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MULTIVALUED LOGICS FOR ARTIFICIAL INTELLIGENCE:
GINSBERG'S SYSTEM

Abstract

This paper deals with a family of multivalued logics originally proposed by Matthew Ginsberg as a uniform approach to inference in Artificial Intelligence. Ginsberg generalizes Belnap's four-valued logic introducing the notion of *bilattices*, which are algebraic structures that contain two partial orders simultaneously. Using bilattice-based logics it is possible to unify a variety of existing inference systems, such as McCarthy's Circumscription, De Kleer's ATMS, Reiter's Default Logic, Moore's Autoepistemic Logic, and others. Moreover, it has been shown that Ginsberg's system, when implemented, is at least as computationally efficient as the original ones, in many cases even more.

We begin with a brief survey of the applications of multivalued logics to Artificial Intelligence and computer science developed during the last decades (§ 1); afterwards we focus on Ginsberg's system, considering its basic principles and some of the advantages it offers, both from the theoretical and the practical points of view (§ 2). Then we describe in greater detail the structure of bilattices (§ 3) and of the bilattice-based inference systems (§ 4); we present two examples, showing how Ginsberg's formalism deals respectively with classical logic (§ 5) and with Reiter's Default Logic (§ 6). Finally, we consider some further applications which bilattices have found in recent years, both inside and outside the field of Artificial Intelligence, and discuss future perspectives (§ 7).