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Book reviews

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Artificial intelligence in engineering by Graham Winstanley (Ed.), John Wiley & Sons, Chichester, 1990, pp 419, £19.95.

This book seeks to explain AI technology to that large audience of engineers not intimately involved in its development and who might want to use it. It presents important concepts in a well-organized, thorough and highly readable format.

The book defines AI through historical perspective, examples and comparison with the systems philosophy, and then examines AI use in some engineering domains. Each chapter of the book is self-contained and includes suggested detailed readings.

The first four chapters give an in-depth idea about AI, Knowledge Based Systems shells and languages and knowledge engineering tools and techniques. In Chapters 5, 6 and 7 engineering applications are described. The three remaining chapters extend the book's scope by examining development in reasoning, the mathematical foundations of AI, and the type of processing platforms on which AI applications can run.

In Chapter 1, my favourite, Winstanley introduces the concept of systems philosophy, and presents it as a holistic philosophy which attempts to rationalize the whole of our natural environment, from the behaviour of subatomic particles to the nature of the universe. He then introduces some more systems generic concepts, and the tools relevant to the systems scientist when using these concepts. The chapter finally concludes that the systems philosophy can provide the means to approach the solution to complex engineering problems with AI techniques.

Methods used to represent domain knowledge and methods of reasoning are central to AI. Chapter 2 deals with such methods. Knowledge is classified into theory, rules and examples, and reasoning is classified into induction and deduction. The types of knowledge representation considered are relational models, semantic networks, inference networks and predicate logic; each of these are examined in turn, with their capabilities and limitations highlighted. Two areas of knowledge processing—using logic for reasoning and searching world models—are discussed. The IDEAS system used as an example of a framework for developing and evaluating tools for building knowledge based systems for engineering applications is described.

A subset of AI is expert system technology. Chapter 3 first examines expert system development toolkits and shells such as KEE, ART, Goldworks, KES and Crystal, and then concentrates on issues relating to the choice and use of programming languages in the development of dedicated expert systems. The chapter briefly covers Prolog, Lisp and the Smalltalk object-oriented language.

The broad discipline covering the whole process of knowledge-based development that is knowledge engineering is described in Chapter 4. The complex task of a knowledge engineer and a few of the common techniques used in knowledge acquisition are examined. The chapter also provides overviews of some of the developing knowledge acquisition toolkits and methodologies. Such examples are TEIRESIAS and ETS, which provide support for production rule elicitation, and KADS, KEATS, ROGET and RBFS, which aim to elicit the overall structure of domain models through the identification of concepts and their relationships.

Chapters 5, 6 and 7 are the three applications chapters that deal with engineering design manufacture and testing, planning and project management and industrial computer vision. The chapters discuss the issues important and relevant to industry, and conclude that advances in both hardware and software will push AI techniques into the forefront of industrial applications arena.

Chapter 8 highlights the important aspect of uncertainty, temporal and spatial reasoning, and their current development. The chapter argues that the utility of the various approaches development for AI reasoning should be examined in the context of knowledge engineering and of end use, and that there is a need to identify the suitability of the formalism in user terms by analysing the efficiency of the interaction, minimizing the ambiguity and making the computed solution accurate to that required by the application.

Chapter 9 examines the use of discrete mathematics such as set theory, logic, etc., in describing physical laws and logistic constraints of the real-world problems under consideration in engineering AI applications. The theory helps in constructing abstract data structures, the relations aid the study of problem structure, and predicate calculus, for example, is used to generate rules which embody knowledge about the problem. The chapter helps to develop an understanding of the range of problems faced by the AI system builder and the underlying mathematical concepts at the heart of many AI systems such fuzzy logic.

Chapter 10 presents an overview of the current and new computer architectures for executing AI applications. It illustrates the factors that have influenced current designs and those that are likely to influence future systems. In the first part of the chapter, sequential implementations written in languages such as Lisp are described, and a survey of available sequential Lisp platforms is given, with the effect of VLSI and RISC processor architectures on future systems highlighted. The second part considers parallel implementations, and examines several parallel processing systems. The chapter concludes by introducing a different computational paradigm, called *connectionism* or *neural networks*, and its possible impact on AI processing in the future.

To all researchers interested in the application of AI techniques in engineering, I would say you must read this book. It not only provides the engineer with sufficient information to appreciate the potential of real-life engineering applications, but it also gives a good understanding of AI in general, and knowledge based systems in particular. I only wish there was an additional chapter on neural networks to make the AI tour complete.

On object-orieted database systems by K. R. Dittrich, U. Dayal and A. P. Buchmann (Eds.), Springer-Verlag, Berlin, 1991, pp. 422 (hardcover), DM98, ISBN 0-387 53496-2.

As explained in the preface, this book contains papers that were presented at the First International Workshop on Object-Oriented Database Systems held in Asilomar, California, and subsequently revised. Unfortunately, the preface does not provide the date for this workshop, information that would be helpful to the reader. It appears from the papers that it was probably held in 1986. The papers, with the clear exception of the Introduction, were probably written in the 1985–1987 period.

The subject matter is extremely important. Object-oriented databases have been developed as research prototypes and commercial products. They are more appropriate than relational databases in certain applications. Along with deductive databases, object-oriented databases are a prime candidate for third-generation database systems.

The 23 papers in the book are divided into eight parts. Part I (Introduction) contains one paper; 'Object-Oriented Database Systems: The Notion and the Issues' by K. R. Dittrich. It is an up-to-date (1990–1991) introduction to the basic concepts and issues concerning object-oriented databases. Part II (Data Model Concepts) contains five papers. The topics are PROBE, the connections between views and objects, inheritance issues, procedures in Postgres, and constraint handling. Part III (Language Issues) contains three papers on the languages GALILEO, Trellis and Godal. Part IV (Interfaces) contains two papers on the interfaces PROTEUS and ERIC. Part