

Preface

With this special issue on artificial intelligence (AI), the *IBM Journal of Research and Development* continues a tradition, started in the earliest days of the field, of providing a forum for the dissemination of IBM work in this field. This tradition began in the 1950s with the publication of such seminal papers as "Intelligent Behavior in Problem-Solving Machines" by Herbert Gelernter and Nathaniel Rochester, and "Some Studies in Machine Learning Using the Game of Checkers" by Arthur L. Samuel. In 1986 a special issue of the *Journal* devoted to the topic of knowledge systems was published. Papers in the present issue are intended to indicate some of the recent work in AI by IBM people.

We open this issue with a special paper by Gio Wiederhold, John McCarthy, and Edward Feigenbaum of the Computer Science Department at Stanford University. Colleagues and friends of the late Dr. Samuel during his tenure at Stanford following his retirement from IBM, they have written a review of his life and work as a pioneer in machine learning, which we hope will remind today's researchers how indebted the field is to him.

Five of the eight technical papers in this topical issue are based on or related to Prolog. The first technical paper, by Antonacci and Calamini of the IBM SEMEA Scientific and Technical Solution Center, describes a prototype inference engine and a text-analyzing system (System N) for extracting nonsuperficial meaning from natural language text. The authors make use of conceptual graphs and fuzzy logic in their approach.

In the next two papers, researchers from the Rio de Janeiro Scientific Center of IBM Brazil discuss their work on extensions of logic programming systems. Casanova et al. define a default logic interpretation for normal programs, capturing the nature of extending SLD resolution ($S = \text{Selection}$, $L = \text{Linear}$, $D = \text{Definite}$) to SLDNF resolution (SLD with the negation by finite failure rule). The paper by Guerreiro et al. describes two experimental logic programming systems which are direct generalizations of Prolog. STORK is a full clausal first-order system that supports classical negation as well as negation by finite failure. PENGUIN extends STORK by using clausal defaults to capture nonmonotonic reasoning.

A number of workers have advocated the extension of the logic programming paradigm by the introduction of types to support, among other things, such software engineering principles as modularization and data abstraction. In the fourth paper, Beierle describes the realization of typed unification procedures on an extension

of the Warren Abstract Machine architecture. He also discusses a particular abstract machine developed for PROTOS-L, a logic programming language based on polymorphic order-sorted unification developed at the Institute for Knowledge Based Systems at the IBM Germany Scientific Center in Heidelberg.

Asakawa et al. discuss the problems in using current Prolog environments for application development, and offer a compiler-based modular programming system for Prolog, called ZEPHYR, which was developed at the IBM Tokyo Research Laboratory, as a vehicle for overcoming these problems.

An object-centered knowledge representation service developed at the IBM Thomas J. Watson Research Center and its use in a knowledge-intensive decision support tool, FAME (for FinAncial Marketing Expertise), are described in the paper by Apté et al. The knowledge representation language, called K-Rep, is a member of the growing family of term subsumption languages or description logics, which have attracted a great deal of interest in the knowledge representation community.

In another paper originating at the IBM Germany Scientific Center at Heidelberg, T. Wetter of the Scientific Center and R. Nüse of the University of Heidelberg assess the problems of using natural language directly for knowledge acquisition. They analyze the theoretical feasibility of such an approach, and describe several models and strategies that might be used in experimentation.

The final paper in our topical collection discusses an application in robot manipulation: T. N. Nguyen of IBM U.S. Systems Management Marketing and H. E. Stephanou of the Rensselaer Polytechnic Institute have applied a symbolic-to-numeric, "topological" reasoning scheme to the problems of robot grasping and regrasping.

The *Journal* staff and I are very much indebted to the other guest editors for this issue: Dr. Sanjaya Addanki and Dr. Se June Hong of the IBM Thomas J. Watson Research Center, and Dr. John Sowa, recently retired as a member of the staff at the IBM Skill Dynamics Education Center. Their help in locating potential subjects and authors throughout IBM, selecting the papers that were reviewed for the issue, and identifying the many peer reviewers both within and outside IBM, was indispensable. Our thanks go as well to the reviewers themselves, whose knowledge and experience were all-important in selecting the published papers and improving their presentation.

James H. Griesmer

Guest Editor