Three Talks on Semantic Technology

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1. Semantic Technology

Abstract. In 1956, the goal of artificial intelligence was to design computer systems that could approximate or even exceed human abilities. Forty years later, a supercomputer beat the world chess champion, but only by a brute-force method of testing billions of possible moves. For language understanding, the hope of approximating human ability is still an elusive goal that has never been achieved. Yet many computer systems that recognize and respond to aspects of meaning can support flexible and adaptable computer interfaces. This talk discusses the issues involved, the technology for addressing them, and the prospects for future semantic systems.

2. Logic, Ontology, Analogy

Abstract. The level of precision of human reasoning depends largely on the nature of the subject. For the "hard" sciences of mathematics, physics, and computer technology, people can reason with the precision and rigidity of formal logic. But for the softer fields of business, law, politics, and everyday life, people use the more flexible, adaptable, and approximate methods of analogy. Computer systems today can reason by formal logic more precisely and accurately than most humans, but they are much worse than a child at handling the informal, approximate methods of everyday life. For the informal methods various techniques based on statistics, fuzzy sets, rough sets, and analogy are important. For both the formal and the informal methods, some kind of ontology is necessary to relate the words of language to the concepts and relations of the subject matter. This talk discusses the issues involved, the technology available, and the use of ontology with that technology.

3. The Goal of Language Understanding

Abstract. No human being can understand every text or dialog in his or her native language, and no one should expect a computer to do so. However, people have a remarkable ability to learn and to extend their understanding without explicit training. Fundamental to human understanding is the ability to learn and use language in social interactions that Wittgenstein called *language games*. Those games use and extend prelinguistic knowledge learned through perception, action, and social interactions. A computer system that relates language to virtual models might mimic some aspects of understanding, but full understanding requires the ability to learn and use new knowledge in social and sensory-motor interactions. This talk examines various technology for designing and implementing language processors. It suggests ways of using that technology to support computer systems that could come close to what people would consider understanding.

Related Publications by the Speaker

A summary of conceptual graphs and their relationship to Peirce's existential graphs, the ISO standard for Common Logic, and other logic-based notations, such as RDF(S), OWL, SQL, Prolog, and Z. "Conceptual Graphs," in F. van Harmelen, V. Lifschitz, and B. Porter, eds., *Handbook of Knowledge Representation*, Elsevier, 2008, pp. 213-237. http://www.jfsowa.com/cg/cg_hbook.pdf

A survey of the psychological, philosophical, and linguistic issues related to artificial intelligence. "Categorization in Cognitive Computer Science," in H. Cohen & C. Lefebvre, eds., *Handbook of Categorization in Cognitive Science*, Elsevier, 2006, pp. 141-163. http://www.jfsowa.com/pubs/cogcat.htm

A discussion of analogical reasoning and applications of the VivoMind Analogy Engine (VAE). "Analogical reasoning," co-authored with Arun K. Majumdar, in de Moor, Lex, Ganter, eds., *Conceptual Structures for Knowledge Creation and Communication*, Proceedings of ICCS 2003, LNAI 2746, Springer-Verlag, Berlin, 2003, pp. 16-36. http://www.jfsowa.com/pubs/analog.htm

A discussion of the complexity of what people have in their heads and the challenge of implementing systems that can handle anything remotely similar. "The Challenge of Knowledge Soup," in J. Ramadas & S. Chunawala, *Research Trends in Science, Technology and Mathematics Education*, Homi Bhabha Centre, Mumbai, 2005, pp. 55-90. http://www.jfsowa.com/pubs/challenge.pdf

"A Dynamic Theory of Ontology," in B. Bennett & C. Fellbaum, eds., *Formal Ontology in Information Systems*, IOS Press, Amsterdam, 2006, pp. 204-213. http://www.jfsowa.com/pubs/dynonto.htm

A summary of Peirce's work on logic, semeiotic, and related topics and their relevance to modern work on semantic technology. "Peirce's contributions to the 21st Century," in H. Schärfe, P. Hitzler, & P. Øhrstrøm, eds., *Conceptual Structures: Inspiration and Application*, LNAI 4068, Springer, Berlin, 2006, pp. 54-69. http://www.jfsowa.com/pubs/csp21st.pdf

Issues in modal logic, a comparison of the approaches to semantics by Kripke and Dunn, and their application to conceptual graphs. "Worlds, Models, and Descriptions," *Studia Logica*, Special Issue *Ways of Worlds II*, **84:2**, 2006, pp. 323-360. http://www.jfsowa.com/pubs/worlds.pdf