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The Grailog Systematics for Visual-Logic Knowledge Representation with Generalized Graphs

By:

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Directed labeled graphs (DLGs) provide a good starting point for visual knowledge representation but cannot straightforwardly represent nested structures, non-binary relationships, and relation descriptions. These advanced features require encoded constructs with auxiliary nodes and relationships, which also need to be kept separate from straightforward constructs. Therefore, various extensions of DLGs have been proposed for knowledge representation, including graph partitionings (possibly interfaced as complex nodes), n-ary relationships as directed labeled hyperarcs, and (hyper)arc labels used as nodes of other (hyper)arcs. Meanwhile, a lot of AI / Semantic Web research and development on ontologies & rules has gone into extended logics for knowledge representation such as object (frame) logics, description logics, general modal logics, and higher-order logics. The talk demonstrates how knowledge representation with graphs and logics can be reconciled. It proceeds from simple to extended graphs for logics needed in AI and the Semantic Web. Along with its visual introduction, each graph construct is mapped to its corresponding symbolic logic construct. These graph-logic extensions constitute a systematics defined by orthogonal dimensions, which has led to the Grailog language as part of the Web-rule industry standard RuleML (http://ruleml.org/#Grailog). While Grailog's DLG sublanguage corresponds to binary-associative memories, its hypergraph sublanguage corresponds to n-ary content-addressable memories, and its complex-node modules offer various further opportunities for parallel processing.

Dr. Harold Boley is Adjunct Professor at the Faculty of Computer Science, University of New Brunswick, and Leader of the Semantic Web Laboratory at the National Research Council Canada, Information and Communications Technologies. His specification of Web rules through RuleML has found broad uptake. It was combined with OWL to SWRL, became the main input to the W3C Recommendation RIF, and is the basis for the LegalRuleML development at OASIS. His work on Rule Responder has enabled deployed distributed applications for the Social Semantic Web.

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