The Winograd Schema Challenge and Reasoning about Correlation *D.Bailey, A.Harrison, Y.Lierler, V. Lifschitz, and J.Michael*

Summary:

Winograd Schema Challenge (WSC) is a test of machine intelligence proposed by Levesque, Davis, and Morgenstern (2012) as an alternative to the Turing Test. WSC requires the coreference resolution of anaphora: the machine must identify the antecedent of an ambiguous pronoun in a sentence. WSC contains questions in a special format and each question/sentence contains: (1) Two noun phrases of the same semantic class, (2) An ambiguous pronoun that may refer to either of the above nouns and (3) a special word and an alternative word which can be replaced by each other so that we can form pair of sentences. The task is, a machine should identify the referent of ambiguous pronoun, it has two options corresponding to two noun phrases in the question. To succeed in this challenge, the task should require the use of background knowledge and commonsense reasoning. In this paper, authors treat coreference resolution as a by-product of a general process of establishing discourse coherence. Studies of examples from a list compiled by Ernest Davis by the authors show that in many cases coherence of the solution can be explained by the correlation between two clauses formed when the correct answer is substituted for the pronoun. The authors treat correlation is the measure of person's beliefs based on background knowledge. In this paper, authors propose a deductive system for deriving formulas expressing correlation called 'correlation calculus' and show that his system can be used to justify the answers to several examples from Davis's collection. The questions this paper is concerned about is: (1) Can we have a deductive system which can be used to reason about the solutions to Winograd Schema?

To tackle the question authors developed a first-order logic based correlation calculus, where each correlation formula has expressed a combination of sentences which has no free variables. Inference rules of correlation: implication, replacement, symmetry, negation, and substitution were introduced. To justify the correctness of the proposed solution authors encoded the solution as a correlation formula in which discourse referents are represented by object constants. The authors annotated the first 100 Winograd schema sentences from Davis's list in which 64 exhibited positive correlation and 8 exhibits negative correlation. This analysis was applied to 72 sentences out of 100 annotated examples. The main obstacles on the way to the solution are this approach to reasoning about correlation relies on the availability of axioms expressing relevant commonsense knowledge. Authors manually constructed axioms to handle examples from Davis's list. Authors mentioned that automatically extracting these axioms is possible from existing lexical and commonsense knowledge bases such as Wordnet, FrameNet, VerbNet, PropBank, and Knext and OpenCYC as their Future work. This approach can be expanded to other tasks relying on discourse coherence like temporal anaphora resolution and lexical disambiguation.