Visiting Research Report

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Visiting researcher
4th laboratory (Constraint solving)
From October 18 till November 1, 1991

1   Main activities

The main events during this slightly more than two weeks visit have been:

- A presentation, *Real-Time Logic Programming*, for the PIM and parallel software working groups. During this presentation, we showed the suitability of committed-choice languages for real-time processing. We proposed a minimal number of extensions to a KL/1-type language, which would make it an excellent tool for real-time processing.

- A presentation, *Towards Real-Time Constraint Solving*, for the CLP working group. This presentation is somewhat related to the previous present, and describes a way in which constraint solving can be integrated in committed-choice languages.

- A three-day workshop on constraint solving for ICOT, RIT, and SICS researchers. During this workshop, the cooperative research conducted between ICOT and SICS were examined in detail. Several new topics and current reserach was also discussed.

- Attending PIM demonstrations. The Mitsubishi and Fujitsu parallel inference machines were demonstrated in the ICOT annex.

Besides these activities, the time has been very busy with preparations, and numerous discussions in the Constraints research group led by Dr Aiba.

Some time has also been consumed by instructions about how to debug and maintain the PSI-3 machine on loan to SICS from ICOT.

2   Research results

Because of the very busy schedule, not much time has been left for research. However, the very stimulating discussions during the workshop, and mainly with Sato Yosuke-san, Sakai-san, Sawada-san, and Aiba-san, has given us some very interesting ideas. It seems that these ideas may imply a new single-exponential algorithm for discovering existence of real roots to a system of algebraic equations. Other single-exponential algorithms do exist (Grigorev; Renegar), but they add so many new variables that they become even more impractical than the double-exponential Collins' algorithm.

3   Social events

ICOT has made great entertaining efforts. The first was an excellent welcome party at ICOT. The second was a lunch with Dr Fuchi at a high-class Chinese restaurant. The third, which was very much appreciated by all the Swedish participants of the workshop, was a superb Chinese dinner, followed by a popular case study of modern Japanese-international culture.

4   Impression of ICOT

ICOT support during this visit has been truly excellent – perhaps even a bit too good. The effort ICOT feels it has to do in order to accept visiting researchers may be so heavy that ICOT must restrict the number of visitors.

My impression is that ICOT researchers are extremely easy to discuss with, and that there is no difference compared to foreign researchers.

Working hours differ in no substantial way from those of SICS'. Office space is of course limited, but considering the space constraints in central Tokyo, this is perfectly understandable. However, smoking is a *very serious problem* at ICOT. Sometimes working becomes impossible due to the thick tobacco smoke in the room. This is especially serious since everybody shares the same office space and there is no way to avoid the smoke. The situation would be considered unacceptable and even illegal in some other countries.

My impression of computer resources are that they are fairly adequate, although response times are a bit long. Although PSI machines are available for everybody, it seems that most people use the unix system for E-mail, word processing etc.

5 Summary

The visit has been very fruitful and a source of much inspiration. It has been excellently administrated by ICOT, and I am very grateful, especially to Dr Aiba for its organization, and for all the help I have received during the visit.

Curriculum Vitæ and Research History

Martin Nilsson

1 General Information

Date of birth: June 26, 1959.

Status: Swedish citizen, married.

Academic degrees: M.Sc., Royal Institute of Technology, B.Sc., Stockholm University, Ph.D., University of Tokyo.

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2 Curriculum Vitæ

1975 Completed undergradute course in mathematics at Stockholm University.

1976 Won the Swedish national Physics competition for senior high-school students, and received the third prize in the Mathematics competition.

1977 Received a third prize at the International Mathematics Olympiade in Belgrade, Yugoslavia.

1978 Began computer science study at the Royal Institute of Technology, Stockholm.

1980-81 Military service at the National Defence Research Institute, Stockholm.

1981 Began research at Uppsala Programming Methodology and AI Laboratory, Uppsala University.

1983 Completed M.Sc. degree at R.I.T.

1983 Began study for a Ph.D. in computer science at Uppsala University.

1984 Received a Japanese Ministry of Education scholarship for study in Japan.

1984-85 Completed Intensive Japanese course at Osaka University of Foreign Studies.

1985 Passed entrance examination for doctor's course in information engineering at Tokyo University, Faculty of Engineering. Received a young researcher scholarship from the Swedish Board for National Technical Development (STU).

1986 Member of the Parallel Programming Systems Working Group at ICOT, the Institute for New Generation Computer Technology.

1987 Passed level 2 of the Japanese government's Japanese Language Proficiency Test.

1989 Received doctor's degree from the University of Tokyo. Returned to Sweden and obtained a position at the Swedish Institute of Computer Science.

1990 Co-organizer of the Japan-Italy-Sweden workshop on parallel processing and logic programming.

3 Research History

From 1980-83, at RIT and in Uppsala, I worked with formalizations of iterated knowledge, i.e. knowledge about knowledge. Such problems turned out to be very elegantly expressible as Prolog programs.

However, efficiency issues forced me to think of implementations and parallelism, on which I concentrated after coming to Japan in 1984. One nice feature of logic programming languages is their expressional power despite the small number of primitives available. This property I used to develop an implementation method for committed-choice languages like GHC, on vector-parallel supercomputers. In 1989, I had a Hitachi supercomputer reach a peak performance of 5 million reductions per second using this method.

After finishing my doctoral degree at the University of Tokyo on this subject, I returned to SICS in Sweden. My current research focuses on applying logic programming in two main fields: constraints and real-time processing, in particular robotics.