June 14, 2010

IEEE IRI-2010 KEYNOTE SPEECH

Precisiation of Meaning—Toward Computation with Natural Language

by

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Abstract The coming decade is likely to be a decade of automation of everyday reasoning and decision-making. In a world of automated everyday reasoning and decision-making, computation with natural language is certain to play a pivotal role. Much of human knowledge, and especially world knowledge, is described in natural language. Basically, computation with natural language is closely related to computation with information described in natural language and, more concretely, to Computing with Words (CW or CWW), but not to natural language processing.

Unprecisiated (raw) natural language does not lend itself to computation. A prerequisite to computation is precisiation of meaning. Natural languages are intrinsically imprecise. A major source of imprecision is unsharpness of class boundaries. Unsharpness of class boundaries is coextensive with fuzziness. In this perspective, most human concepts are fuzzy. Everyday examples are near, fast, sweet, similar, etc. To deal with fuzzy concepts what is needed is fuzzy logic. Computing with Words is based on fuzzy logic.

In a natural language, information is carried by propositions. More concretely, for computational purposes a proposition may be viewed as an assignment statement in which the variable to which a value is assigned, and the assigned value, are implicit rather than explicit. Equivalently, a proposition may be viewed as a constraint in which the constrained variable and the constraining relation are implicit rather than explicit. These unconventional views of a proposition play a key role in CW.

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In CW, precisiation of meaning involves four steps. Given a proposition, p, the first step is that of clarification of the meaning of p. As a simple example, p: Overeating causes obesity, is clarified by interpreting its meaning as: Most of those who overeat are obese.

The second step involves identification of the constrained variable, X, and the constraining relation, R. Both X and R are described in a natural language.

The third step involves construction of what is referred to as an explanatory database, ED. ED consists of a collection of relations which are needed to precisiate (define) X and R.

The fourth step is precisiation (definition) of X and R in terms of ED. At the conclusion of this step p is represented as a constraint in which the constrained variable X, and the constraining relation R, are precisiated (defined) as functions of ED. Once it is precisiated, p is ready to serve as an object of computation through the use of the machinery of fuzzy logic. This is the essence of CW. Through its capability to compute with information described in natural language, CW opens the door to a wide-ranging enlargement of the role of natural languages in scientific theories. The capability to compute with information described in natural language plays a particularly important role in the context of decision-making with imprecise probabilities.

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