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Book Reviews

Soft computing: fuzzy logic, neural networks and distributed artificial intelligence by F. Aminzadeh and M. Jamshidi (Eds.), PTR Prentice Hall, Englewood Cliffs, NJ, pp 301, ISBN 0-13-146234-2.

"Soft computing" is a new term that refers to an important body of work, including fuzzy logic, belief networks, neural networks and genetic algorithms, that attempts to make computing more flexible, more human, and more capable of dealing with the vagaries of real life. It is an area that I believe is very important for the field of artificial intelligence; I cannot imagine how it is going to be possible to build a real intelligent system without including at least one component which is in some way "soft" since I am convinced that the ability to handle incomplete and noisy information is central to what we understand by "intelligence".

Now, whilst there have been many excellent papers and monographs on the components of soft computing, there is a need for a book that deals with the whole area, a book that will weave a coherent and compelling argument for the combination of the exciting and powerful soft computing techniques that have been developed, a book that will push the area of soft computing to the forefront of the field of artificial intelligence where I believe it belongs.

Sadly, this is not that book. Instead it is a collection of papers, some of which are in the area of soft computing, and some of which are not. As such, it has no more to recommend it than other, similar collections. Indeed, given that some of the papers contain factual errors, and others are rather sloppily put together, I feel that there is good reason to avoid it.

Reviewed by Simon Parsons, Department of Electronic Engineering, Queen Mary and Westfield College, London.

Formal methods in knowledge engineering by M. Aben, University of Amsterdam, Netherlands, pp 236, ISBN 90-5470-028-9.

The related areas of formal methods and artificial intelligence have had remarkably little overlap over the years, despite their common historical ancestry through the likes of Alan Turing. In some quarters there is suspicion between the two camps. Many formal methods people believe there is little "intelligence" in the AI approach. Indeed, I have heard one very well respected formal methods researcher say that he would be happy with AI if it stood for "Automated Inference" instead.

This thesis forms a contribution which might help remedy the dichotomy, particularly in the area of building expert systems. I am sure that the formal methods and AI communities can each benefit from learning more about the approaches of the other. In the past few years there have been moves afoot to bring the formal methods community in more contact with safety and control engineers, in the context of the application of mathematical approaches to safety-critical, real-time and embedded computer-controlled systems. There has not yet been such a move with respect to AI, but this work could provide a prompting in that direction. In recent years, previous attempts along these lines have only been espoused within the formal methods camp by Ian Craig (applying the Z notation to blackboard systems) and John Rushby et al. (for NASA in the USA), to the knowledge of the reviewer.

The research behind this thesis was undertaken in the framework of the European KADS initiative and methodology for knowledge based system development. The premiss is that informal

methods are insufficient for knowledge engineering, but that formal methods are not in general well developed in a software engineering context. Knowledge engineering concepts are formalized in a VDM (Vienna Development Method) or RAISE-like logic notation. More introduction and/or a glossary of the notation used would be helpful for the reader. A large part of the thesis is taken up by these definitions, although a number of theorems are also stated and proved. The proofs are rather informally structured. A more formally structured presentation could be worthwhile, at least for selected proofs. A number of tools are presented at the end of the thesis, although (not surprisingly for such an ambitious task) these seem rather incomplete. In particular, no refinement or verification tools have been produced.

The presentation includes a good introduction, with an excellent set of references, which are helpfully cross-referenced back from the bibliography to the referring pages in the text, something that I would certainly recommend in all such reference works of significant size. A number of leading formal methods and notations are compared, although I would liked to have seen the B-method included in the list as well. The main criticism I have is the lack of definition of key important terms, including their omission from the index. I would like to see all such terms explained succinctly at first use, especially for a work aimed at multiple fields (such as formal methods and AI). Taking one example (from quite a number), page 1 mentions "conceptual model" with no definition or index entry. I have heard this term used widely, but have yet to see a definition for it, even in specialist computing dictionaries. Perhaps a member of the knowledge engineering community would like to remedy this situation.

The lack of background information is less of an issue for a specialist PhD thesis, but is very important if the work is to receive wider readership. Currently the thesis is better at introducing basic terminology in the formal methods area than in knowledge engineering. Thus it may serve more usefully for knowledge engineers to learn something about formal methods rather than the elucidation of knowledge engineering to the formal methods world. To take a very basic example, the term "formal method" is explained and indexed, but the term "knowledge engineering" is not.

The thesis is pleasingly presented and bound in book form, something that would be a welcome development by more institutions. As it stands, the work will be of limited appeal, but is certainly worth reading by any researcher interested in combining the fields of formal methods and AI. Practitioners with an interest and appreciation of theory (logic in particular) could benefit from the work, but as is to be expected for research work of this type, it is some way off being of value to students. Teachers of advanced students on a specialist course in the subject area of knowledge engineering could find it of use as background reading.

I welcome the work's contribution, although I think there is some way to go before the barriers between formal methods and AI are eradicated. If the thesis were to be transformed into a book for wider consumption, I would want to see much more introductory material, especially setting the scene with respect to knowledge engineering. The curriculum vitae indicates that the author is now working in industry. I am glad to see this since it means that the ideas in this thesis have a chance of being promulgated in the real world. However I suspect it could mean that the author will have little time to make this thesis into a more readable book form. I would be very happy to be proved wrong though!

Reviewed by Jonathan Bowen, University of Reading, UK.