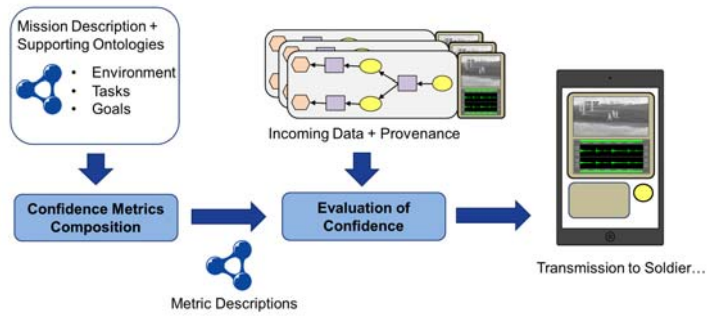


Diagram of Semantic Middleware for Content Provisioning

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