

*SEMANTIC TECHNOLOGY FOR
INTELLIGENCE, DEFENSE, AND SECURITY*



STIDS 2014

Semantics in Support of Collaboration

THE 9TH INTERNATIONAL CONFERENCE
ON SEMANTIC TECHNOLOGY
FOR INTELLIGENCE, DEFENSE AND SECURITY
NOVEMBER 18-21, 2014

Johnson Center
George Mason University
Fairfax, Virginia Campus

Conference Proceedings

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(Eds.)



Preface

The 9th International Conference on Semantic Technology for Intelligence, Defense, and Security (STIDS 2013) provides a forum for academia, government and industry to share the latest research on semantic technology for defense, intelligence and security applications.

Semantic technology is a fundamental enabler to achieve greater flexibility, precision, timeliness and automation of analysis and response to rapidly evolving threats.

The STIDS 2014 theme is Semantics in Support of Collaboration.

Topics of general interest for STIDS include:

- Creating an interoperable suite of public-domain ontologies relevant to intelligence analysis covering diverse areas
- Ontologies and reasoning under conditions of uncertainty
- Semantic technology and ontological issues related to:
 - Source credibility and evidential pedigree
 - Use of sensing devices including security, e.g. global infrastructure grid (GIG), images and intelligence collection in general
- Usability issues relating to semantic technology
- Best practices in ontological engineering

Fairfax, VA
November 2014

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Michael Dean Best Paper Award



August 7, 1961 - November 19, 2014

The Michael Dean Best Paper Award was established in 2014 in recognition of Michael Dean's many and diverse contributions to the STIDS community. We are gratified that Mike was aware that an annual award was being established in his honor, and deeply saddened at his passing one day prior to announcement of the winner. This year, at this sad moment, the award carries special meaning, both for the winner and for the entire STIDS community.

In selecting the winner, the committee sought to highlight the qualities that made Mike such an asset to the community. The criteria for selection exemplify the very best contributions to the conference and the community.

To this end, the Michael Dean Best paper is the paper that, in the judgment of the award committee, best satisfies the following criteria.

1. Conveys a clear, careful understanding of the problem or issue being addressed, and clearly states why it matters.
2. Conveys a thorough understanding of technical issues, and a well-grounded, pragmatic view of prior and related work.
3. Clearly identifies the specific semantic technologies being discussed, and their relationship to the problem.
4. Identifies specific experience or expertise on which the paper and its conclusions draw.

5. If a semantic system or application is being presented as part of a solution, clearly identifies and communicates the components of this system, including any ontologies, and how they interact, as well as their degree of actuality, availability, maturity and source.
6. Identifies whether and how such system/ application/ components have been evaluated and with what results.
7. Identifies outcomes, experiences, and lessons learned.
8. Demonstrates prioritization of greater technical and domain understanding and problem-solving over self-promotion, organization promotion, partisan or programmatic scorekeeping, or other, narrower concerns.
9. Demonstrates knowledge of prior and current art, strengthens such knowledge in the community, and promotes better understanding by sharing the rationale for choices, especially when they diverge from common practice.
10. Demonstrates and strengthens the state of the art of Semantic Technology via the quality of the work described. Provides promising ways forward while negotiating known trade-offs and avoiding known pitfalls. Helps more junior technologists avoid repetition of old errors, and provides more senior technologists with new insights.

The winner of the award was announced at a special session on the last day of the conference.

- *2014 Michael Dean Best Paper*: Daniel L. Costa, Matthew L. Collins, Samuel J. Perl, Michael J. Albrethsen, George J. Silowash, Derrick L. Spooner. 2014. An Ontology for Insider Threat Indicators.
- *First runner-up*: Alessandro Oltramari, Lorrie Faith Cranor, Robert J. Walls, Patrick McDaniel. 2014. Building an Ontology of Cyber Security.
- *Second runner-up*: Robert C. Schrag, Edward J. Wright, Robert S. Kerr, Bryan S. Ware. 2014. Processing Events in Probabilistic Risk Assessment.

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STIDS 2014 Keynote Speaker: November 19



Dr. Mark Greaves

Accelerating Discovery in the 21st Century

One of the most technically promising areas for semantic technology has been in accelerating the process of scientific discovery. Like the STIDS community, the general scientific community has struggled with needing to combine and understand data in support of modeling and data analytics. Semantic technology is frequently part of the answer. However, advanced scientific information processing systems have gone beyond supporting data integration and modeling, to attempt to directly assist scientists in creating and testing hypotheses. In this talk, I will discuss some new developments and challenges in AI systems that support scientific discovery.

I will also discuss several parallels to the concerns of the STIDS community, and conclude with some lessons.

Biography: Dr. Mark Greaves

Mark Greaves is currently Technical Director for Analytics in the National Security Directorate of the US Department of Energy's Pacific Northwest National Laboratory, providing scientific, programmatic, and business development leadership. At PNNL, he works with national security clients and cutting-edge PNNL scientific teams to advance the nation's overall capability for extracting meaning from large heterogeneous data sets.

Previously, Mark was Director of Knowledge Systems at Vulcan Inc., the private asset management company for Paul Allen, where he led advanced research teams in large knowledge bases and semantic web technologies, including semantic wikis and data-intensive artificial intelligence technologies. He also served as Vice President of the Allen Institute for Artificial Intelligence, which supports individual researchers and research groups that have the promise to dramatically accelerate progress in artificial intelligence. Prior to Vulcan, Mark was Director of DARPA's Joint Logistics Technology Office, and Program Manager in DARPA's Information Exploitation Office. At DARPA, he directed national research programs in semantic web technology, formal ontology specification, logistics and supply chain control technologies, and the application of software agent technology to problems of distributed control of complex systems-of-systems. In May of 2005, he was awarded the Office of the Secretary of Defense Medal for Exceptional Public Service for his contributions to US national security while serving at DARPA.

Prior to coming to DARPA, Mark worked on advanced programs in software agent technology at the Mathematics and Computing Technology group of Boeing. He has published two books and over 20 papers, holds two patents, chaired the FIPA technical committee on agent communications languages, and from 2001 to 2004 served as co-chair of the Joint Readiness and Sustainment of Strategic Systems chapter of the Defense Joint Warfighting Science and Technology Plan. He currently serves on the Advisory Boards of several Semantic Web-oriented organizations, and is a Fellow of the Semantic Technology Institute. Mark holds a PhD in Philosophy from Stanford University.

STIDS 2014 Keynote Speaker: November 20

Dr. Heather McCallum-Bayliss

Meaning Technologies: At the Cutting Edge

Exploring new types of knowledge that can be extracted from on-line data is crucially important to US intelligence, defense and security concerns. In general, we continue to move existing technologies into different corners and aspects of the data world but we have not explored very successfully the development of technologies that tackle the areas of cognition and social interaction. Inferring behaviors and intentions is currently dependent on external criteria or ontologies but there is often little motivation or evidence. Two IARPA programs have ventured into uncharted territories by attempting to determine if on-line data have more to reveal than we have considered. The SCIL Program is based on the hypothesis that automated systems can identify the strategies that people interacting in on-line groups use to establish their social roles and signal their social intentions by examining the language they use. The Metaphor Program is based on the hypothesis that automated systems can reveal the underlying beliefs and worldviews of cultures by examining their use of metaphorical language. The talk will delve into the status and results of these research efforts. Information about IARPA, the goals of the organization and principles that guide research programs will also be introduced.

Biography: Dr. Heather McCallum-Bayliss

Heather McCallum-Bayliss received her Ph.D. in Theoretical Linguistics from Georgetown University. She taught at Georgetown for seven years before moving to a research firm that focused on the development of human language technology systems with particular focus on systems for multilingual and multicultural name-searching. This work resulted in a patent for a phonologically based, multicultural name-search system. Since 2003, Dr. McCallum-Bayliss has defined and managed advanced multilingual research programs at the ODNI (Office of the Director of National Intelligence)'s Intelligence Advanced Research Projects Activity (IARPA) and its predecessor organizations. These efforts have produced automated question-answering systems as well as systems that tackle the use of language for characterization of social and cultural meaning and understanding. Dr. McCallum-Bayliss continues at IARPA as the Program Manager for the Metaphor and SCIL Programs.



Dr. Jeffrey Morrison

Uncertainty in Decision Making

The science & technology community faces a challenge – and an opportunity. Much research has addressed helping decision makers “Know what they Know”. We now need to think about helping decision makers in making decisions with incomplete, or imperfect information, i.e. making decisions in uncertainty. The semantic technology should play a key role in There is an urgent need to find ways to address this challenge. Many DOD mission areas need to Maximize the Impact of Limited Operational Assets allocated within a dynamic and uncertain “targeting” environment. This presentation will propose a number of questions, including:

- How might we develop strategies for Managing Uncertainty?
- Can we Optimize given the uncertainties?
- Can we Develop Quantitative Decision Support to Manage Uncertainty?

Research is needed that takes a different direction from much of the work with uncertainty to date. Rather than developing estimates of uncertainty, what is needed are decision support tools to optimize decision making despite uncertainties. Insights will be provided on the role of Uncertainty in the “targeting” process for targeteers, mission planners, and watchstanders to determine when & how to task operational assets. The Office of Naval Research has begun several projects to understand operational requirements for making decisions in uncertainty for Navy operations, and representative decision support concepts, and modelling efforts currently being developed are described.

Biography: Dr. Jeffrey Morrison

Dr. Jeffrey G. Morrison joined ONR's Human & Bioengineered Systems Department (341) as a Program Officer in January, 2011 where he leads the Command Decision Making (CDM) program. The program is conducting Basic & Applied cognitive science research for application to individual & group decision making. The current operational focus is on multi-echelon Command & Control. The science focus is on developing Proactive Decision Support tools (PDS) that are aware of mission and tasks context as well as the facilitating the development of a science of Context-Driven Decision Making (CDDM).

Prior to coming to ONR, Dr. Morrison was a Engineering Psychologist / Cognitive Scientist with the Space and Naval Warfare Systems Center – Pacific (SSC Pacific) for 17 years. He was most recently embedded as a Navy Scientist with the Combating Terrorism Technical Support Office (CTTSO) where he served as Chief Scientist to the ASD RDT&E sponsored Human Social Culture and Behavior Modeling Program (HSCB). During 2007-2008, Dr. Morrison was detailed to the Director of National Intelligence where he served as an IARPA Program Manager studying the analytic process and the potential application of virtual world technologies to enable it. Dr. Morrison was a senior scientist supporting several DARPA projects, including the development of user-composable automation for Maritime Domain Awareness (FastC2AP), Predictive Analysis for Naval Deployment Activity (PANDA), and the Augmented Cognition program. He also was principle investigator for numerous ONR sponsored projects, including: Knowledge Web (K-Web), and Tactical Decision Making Under Stress (TADMUS).

Dr. Morrison has been the recipient of numerous professional awards including: The 2005 Jerome H Ely Award for Article of the Year in the Journal of Human Factors; the 2004 ONR Arthur E. Bisson Prize for Naval Technology Achievement; and the American Psychological Association - Division 21, George E. Briggs Award for Original Research.