CYBERNETICS AND SYSTEMS ON THE WEB

The commercial use of PROLOG

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Abstract

Purpose – The commercial use of the logic programming language PROLOG is reviewed, with reference to applications in legal document preparation, advice to medical practitioners, natural language processing and analysis of social networks. Natural language processing is applied to story generation with extension to a flexible scheme for production and editing of documents, and in a separate scheme to computer programming. PROLOG is also the basis of a means of network analysis that has been applied in the study of business alliances and in analysis of terrorist networks.

Design/methodology/approach – The aim is to review developments accessible through the internet, especially those of general cybernetic interest.

Findings – Reference is made to tested practical applications and it is shown that logic programming continues to be a live topic. There are implications for its relationship to human mental processes, but these are not explored here.

Practical implications – In a large class of application areas, the use of logic programming allows rapid and relatively error-free program development, possible with modest hardware requirements.

Originality/value – It is hoped this is a valuable periodic review.

Keywords Programming languages, Cybernetics, Business environment

Paper type General review

PROLOG lives!

An important spin-off from the Artificial Intelligence effort is the possibility of declarative, or logic, computer programming, for which the best known language is PROLOG. The compiler and operating system for this are based on the "resolution method" of automatic theorem proving. A PROLOG program is essentially a statement of a problem in formal logic, so in many application areas its use removes the need to perform programming as usually understood. The term "rapid prototyping" is used to indicate this quick and easy implementation of a working system, which should be relatively error free from the start.

PROLOG has been made to run on quite modest computers, with even a version on the Sinclair Spectrum. A version termed WIN-PROLOG is available from Logic Programming Associates Ltd, running under Windows on a PC. It has many attractive features including means of interacting with databases in various formats and with programs in other languages. This last means that a PROLOG part can be a "back end" of a package whose "front end" or user interface is written in a procedural language. The company also offers a selection of "toolkits" for special application areas, including operation under uncertainty using either fuzzy or Bayesian methods, and operation as an expert system or for data mining. One toolkit allows interaction with a displayed tree-structure graph, and another under development is geared toward case-based reasoning. Provision is made for interactive operation of installations over the web.

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Details can be obtained from the company at: www.lpa.co.uk or by e-mail to info@lpa.co.uk. In order to raise awareness of the practical value of the methods, e-mail messages from the Marketing Director carry as part of their common signature the question: "Ever wondered what industry does with AI?" coupled with an invitation to read about applications in: "Global News Links" on the web page: www.lpa.co.uk/new_lin.htm

Legal document generation

At the time of writing the first item in this page gives the news that no less than Microsoft has chosen a system called *DealBuilder* to manage and generate its end user license agreements (EULAs). *DealBuilder* is largely written in WIN-PROLOG and is described as an intelligent document development and assembly tool which greatly simplifies the creation of legally correct documents in multiple languages. *DealBuilder* has in fact been used by a number of top law firms. Further details can be found at: www.business-integrity.com, with an impressive list of client firms, and of the use by Microsoft at www.business-integrity.com/news_Microsoftrelease.htm

Medical decision making

An early and now classical use of expert system methods is as an aid to medical diagnosis, with *Mycin* well known as a ground-breaking development. A system to help doctors make complex treatment decisions for patients has been developed by the company InferMed, with details at: www.infermed.com/arezzo, again using WIN-PROLOG. InferMed is a leading company in the medical software field, set up initially in conjunction with the Imperial Cancer Research Fund (now Cancer Research UK). It is claimed that the AREZZO clinical decision support software enables the design, creation, and execution of clinical guidelines and patient care protocols that guide medical professionals with advice tailored for each patient individually. It guides the user through the collection of the necessary data to assist in making decisions about the optimum clinical actions to be taken.

Natural language interactions

Two of the listed applications of PROLOG involve interaction with natural language. One is in a system called *Brutus* which originated as a story-writing program devised initially just to explore the possibilities of machines in this area. The performance was impressive since it passed the Turing test when required to produce very short (in fact, one-sentence) stories following a given lead. It was able to compete with humans because of its store of background knowledge including for example an understanding of the principle of betrayal.

The system has evolved from being essentially a toy to being useful for the preparation of commercial documents of many kinds. Two major difficulties were, first, the need to insert a very large amount of domain knowledge, and secondly the need for the system to interact with humans in the repeated revision of a document subsequent to its initial generation. These appear to have been overcome, and a working system is described by Bringsjord (2002) in a paper that can be found online at: http://terry4h.home.mindspring.com/PC%20AI%2016.1%20Issue%20Site%20-%20Paid/PC%20AI%2016.1%20Selmer%20paid%20pg%2036.htm

A project aimed at allowing the use of natural language as a computing language has been undertaken by the company Conversational Computing, Inc. Here too

WIN-PROLOG is used and a successful system is claimed. A detailed description can be found at: www.wordsonly.com/technology.htm

Analysing social networks

Highly significant in the present world situation is a system called *InFlow* that allows the modelling and analysis of social networks. It is devised by Valdis E. Krebs, again using WIN-PROLOG, and has been applied both in business studies and in analysis of terrorism. One of its applications to business studies results in a highly sceptical assessment of the value of alliances between companies, particularly in the IT industry, in a paper by Bill Robinson in *Forbes Magazine*, available at: www.forbes.com/2002/07/01/0701alliances.html. This makes reference to the web site of Krebs' company Orgnet at: orgnet.com, where a network is shown having 222 nodes representing IT companies, with a very dense mass of linkages indicating alliances that have been formed at some time, most of them unprofitable.

An important paper is an analysis by Krebs of terrorist networks argued to be behind the 2001 attack on the World Trade Center. This is in the peer-reviewed internet journal *First Monday* with the title "Uncloaking Terrorist Networks" and can be found at: http://firstmonday.org/issues/issue7_4/krebs/. The analysis is of course after the event, and the author acknowledges that the main use of such analysis has been in prosecution rather than prevention, but the possibility of prevention is not ruled out.

A good case has undoubtedly been made for the practical value of declarative programming using PROLOG.

Reference

Bringsjord, S. (2002), "AI research to AI business, and back; automatic story generation and intelligent document production", *PC AI Magazine*, January/February, Vol. 16 No. 1, pp. 36-43.