UNCERTAIN SYSTEM THEORY: STRUCTURES OF LOGIC AND INFERENCE UNDERLYING KNOLWEDGE

Brian R. Gaines
Department of Industrial Engineering
University of Toronto
Ontario, Canada M5S 1A4

ABSTRACT

Interest has grown in recent years in founding a new generation of computing systems on some form of logical calculus. In particular, logic is seen as a basis for knowledge representation and processing and for fifth generation computer systems. This paper presents and discusses the arguments for this approach and suggests that it is sound. However, the logic generally used is some restricted form of standard first order predicate calculus, and it is argued that this is inappropriate on a number of grounds. The origins and motivation behind standard logic are examined to show the source of some of the problems. Various nonstandard logics that attempt to overcome the defects are outlined and their merits and defects discussed. In particular, logical and psychological system theories based on an axiom of unrestricted predication are shown to be plausible and attractive alternatives to standard logic for general reasoning. These logics are shown to reduce to standard logic for certain forms of mathematical reasoning and to fuzzy logic for certain forms of knowledge processing.