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23



4C brings business into the future

Artificial intelligence (AI) may seem like a science fiction pipe-dream, populated by evil machines and wayward robots, but, according to Professor Eugene C Freuder, AI could shortly become an everyday reality, as businesses look for failsafe solutions in an increasingly competitive marketplace.

Success in business is based on knowing - and getting around - your limitations. Be-

The science of artificial intelligence (AI) could soon be an everyday presence in workplaces as companies look for increasingly advanced solutions, writes **Kathy Burke**

cause the process relies on organisation and foresight, it lends itself well to the world of automation.

Freuder knows this only too well. As one of the world's leading constraint computation specialists, he is well versed in the everyday rigours of business organisation.

"Constraint computation might not say much to the per-

son on the street," said Freuder, "but once you get into the mindset, if you are a person like me, you see constraints everywhere."

Typical constraints faced by businesses on a daily basis vary widely. Most will be forced to get around financial barriers on an ongoing basis. Organisational, regulatory, legislative and logistical limitations also create obstacles.

Freuder heads up the Cork Constraint Computation Centre (4C) at University College Cork. 4C was formed in October 2001, when Freuder moved his research lab from the University of New Hampshire in the US to merge with the UCC Department of Computer Science Constraint Processing Group, headed by Professor James Bowen.

Explaining the thinking behind 4C's ground-breaking research, Freuder said: "Difficult problems can offer too many choices. The 4C centre develops the basic science to enable computers to help with these choices by applying advances in artificial intelligence and other disciplines to make constraint programming more powerful, practical and easier to use."

At its simplest, constraints computation uses artificial intelligence to "do the maths". The old-fashioned spreadsheet represents a very basic form of the technology.

Spreadsheet users set a value in order to see what effect it has on another value. Constraint technology takes this to another level, incorporating automated reasoning and "what if?" analyses.

Constraint computation is sexier than it sounds. The 4C Centre and its partner institutions work to develop artificial intelligence with the aim of building next-generation computers of science-fiction proportions.

As part of the Automated Constraint Engine (ACE) project, 4C is collaborating with Professor Susan Epstein of the City University of New York to apply her cognitive science model to constraints programming.

The idea behind the ACE project is to make computers learn from experience. Heuristics, said Freuder, is about enabling someone to learn or

discover something for themselves. ACE, he said, applies heuristics to machines using "a kind of cognitive architecture".

Although this technology is already being applied to products in the marketplace, it still poses some problems that require PhD-level expertise.

"We are trying to put more of the burden on the machine and less on people so that, increasingly, difficult problems can be solved by people with less and less specialised expertise, while still leaving the person the power to make choices and decisions," Freuder said.

"A person can apply the experience of having encountered a similar problem before. We would like the machine to be able to build a library of experience in the form of things it has seen or handled before, and to be able to do that kind of reasoning."

One of Freuder's 4C researchers is currently looking at the possibility of applying natural language understanding to constraint solving.

"Ideally, this would be like Hal 2001 - without the evil overtones! You would be able to talk to the machines in English, describe your problem, and instruct the machine to solve it.

"Rather than having to learn some archane computer or mathematical language, you would express yourself in English, and have that translated into a formal language with which the machine can compute," said Freuder.

The centre has an active Industry Associates Program, which targets industry, organising events aimed at involving and educating companies.

This approach has already led to significant industry collaboration.

"A couple of students in our group already have spin-offs in their eyes," Freuder said.

Earlier this year, Bausch & Lomb announced plans to assist with the funding of a 4C Centre project on improved manufacturing processes as part of Enterprise Ireland's innovation partnership grants scheme.

The centre also collaborates with the University Affairs Committee of the Xerox Corporation in New York.

According to Freuder, 4C will deliver a dozen papers at the two top international conferences on artificial intelligence this summer - the 19th American national inference on Artificial Intelligence (AI) in California in July and the 16th European Conference on AI to be held in Valencia, Spain, in August.

Cork is set to play host to the

second joint conference on automated reasoning early next month.

Such international gatherings are vital, said Freuder, because they make local achievements more visible.

"Things are going very well.

We are producing the science, we're interacting with industry and we have built up a critical mass here for our researchers

and for industrial interaction," he said.

"We had a distinguished Australian academic say recently, 'I had no idea there was so much going on here'. It's good to get that kind of visibility."

The constraints technology pioneered by Freuder is already used in software currently available on the market.

It is often, for example, embedded in commercial enterprise resource planning (ERP) and customer relationship management (CRM) applications.

French software company ILOG is a big player in the emerging constraints (or optimisation) field.

The company has already spearheaded two high-profile projects, helping the French railway system to allocate resources and the French prison system to schedule personnel requirements.