

ARTIFICIAL INTELLIGENCE IN HUNGARY – THE FIRST 20 YEARS

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The main objective of this paper is to give a short overview of the history of Artificial Intelligence in Hungary between 1975 and 1996, with a brief outlook on the past 10 years. Hungarian AI began at the end of the 1950s when Professor László Kalmár from Szeged University designed a machine which could be programmed in a mathematical formula language. With this symbolic language and his logic machine built at Szeged University, he was the founder of computer science research and education in Hungary –and furthermore a forerunner of AI. Thereafter the country came into the limelight again in 1975 with the development of a Hungarian Prolog interpreter, which was the second of this kind in the world. Based on it Hungary quickly became a Prolog ‘superpower’ as in the early 1980’s two Hungarian-made Prolog systems were developed: MProlog (Modular Prolog) and Communicating Sequential Prolog (CSPProlog), which were sold all over the world. Using these tools researchers and experts from different application domains developed successful Prolog applications, and later on expert system tools and concrete expert systems. However, this enthusiastic activity stopped in 1990 due to the international “AI winter” on the one hand, and to the new system of Hungarian economic motivators on the other. 1996 was a remarkable year for the Hungarian AI community: it was the first time that the European Coordinating Committee for Artificial Intelligence organized the European Conference on AI (the 12th ECAI) in a Central and Eastern European Country, namely in Hungary. On this occasion a survey of the first 20 years of the Hungarian AI research, application and education activities was prepared, but has not been published since then; the present paper is an updated version of this survey from 1996.

1. PREFACE

1996 was the first year when the European Coordinating Committee for Artificial Intelligence (ECCAI) organized the European Conference on AI in a Central and Eastern European Country, namely in Hungary. *The 12th European Conference on Artificial Intelligence, ECAI’96* (Budapest, 12-16 August 1996) was organised by the *John von Neumann Computer Society (NJSZT)*. The organising committee had the intention to provide many different kinds of opportunities for demonstrating AI research, as well as its application and education in Hungary – our results and plans. To support this goal the following materials were prepared: *Hungarian AI Bibliography* [53] with an additional *Preprint Collection* of 9-volumes and a survey with the title „*The State of the Art of AI in Hungary in 1996*” [54]. (The keyworded bibliography contains 400 selected items from nearly 190 Hungarian authors/co-authors, the survey is an extended version of [55]).

The main objective of the present paper is to give a short overview of the early history of AI in Hungary by providing the readers with information on its various aspects. As everyone knows the

Hungarian economic life has been under reconstruction since 1990 (and this has remained the situation ever since up to the present day, in 2006). Research labs, staff and fields of activity have undergone major changes during these years which makes it difficult to get an up to date picture. An appendix is attached to this paper which lists the institutes mentioned in this survey – given the name and webpage of their successor today.

I would like to thank all colleagues for giving information concerning themselves and their recent AI work and – especially Bálint Dömölki, László Csink and Péter Szeredi – for helping me to prepare the above collections and this present survey.

2. THE ROOTS

The roots of Artificial Intelligence in Hungary date back to end of the 1950's, when professor *László Kalmár*¹ from Szeged University² designed a machine which could be programmed in a mathematical formula language. With this and his logic machine built at Szeged University, he was the founder of computer science research and education in Hungary – and like that he might be considered as a *forerunner of AI*. Thereafter the country came into the limelight again in 1975 when the first Hungarian Prolog interpreter and its applications were developed. In the early 1980's the *Hungarian Modular Prolog system* (MProlog) with its applications followed, see [57] and [56]. The survey [56] was presented at the *first International Workshop on Logic Programming*, held in Debrecen (Hungary) in 1980; this illustrates the fact that at that time Hungary was a 'superpower' in the area of logic programming implementation and application. MProlog should be considered significant also from an economic point of view: by 1988 more than 1500 MProlog systems were installed in 25 countries all over the world. There was another successful Hungarian Prolog implementation, the *Communicating Sequential Prolog* (CSPProlog), see [22]; by 1996 this system was installed in 150 institutions, in 14 countries.

By the early 1980's there were a number of AI labs in Hungary doing research and/or applications in knowledge based technology. The most important centers were the Computer and Automation Institute of the *Hungarian Academy of Sciences* (SZTAKI), the *Computing Applications and Service Co.* (SZÁMALK), the *Central Research Institute for Physics of the Hungarian Academy of Sciences* (KFKI), the *Computer Research and Innovation Center* (SZKI Theoretical Laboratory, later IQSOFT). Of these SZTAKI is the only one still carrying out AI research activities today.

3. AI ASSOCIATION

In Hungary the *John von Neumann Computer Society* (NJSZT) was founded in 1968 for disseminating computer culture. The Hungarian AI community in 1976 was officially formed by creating an *Artificial Intelligence and Pattern Recognition Section* (AI&PR Section), with approximately 80 members – within the NJSZT.

In 1979 series of seminars entitled „*Theoretical and practical problems in programming*” was started under the auspices of the AI&PR Section, SZKI and SZÁMALK. For six years this series provided a high quality forum for those who were interested in computers and computer science,

¹ <http://www-history.mcs.st-andrews.ac.uk/Biographies/Kalmar.html>

² Formerly called József Attila University

especially current AI technics and applications. This weekly series of seminars was a type of workshop activity that proved to be useful for those interested in current IM techniques and applications. The most important results of Hungarian researchers were accounted for by the scientists themselves. International achievements were regularly reviewed at seminars that intended to give either a broader view or a thematic outlook in the field. The program was scheduled a month in advance so that participants could choose according to their interests. These weekly seminars were frequented by 70-100 people regularly including attendees from the country and abroad as well. When the Japanese 5g project was thematically discussed the number of visitors often increased to 150. Everybody was happy to share experiences and ideas with others in the highly active atmosphere life of those years. But as we were closing towards the economical changes in 1990, the market oriented approach became more and more widespread and it could be felt in the tone and the choice of topics of the seminars. Meetings grew scarcer, the audience shrank. Quite soon the seminars took place only 4 times a year and were frequented only by 20-40 people.

Experts and researchers working in different fields of AI ran *other forums* too, among others monthly/quarterly seminars within the NJSZT and outside of it. After several years of coexistence it turned out that the groups interested in pattern recognition were almost disjoint from those interested in other topics of AI. Consequently, in 1990 the *Artificial Intelligence Group* (AI Group) and an *Image Processing Group* (IP Group) were founded as two separate sections, within the NJSZT, both being legal successors of the AI&PR Section. These groups organized regular meetings such as the *Hungarian Workshops on Image Analysis* and the *Hungarian AI Conferences* (see below). The AI Group organized other regular activities, such as the *quarterly AI-day* featuring lectures on selected topics, e.g. „Applications of Expert Systems”, „Cognitive Aspects of AI”, „Intelligent Decision Support Systems” and „Neural Networks”. In addition to these meetings there were occasional lecture afternoons of invited speakers of both AI and IP Groups.

Besides the two main AI Special Interest Groups, there has been an expressive AI-activity in the frame of the *Section of Medical Informatics* of NJSZT, founded in 1968. Another separate interest group of a field close to AI was the *Hungarian Robotics Association* (HRA). The HRA was founded in 1985, had 40 affiliated institutions and more than 300 individuals. Soon their aim was to turn the association into a consortium formed by industrial companies, R&D institutions, individuals, universities and ministries that had interests or duties concerning the reconstruction of the Hungarian economy.

There were more than 200 Hungarian individuals in 1996 who registered in the *Hungarian AI Directory* – though in the *European AI Directory* the number of Hungarian colleagues is only 160. The NJSZT is a member of IFIP (since 1969), IAPR (since 1982), ECCAI (since 1983), IMIA and EFMI (since 1986 and 1988).

4. AI NEWSLETTERS

Unfortunately currently there is no AI periodical in Hungary. Nevertheless, in the first 20 years there were journals regularly reporting on AI developments, for instance *Információ-Elektronika* published a thematic series on the 5th generation project in 1983/84 (based on the above mentioned series of seminars). After publishing the first national volume of studies on Expert Systems in 1988 [24], this journal devoted a special issue to the state-of-the-art of the expert system field in Hungary [39]. (Unfortunately, this journal and other ones have ceased to exist due to financial difficulties in

the early 1990's.) The national monthly computer magazine *ÚjALAPLAP* published between 1992 and 2000 a series of articles promoting AI (this journal met with financial difficulties and ceased to exist in 2002). Other Hungarian computer journals often published AI related papers, too.

5. AI MEETINGS

The first regular meetings arranged in the field dealt with image processing. The *triennial Hungarian Workshop on Image Analysis* was first held in 1985, while the last one (with about 70 participants) in 1991 [8].

The *first two-day seminar devoted specifically to Artificial Intelligence* was held in Visegrád (Hungary) in 1989 with a proceedings in English, containing 15 contributions, see [19]. There were also 20 other lectures not included in the proceedings. The *Second Conference on Artificial Intelligence* was held in 1991 in Budapest. This time there were about 300 participants from almost all institutions that have anything to do with AI. During the three-day conference 46 lectures were delivered and compiled in an English proceedings, see [20]. Due to the use of Hungarian as the official conference language most of foreign participants were from neighboring countries. The conference featured lectures in a wide range of AI areas, including theory and applications of expert systems, knowledge representation and acquisition, reasoning techniques, natural language understanding, pattern recognition, decision support systems, logic programming (Prolog), learning, cognitive psychology and education of AI. The *3rd nationwide AI conference* with the same topics was held in Budapest, in 1993, see [38].

Besides national AI gatherings there were *regular Austrian-Hungarian Conferences*, most of them include AI-related topics. For example, Intelligent Systems in 1991, see [31] – this conference was held in cooperation with the Slovak Cybernetic Society, as well. Further to the aforementioned meetings (and the memorable Workshop on Logic Programming, held in Hungary in 1980) additional international conferences held in Hungary included up to 1996:

- the *5th International Conference on Computer Analysis of Images and Patterns* (1992),
- the *10th International Conference on Logic Programming (ICLP'93)*,
- the *5th International Conference on Computer Analysis of Images and Patterns (CAIP)*, see [9],
- *IFIP/IFAC International Working Conference on Knowledge Based Hybrid Systems in Engineering and Manufacturing (KNOWHSEM'93)*, see [44],
- the *8th Symposium on Microcomputer and Microprocessor Application* (1994),
- the *1st and 2nd EURASIP International Workshop on Image – and Signal – Processing* (1994, 1995) and
- the *12th European Conference on AI (ECAI'96)*.

6. RESEARCH

The Hungarian Academy of Sciences, state funding agencies such as the National Committee for Technological Development and other sources provided financial support for R&D activities. The research centers were more or less the offsprings of those being active in the early period of Hungarian AI, see e.g. the surveys [52]. Some of these, however, became victims of the rationalization/privatization wave and ceased to exist, or are operating with a reduced staff. Many of them are being reorganized, sometimes split into a number of new companies – and new researchers

have been entering the scene – ever since. Research labs, staff and fields of activity are currently undergoing major changes which makes it difficult to get and maintain an up-to-date picture.

AI research in Hungary was confined to small teams at academic institutions, universities and smaller firms. The following *illustrative list (from 1996)* contains *some better-known on-going research projects* (identification of the institution). Most of them were associated with international projects. As it can be apparent from the list the research area of Hungarian scientists covered a rather broad field of AI at that time.

Applications of AI in Engineering

- AI in pharmaceutical design (ALL), see [17]
- AI in process planning (BDMF), see [33]
- abstract theory of architectural design (BME), see [32]
- AI in measurement science (BME), see [15]
- Expert Systems for accelerator beam scheduling (KFKI MSZKI), see [42]
- AI in computer network protocol engineering (KFKI MSZKI), see [14]
- AI in material testing machines, logistics (ME), see [11]
- Expert System application in optimization of engineering designs (ME), see [35]
- Expert Systems in mining engineering (ME), see [6]
- process planning with reasoning and optimization (SZTAKI), see [43]
- Expert Systems in nuclear power plant vibration diagnostics (VEIKI), see [4]

Artificial Life

- active tissues from active elements (ALL), see [10]
- grammar systems – a grammatical approach to distribution and cooperation (SZTAKI), see [12]

Cognitive Science

- way of thinking – the limits of relational thought and AI, (ELTE) see [45]

Epistemological Foundations

- Aristotelian phenomenology of human mind (ALL) see [3]
- computer epistemology (SZTAKI) see [62]

Foundation of Computer Science

- first-order logical foundation of computer science (ALL), see [29]
- logic based simulation (ML and ALL), see [23]

Genetic Algorithms

- continuous restoration Expert System (KFKI MSZKI), see [37]

Inductive Logic Programming

- theory of inductive logic programming (JATE), see [2]
- theory of revision (JATE) see [34]

Knowledge Based Systems

- knowledge generating systems (ALL), see [21]
- compensation planning, benefit advisory system (BKE), see [25]
- design methodology of Expert System – Group Decision Support System tools (BME) see [26]
- methodologies for supporting the transfer from knowledge representation to Expert Systems in the field of banking (BME), see [27]

- KBS development environment – connected with CommonKADS projects (ITA), see [46]
- mathematical programming Expert Systems (SZTAKI), see [5]
- further ES developments see in [52].

Knowledge Representation

- information models of knowledge (ALL), see [28]
- modeling measurement problems with constraints (BME), see [58]
- representing and manipulating of medical knowledge (SOTE), see [13]
- pattern representation of knowledge (SZTAKI), [63]

Machine Learning

- mathematical and computational problems in the learning theory (JATE), see [59]

Multi Agent Systems

- integrating intelligent systems into a cooperating community for electricity management (KFKI MSZKI), see [61]

Natural Language Processing

- industrial applications of NLP technologies (MorphoLogic), see [49]
- natural language interfaces based on attribute grammar (JATE), see [2]

Neural Networks

- neural filters, neural network in dynamic system modeling (BME), see [16]
- use of ANN for prediction of roll forces in hot rolling of steels (ME), see [18]
- analogical and neural computing – CNN, a new paradigm (SZTAKI), see [50]
- neuro-fuzzy approach to pattern recognition and control (SZTAKI), see [47]

Logic Programming and applications

- CUBIQ – parallel logic programming, graphical tool set and knowledge base tools (IQSOFT), see [60]
- LOGFLOW – massively parallel Prolog machine (KFKI MSZKI), see [36]
- distributed real-time Prolog (ML), see [22]

Reasoning with Uncertainty

- plausible reasoning as a foundation of machine discovery (ALL), see [21]
- design of fuzzy controllers (BDMF), see [51]
- fuzzy reasoning and control (BME), see [41]
- fuzzy reasoning in vague environment (ME), see [40]

Speech Understanding

- speech recognition systems (BME), see [30]
- multilingual text-to-speech converter (NYTI), see [48]

Vision, Signal Understanding and Image Processing

- texture analysis and applications (SZTAKI), see [7]

We can mention that the *National Technical Information Center and Library (OMIKK)* serves current data from their R&D databases: Hungarian R&D Information Systems, -Institutes, -Projects and -Experts (both in Hungarian and in English).³

³ <http://www.info.omikk.bme.hu/nkr1>

7. DEVELOPMENT

In Hungary there was significant product development work in almost all the fields of AI (see [53]). In the following we confine our attention to *KBS tools and applications*. Up until 1991 the national KBS shells and applications were *logic- and rule-based*, and mostly ran on PCs. After the *weakening of the COCOM restrictions* and the appearance of multi-national computer companies, shells for workstations and mainframes supporting multiple paradigms became available. By 1996 projects on intelligent, integrated applications were run and *application oriented* shells were developed; hybrid shells like ART, KEE, Level5 Object and G2 were in use at a number of sites.

Below we give *a representative list of some well known Hungarian made tools for Logic Programming and Knowledge Based technologies* (together with the developing institution).

AI language systems developed in Hungary:

- *MProlog*, Modular Prolog (IQSOFT, formerly Theoretical Laboratory of SZKI)
(It was the first Hungarian-made AI tool in the international AI market.)
- *CS-Prolog*, Communication Sequential Prolog Professional (ML and ALL)

The first Hungarian general purpose KBS shells:

- *ALL-EX PLUS*, a hybrid shell (ALL and ML)
- *GENESYS*, a rule based shell (SZÁMALK)
- *MProlog Shell*, an MProlog based shell (IQSOFT)

By the time these tools became marketable the well known phenomenon of international ‘AI winter’ had already started in the sector (in 1988-89). The products that survived this period and remained on the market were CS-PROLOG and ALL-EX PLUS.

Other, problem-oriented KBS tools developed in Hungary:

- *CAPE*, for supporting protocol analysis (KFKI MSZKI)
- *CASSANDRA*, for problem-oriented simulation systems (KFKI MSZKI)
- *CreditExpert*, for the evaluation of loans in shop level, directed from the center (ARAMIS)
- *DINE*, an intelligent Group Decision Support System (GDSS) shell (SZTAKI)
- *KAS-NES*, a case-driven shell, based on statistical pattern-recognition methods (SZTAKI)
- *METABOLEXP*, an in-house toolkit for building chemical and medical-biological predictive KBSs (CompuDrug)
- *OPSQL*, an intelligent data dictionary coupling OPS5 and ORACLE DBMS (KFKI MSZKI)
- *PANGEA*, a simple rule-based shell for handling engineering tasks (BME)
- *ProjectExpert*, for supporting the define and design phase of project building (ARAMIS)
- *REALEX*, a real-time shell for industrial applications (BME)
- *TenderExpert*, a toolkit for evaluation of competitive bidding (ARAMIS)
- *ZEXPERT*, an Mprolog-based banking shell (IQSOFT).

In the 1980’s work on KBS development tools was carried out in parallel with that on methodology, as well as with the application development. Some better-known *Hungarian KBS application projects* between 1985-1991 (indicating the application areas and the number of projects): building

industry: 7, chemistry: 10, computing: 6, energetics: 7, medicine and health service: 16 and other industrial projects: 11 (see [52]). In 1991 there were about 30 systems at product level. More than 40 national institutes were engaged in KBS development and even more experts from a further 40 institutions were working on building applications. In the 1990's the activity in research, development and application areas diminished, but also new projects were started to develop integrated AI applications, using both the above mentioned tools and object oriented languages.

By 1990 there were two internationally *successful Hungarian made tools*, *MProlog* and *CS-Prolog* systems. From the following years we would highlight two prize-winning Hungarian products:

- *Natural language processing tools*, such as spell and grammar checkers, hyphenators, thesauri (MorphoLogic):
From 1993 these tools have been licensed by Microsoft, Lotus and other international software companies. Around 100.000 copies of these tools were sold in Hungary. Furthermore MorphoLogic is developing versions of these tools for other languages, such as Polish, Romanian and Bulgarian. In 1999 the MoBiMouse dictionary system was awarded the European IST Prize, and in 2004 the Prize for innovation in IST technology.
- *Recognita Plus*, the Hungarian made OCR product (Recognita):
By 1996 Recognita had 140.000 installations all over the world. They have distributors in 28 countries. The University of Nevada Las Vegas conducts an annual test of page-reading systems. One of the winners of the 1996 test was the Recognita Plus OCR program. (By 2006 Recognita became part of the NUANCE Corporation.)

8. EDUCATION

Although some topics of AI appeared in Hungarian higher educational programs as part of already established subjects in the beginning of the 1980's, it was around the middle of 1980's when AI became part of the curriculum as a stand-alone subject on its own right, first at the Budapest University of Economic Sciences (BKE) and at the Kandó Polytechnic of Technology (KKMF). Today within the first three years of all Technical Informatics and Computer Science programs at universities and polytechnics in Hungary courses named "Introduction to Artificial Intelligence" are taught normally. Depending on the type of the institution there were various subjects in the curricula. In the following we would like to present three examples of educational AI programs; the first program focuses on computer science and the others are based on computer engineering.

Courses in AI were started in the mid 1980's at the *Eötvös Loránd University (ELTE)*. The AI module, as a separate part of the informatics education, was established in 1988. The compulsory basic course, which takes two semesters, gives an introduction to the main techniques of knowledge representation as well as to the search, knowledge representation and inference methods involved. Subsequently the students can progress by obtaining credits from the following subjects: knowledge based technology and expert systems, AI languages, (especially Prolog and its applications but LISP, too), robotics, cognitive science, etc. New subjects are continuously added to the present list. A new course is under development about pattern recognition, neural networks, intelligent crawlers, human computer interface (research: head mouse and eye mouse), multi-agent technology, lego-robotics and ontology. Since 1992/93 a three year postgraduate program is being offered.

The second example is the *Technical University of Budapest (BME)*, which has a long standing tradition in teaching applied Artificial Intelligence and related subjects. BME has been offering under-graduate, graduate and post-graduate courses in AI for more than 20 years. Compulsory Msc courses include: intelligent measurement systems (AI methods in design complex engineering systems), application of AI (an AI survey with emphasis on how AI methods should be interpreted and evaluated from the point of view of their technical usage) as well as robotics and vision. Optional Msc courses include: AI – state-of-the-art, symbolic signal processing, neural networks, KBSs, ESs, soft computing methods. Almost every subject is accompanied with properly adapted laboratory practice. Other subjects currently taught include e.g. machine learning, knowledge-based technology, constraint programming, intelligent agents, embedded and ambient systems. Ph.D. courses cover the following fields: advances in AI (intelligent real-time systems, 2nd generation ESs, knowledge-level analysis, agent systems, etc.), fuzzy logic, neural networks.

The third example is *Kandó Polytechnic of Technology (KKMF)*. A new model for teaching AI has been designed at the institute emphasizing that any intelligent action requires at least a minimal degree of the following capabilities: sensing, information processing, “knowing”, learning and reaction (signaling, moving). According to this model the compulsory subject, entitled “Introduction to AI”, addresses the following major areas: sensory systems, incremental intelligence, classic and new search methods, genetic algorithms, classic and fuzzy logic and their applications, artificial neural networks, pattern recognition and image processing, as well as machine learning and robotics. The elective specialization module contains three main courses: theoretical basis of AI, digital image processing and artificial neural networks. Other supplementary elective courses include: robotics, decision support systems, ESs, knowledge-based technology, intelligent systems and embedded systems. For the last 5 years special training courses have been organised for blind and visually impaired even deaf and hard hearing persons – using special AI-related techniques such as speech recognition, speech generation and optical character recognition (OCR). So far more than 100 students graduated in each categories.

Other universities and institutes of technology offer a number of courses in their BSC and MSC curricula to broaden and/or deepen students’ AI knowledge. It can be stated that AI education is one of the most dynamically evolving fields in the Hungarian higher education.

9. FUNDING

The *Hungarian Academy of Sciences (MTA)*, the *National Committee for Technological Development*, the *National Research Foundation of Hungary* and other sources available at that time granted financial support to R&D activities related to AI, too. In the mid 1990’s the European Community programs for cooperation with countries of Central Europe provided funding for several AI-related R&D projects in Hungary.

10. SUMMARY

To characterize the situation it can be said, that although potential users are beginning to recognize the advantages of AI technology, a lot of projects are delayed by lack of financial support or interest, or because of the reorganization of the Hungarian economic, financial and scientific life. Several systems are used in-house, where they were developed, never making it to the market. Fortunately, in many fields – e.g. in engineering and financial spheres – extensive work is done in the area of

information systems. Implementing such systems on a wide scale forms a good basis for the development of usable intelligent systems in the near future.

The modernizing wave of the Hungarian economic system raised special demands towards information technology today. The emphasis lies on the construction of the basic information infrastructure. In the 1990's the conventional technologies were in the focus of interest in Hungary (reengineering, reorganizing early applications, building integrated information services, etc.). Parallel with the massive computerization the interest for AI techniques is growing. Incorporation of AI techniques in everyday software technology has already begun – in Hungary, too.

The first 20 years of Hungarian AI research was very intensive, and laid the grounds for the contemporary AI research, as well: multi agent systems, ambient intelligence (e.g. human-machine cooperation, embedded systems), declarative programming languages and their applications, natural language technologies, image processing (especially in medical field), info-bionics, semantic WEB, ontologies (e.g. the development of a Unified Hungarian Ontology), as well as several data mining and text mining applications. There are a number of talented AI researchers, experts and system builders with notable national and foreign experience (as exemplified by the collection of interviews with 31 prominent Hungarian AI figures⁴). AI education is being set up and thereby an institutional way of knowledge transfer is being formed. The latest developments indicate that AI in Hungary has reached maturity concerning theoretical work as well as applications.

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⁴ www.agent.ai/main.php?folderID=150 (in Hungarian, made by the *AITIA International Inc.*, www.aitia.ai).

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APPENDIX

List of Hungarian institutions referred to in the paper

(their *successor* in 2006 and homepages)

- ALL*: Applied Logic Laboratory (www.all.hu)
- ARAMIS*: ARAMIS Bt. – Applied Research and Management for Information Systems
In 2006 *Winsdom Research and Consulting Co.* (www.winsdom.com)
- BDMF*: Bánki Donát Polytechnic
In 2006: *Budapest Tech, John von Neumann Faculty of Informatics* (www.nik.bmf.hu)
- BKE*: Budapest University of Economic Sciences
In 2006: *Corvinus University of Budapest* (www.uni-corvinus.hu)
- BME*: Technical University of Budapest
In 2006: *Budapest University of Technology and Economics* (www.bme.hu)
- CompuDrug*: CompuDrug Ltd.
In 2006: *ARMI Hungary, Inc.* (www.albmolecular.hu)
- ELTE*: Eötvös Loránd University (www.elte.hu)
- ITA*: Information Technology Foundation, Hungarian Academy of Sciences (www.mtaita.hu)
- JATE*: József Attila University
In 2006: *Szeged University* (www.u-szeged.hu)

KFKI–MSZKI: KFKI Research Institute for Measurement and Computing Techniques
In 2006: *KFKI Group* (www.kfki.com)

KKMF: Kandó Polytechnic of Technology
In 2006: *Budapest Tech, John von Neumann Faculty of Informatics* (www.nik.bmf.hu)

ME: University of Miskolc (www.uni-miskolc.hu)

ML: ML Consulting and Computing Ltd.
In 2006: *Multilogic Co.* (www.multilogic.hu)

MorphoLogic: MorphoLogic (www.morphologic.hu)

MTA: Hungarian Academy of Sciences (www.mta.hu)

NYTI: Research Institute for Linguistics, Hungarian Academy of Science (www.nytud.hu)

NETI: Institute of International Technology (www.neti.hu)

NJSZT: John von Neumann Computer Society (www.njszt.hu)

OMIKK: National Technical Information Center and Library
In 2006: *BME – OMIKK* (www.omikk.bme.hu)

Recognita: Recognita Corp.
In 2006: *NUANCE Co.* (www.nuance.com)

SOTE: Semmelweis University (www.sote.hu)

SZÁMALK: Computing Applications and Service Co.
In 2006: *SZÁMALK Education and Information Techn. Ltd.* (www.szamalk.hu)

SZTAKI: Computer and Automation Research Institute, Hungarian Academy of Sciences
(www.sztaki.hu)

VEIKI: Institute for Electric Power Research Co.
In 2006: *VEIKI Co.* (www.veiki.hu)