

KNOWLEDGE- BASED SYSTEMS

*Techniques and
Applications*

VOLUME 1

KNOWLEDGE- BASED SYSTEMS

*Techniques and
Applications*

VOLUME 1

Edited by

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ACADEMIC PRESS

San Diego San Francisco London Boston New York Sydney Tokyo

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PREFACE

As will be made evident by this preface, knowledge-based systems techniques and applications will be one of the key technologies of the new economy of the new millennium. Since artificial intelligence (AI) was named and focused on at the Dartmouth Conference in the summer of 1956, a variety of intelligent techniques have been initiated to perform intelligent activity. Among them, knowledge-based techniques are the most important and successful branch. The technology and accumulation of knowledge have shifted enterprises away from the traditional labor-intensive format to the present knowledge-intensive format. Decision-making and other processes have become somewhat more intelligent and intensively knowledge-dependent.

It is not feasible to treat the broad subject of knowledge-based systems techniques and applications adequately in a single volume. As a consequence this four-volume set has resulted. It provides a rather substantively comprehensive treatment of this broad subject, as will be noted below. The subtitles of the respective volumes are:

- Volume 1—Implementation Methods,
- Volume 2—Optimization Methods,
- Volume 3—Computer Techniques, and
- Volume 4—Applications Techniques.

This four-volume set constitutes a distinctly titled and well-integrated set of volumes. It is worth noting that the contents of these volumes in some cases include chapters which involve methods relevant to one or more of the other volumes. For example, Volume 3 includes a chapter on electric power

systems which involves substantive computer techniques, and so it is appropriate to place it in Volume 3. At the same time, it involves an important application, the subject of Volume 4.

The four volumes provide a substantively comprehensive treatment of knowledge-based systems techniques. These techniques include techniques in active knowledge-based systems, knowledge development expert systems, geometric knowledge-based systems, intensive knowledge enterprise modeling, communication models for module-based knowledge systems, knowledge distribution methods, knowledge base structuring methods, database systems techniques and tools in automatic knowledge acquisition, knowledge acquisition via bottom-up learning, acquiring and assessing knowledge from multiple experts, treating uncertain knowledge-based databases, data mining and deductive databases, knowledge-data, knowledge processing techniques, domain knowledge methods in knowledge discovery, dynamic structuring of knowledge-based systems, dynamic construction of knowledge-based systems, Petri nets in knowledge verification and validation, assembling techniques for building knowledge-based systems, self-learning knowledge systems, knowledge-based hybrid techniques, design knowledge development, knowledge modeling techniques for the construction of knowledge and databases, among other techniques treated in the four volumes.

These four volumes also provide a rather substantive treatment of knowledge-based systems applications. Over 50 examples of applications are presented, and these include database processing, data warehouse applications, software development, experimental software engineering, image processing, image analysis, pattern recognition, business processes, requirements engineering, enterprise processes, industrial applications, assembly sequences in manufacturing, database applications in large corporations, skill learning, transportation planning systems, computer vision techniques, control systems, distributed control, traffic control, chemical process control, knowledge learning in high-order discrete-time control systems, concurrent manufacturing systems design, high-speed civil transportation systems, geographical information systems, development of VLSI electronic systems, distributed intelligent control systems, computer control systems, power systems restoration, electric power grid modeling and control, electric power systems stability, multiagent control systems, machine learning, medical diagnosis, self-learning fuzzy control systems, manufacturing systems, automatic assembly systems in manufacturing, case-based reasoning methods, medical image processing, car configurations design, electronic commerce, customer support, information retrieval, production planning, simulation and optimization of complex production processes, planning methods in the semiconductor industry, computer-aided design, foundry systems operation and metal casting, process control, and finally scheduling systems. It is evident from this list of applications that many more are possible.

Other areas of major importance are knowledge-based expert systems of fuzzy rule-based systems. One of the frequently noted examples of the potential of knowledge-based expert systems is the stunning defeat of Kasparov, the world's chess champion, by "Big Blue," an IBM mainframe computer. Another example is the Chernobyl nuclear reactor disaster, which

could have been avoided if a properly designed knowledge-based expert system had been in place. Yet another example of international importance is the stock market crash of October 19, 1987, the worst in history, and it could have been avoided if the computer-programmed stock trading program had utilized a properly designed fuzzy rule-based system. This area is treated rather substantively in the four volumes, in particular, in Chapters 2, 8, 20, 22, 23, 26, 27, 29, 30, 31, 33, 34, 36, 38, and 41.

This four-volume set on knowledge-based systems techniques and applications rather clearly manifests this broad area as one of the key technologies of the new economy of the new millennium. The authors are all to be highly commended for their splendid contributions to this four-volume set, which will provide a significant and uniquely comprehensive reference source for students, research workers, practitioners, computer scientists, and others on the international scene for years to come.

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