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# Book Reviews

**FRONTIERS OF COMBINING SYSTEMS 2,** edited by Dov M. Gabbay and Maarten de Rijke, Research Studies, Baldock, England, 2000, xiii + 407 pp. ISBN 0–86380–252–4 (Hardback, $105.00).

This is a selection of contributions to the Second International Workshop on Frontiers of Combining Systems, held in 1998, abbreviated as FroCoS'98. In all, twenty papers are included, along with a Preface. The motivation for the series of workshops is of course the observation that interesting areas of investigation or innovation often fall between established "disciplines", and each of the papers in this collection describes a study that links two such established fields.

It is, of course, true that the whole field of cybernetics arose from this kind of linking, with the posing of such questions as: "What does the reflex arc of the neurophysiologist have in common with the feedback loop of the control engineer?" and many topics in robotics have obvious biological parallels. The topics that are linked by the papers in this volume do not range so widely as those linked by the advent of cybernetics, but the general principle, that good material is to be found in the in-between areas, still applies.

In the Preface, the range of topics covered is indicated by the comment: "This general theme of combining systems has attracted attention from across many disciplines, including applied and theoretical computing, logic, artificial intelligence, and natural language processing."

The sessions of the meeting had the respective headings: 'Theorem Proving and Rewriting' (6 papers), 'Logics' (8 papers, one not included in the book), 'Systems' (3 papers) and 'Constraints' (4 papers), but the book contents are not grouped.

All of the papers either show how to combine apparently distinct approaches to their particular area of concern, or else present a general scheme allowing such combinations. Several of the papers refer to formalised approaches to automated deduction, under the heading of constraint problem solving, and others refer to systems of logic (temporal, modal, and others). In most of these papers a considerable amount of background understanding is required since very formal representations are used. Nevertheless it is apparent that important contributions are made.

One paper in the area of automated deduction refers to the combination of systematic algorithms depending on tree-searching with scholastic methods that can be represented as hill climbing.

The first paper in the book, mentioned as having been presented in the session on "Systems", describes a programming language combining features of imperative (or procedural) and declarative programming. Programs appear at first sight to be procedural, until it is realised that the conditions for looping require traversal for all possible values satisfying a particular logical condition. It would be easy to write a purely-procedural program that would be functionally equivalent, depending on generating all possible values or combinations of values and then testing each for conformity to the logical condition, but the run time would be prohibitive. The incorporation of declarative (or logic) programming principles allows relatively efficient operation (though details of the inner working of the compiler are not given) and an application to an intriguing numerical problem is shown.

Several papers refer to the combining of different representations of logic or of mathematics. One refers to the sharing of libraries of mathematics between theorem provers. It appears that digital libraries of mathematics have been set up with differing sets of conventions that are not easily reconciled. Means of reconciling two such libraries are given, depending on use of theorem-proving methods in the transfers between them. The difficulties are such that it is not recommended that all possible pairings of such libraries be similarly treated. A more feasible solution is to reduce each of them, as required, to a basic logical form in which they are all compatible.

Two papers refer explicitly to natural-language processing. One treats some difficult features of English grammar under the heading of "aspectual and temporal phenomena", with introduction of a formal language for their analysis. The other is on the important matter of combining syntactic and semantic theories and information in reasoning.

The topics range widely within the somewhat restricted context indicated earlier, and there is much valuable material here.

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**THE ROBOT IN THE GARDEN: TELEROBOTICS AND TELEPISTEMOLOGY IN THE AGE OF THE INTERNET** edited by Ken Goldberg, MIT Press (Leonardo Book), Cambridge, Mass., 2000, xix + 366 pp., ISBN 0–262–07203–3 (Hardback, £23.00).

There must be many lazy gardeners, including this reviewer, who would welcome robotic help in the garden, but that is not what this book is about. The front cover, as well as a picture on page five, show a small circular garden with equipment above it that can be centred on any point in the garden area and allows remote inspection and manipulation. The emphasis is on the remoteness of the interaction and its implications for epistemology, the study of the grounds of knowledge or of what we term reality. The remote observer/operator may not know whether the garden physically exists or is a simulation, and whichever it is there is an interesting sense in which it also exists at the remote observation/control location.

The garden that is pictured is indeed real and exists in Vienna and can be inspected and tended through the Internet. The term "telerobotics" does not usually refer to intelligent, autonomous robot devices of the kind we would like to see tending our gardens, but to remotely-controlled manipulation devices, though where communication is difficult, as with planetary rovers, the device may also have a considerable degree of autonomy. Other applications of telerobots that are mentioned include bomb disposal and, interestingly, surgery.

Of the eighteen chapters in the book, two are introductory and the remainder are grouped under the four headings of (1) Philosophy, with five chapters, (2) Art, History and Critical

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Theory, with six chapters, (3) Engineering, Interface and System design, with four chapters, and (4) a single-chapter Epilogue. Of the two introductory chapters, the first gives a useful overview of the rest of the book, while the second is mainly concerned with the kind of telepresence provided by "web cams" or television cameras arrange to transmit live over the Internet.

A number of interesting topics are raised under the heading of philosophy. It is claimed that earlier philosophical theories, especially concerning the relationship of perception to the outside world, were influenced by the invention of the microscope and the telescope, and the telepresence allowed by the Internet represents a further step in a similar direction. Much attention is given to the difference between proximal experience (which in some circumstances might be termed "hands-on" or "face-to-face") and the mediated kind provided by telephones and the like. One aspect is that of morality, since the feelings about seeing other people subjected to violence or other unpleasantness may be different according to whether they are experienced proximally or by mediation.

In the papers under the heading of art, history and critical theory, a good deal of attention is given to various kinds of immersive or interactive environments for instruction or entertainment. Attempts to produce immersive experiences go back well before the computer age and include displays of the "diorama" type (of which that in Moscow representing the Battle of Borodino is probably the best known). Experimental interactive performances are described. (The pioneering work of Gordon Pask[1] and the Russian "Colour Music" which he mentions are not explicitly mentioned but should not be forgotten.)

Topics discussed in this section of the book inevitably impinge on the related topic of Virtual Reality. The main focus of the book, however, is on effective presence at a distance, which is not necessarily involved in VR.

One of the chapters under the heading of "engineering, interface and system design" reviews the development of remote manipulators, starting with purely mechanical devices used to handle radioactive material behind a glass screen. Electrical actuation allowed greater flexibility and greater separation of the controller from the scene of manipulation, and finally control using computers and eventually the Internet became possible. Control via the internet inevitably introduces variable delay which could cause an operator to overshoot in making adjustments and could degrade the feeling of telepresence. Techniques for minimising these disadvantages are described. The final, Epilogue, chapter actually dates from 1945 and is a vigorous defence of a new approach to psychology encouraged by consideration of techniques of film-making. It is argued that people are aware of their surroundings as a whole, including aspects that are hidden at any given time and combining inputs from the various sensory modalities. The new approach accepts this awareness and is presented at superseding earlier approaches examining, for example, specific sensory pathways. It is not made clear, though it must be true, that the earlier approaches are still valid and important and complementary to the comprehensive view. The spirited presentation here is a reminder of the importance of what Charles Sherrington,[2] the great pioneer of neurophysiology, described as the "integrative action of the nervous system".

The book contains a wealth of intriguing and perceptive comments and discussions of aspects of the kind of telepresence now possible by digital means and becoming increasingly relevant to Internet use.

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## References

1. G. Pask, "A comment, a case history and a plan", In: (Jasia Reichardt, ed) *Cybernetics, Art and Ideas* (Studio Vista, London, 1971) pp. 76–99.
2. C.S. Sherrington, *The Integrative Action of the Nervous System* (Silliman Memorial Lectures), Constable, London 1906 (2nd edn., Cambridge University Press, 1947).

**PRACTICAL ALGORITHMS FOR IMAGE ANALYSIS: DESCRIPTION, EXAMPLES, AND CODE**, by Michael Seul, Lawrence O'Gorman and Michael J. Sammon, Cambridge University Press, 2000, vi + 295 pp., ISBN 0–521–66065–3 (Hardback, with CD-ROM, £37.50).

This book provides exactly what the title indicates, in what is described in its Foreword as "classic cookbook style", and will be welcomed by programmers concerned with image analysis. Such analysis finds application in medical imaging and in processing of photographs from aeroplanes and satellites and surveillance cameras. It is also applicable in a variety of other scientific contexts, and obviously in *A.I.* and Robotics projects depending on vision.

The authors adopt a businesslike style and do not waste time on general discussion of areas of application. Their biographical notes show, however, that two of them have been involved in research on pattern formation in thin organic films, and in one case also magnetic films. The first author is President of a high-tech company developing systems for medical diagnostics and the second is Chief Scientist in a company developing biometric authentication systems for personal access.

This is undoubtedly an area where it is useful to have well-tried algorithms available. As well as the assurance that the algorithms do what they should, the time-efficiency of operations on two-dimensional data can depend enormously on how the processing is organised. This last point can become evident even in the simple context of the game of "Life" as described by Gardner.[1,2]

The programs on the CD-ROM are in the *C* programming language and are conveniently labelled according to the sections of the book in which they are described. A feature of *C* is that algorithms can conveniently be chained so that the output of one becomes the input of the next. The programs will run on a Windows (95 or 98 or NT) or Linux platform and require a *C* or *C++* compiler.

It is interesting, though not mentioned in the book, that a *C* compiler can be downloaded free of charge from the site: <http://www.cs.virginia.edu/~lcc-win32>. It is mentioned in the "readme" file on the CD-ROM that the development of the programs was done using Microsoft Visual *C++*, version 40. The images have to be in uncompressed TIFF format, and the CD-ROM gives advice on format conversion using packages such as Adobe Photoshop.

The first chapter of the book gives a useful overview of the remainder, and a number of theoretical aspects are treated in an Appendix. Between these, Chapter 2 is on Global Image Analysis, with attention to intensity histograms, global enhancement and geometric image transformations, Chapter 3 is on Grey-Scale Image Analysis with attention to local image operations and noise

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reduction as well as edge detection and template matching, and Chapter 4 is on Binary Image Analysis with attention to morphological and cellular processing, and various operations referring to shape analysis, including determination of convex hulls and inference of straight lines using the Hough transform.

Then Chapter 5 is on Analysis of Lines and Line Patterns and includes polygonalization as well as straight-line and cubic spline fitting, while Chapter 6 is on Analysis of Point Patterns including reference to Voronoi diagrams, and Chapter 7 is on Frequency Domain Analysis. This listing of topics is by no means complete but should give some idea of the wide coverage of this very useful book and CD-ROM.

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## References

1. M. Gardner, "Mathematical games: The fantastic combinations of John Conway's new solitaire game of life", *Scientific American* **223**, No. 4, 120–123 (1970).
2. M. Gardner, "Mathematical games: Lessons from Dr. Matrix", *Scientific American* **224**, No. 1, 104–108 (1971).

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