

University of Helsinki
Department of Computer Science
Annual Report 2004



CONTACT INFORMATION

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1. DEPARTMENT OF COMPUTER SCIENCE IN 2004

The year 2004 was made historic for the Department of Computer Science by the relocation from Vallila, where the department had been housed since 1987, to the brand-new Exactum building on the Kumpula campus. The move with all the activities and events that it entailed took on a central role during 2004; however, the department kept up its main duties in research and education, as well. These duties were defined in the department strategy for 2004-2006, which the department actively started to carry out during this year.

Strategic outlines for the department

In its strategy for 2004-2006, the department emphasizes the quality and continuous improvement of research, teaching and supportive services, as well as co-operation, community spirit and shared operational principles. To implement these plans, the strategy lists a number of concrete proceedings, most of which were started in 2004.

■ ■ 4

In the area of teaching, the most important effort has been made in preparing for the new bipartite degree structure that will be implemented during 2005. A team consisting of teachers and students of the department has been planning the new degree requirements on the basis of core function analyses made in the specialisation areas at the department. The new curriculum will shrink some courses, expand others, and remove some completely. The planning has been adapted to many rules and regulations imposed by the Ministry of Education, the university and the faculty on incorporating such features as minor subjects, language and communications studies, orientation into the job market and personal study plans into the degree requirements. A framework for the new degree requirements has been completed during 2004, and will be finalised during spring 2005.

Another major endeavour in 2005 that the department has prepared for during 2004 is the evaluation of research at the department. For this evaluation, the department has nominated members for the international evaluation panel, gone through the Julki publication database for years 1998-2004 and formed a team co-ordinating the evaluation at the department. The team will collect the material needed for the evaluation at the beginning of 2005. The international Scientific Advisory Board at HIIT (the Helsinki Institute for Information Technology) has already evaluated the research at HIIT in November 2004.

The main strength in research at the department lies in data analysis and mobile computing, and language technology, bioinformatics and empirical research in software engineering were pin-pointed as future focal areas. These focal areas will be supported with new teaching positions, as will sub-programmes, educational programmes and advanced teaching.

Besides the new degree structure, the strategic measures for teaching at the department include student-centred teaching, online teaching, teaching in English aimed for foreign students, and the minor subject teaching in method sciences in co-operation with the rest of

the faculty. The post-graduate education at the department is carried out by the graduate schools HeCSE, ComBi and KIT – the two former ones led and coordinated by the department. In addition, the department has fixed-period Assistants' positions for those post-graduates whose research does not fit in thematically with any of the graduate schools.

Measures taken to further the well-being of personnel include sabbaticals for research or teaching and the improvement of department services. The department supports the work and careers of staff members with the help of planning and development talks twice a year. These talks will form a good basis for the new salary system being implemented at the university in 2005, which entails taking into account how demanding the position is and evaluating personal performance.

Success in teaching

The systematic improvement of teaching at the department was visibly rewarded in 2004 when the department was awarded the university's 'excellent' quality prize for the second year running. The other winners in this category were the Department of German Philology and the Department of Social Science History. In the category for 'good' quality, the departments of Physical Sciences and Home Economics and Craft Science, as well as the Faculty of Theology received prizes.

The reasons given for the award to the department and the other units winning the 'excellent' quality prize were as follows: 'The good quality of the teaching at the departments was obvious from reports. The committee for student affairs especially valued the critical and analytical evaluation of the departments' own functions and the well-written documentation in accordance with the instructions. A concise representation to the point gives a good general picture of the ambience at the departments.'



Relocation to Kumpula campus

The plans initiated as early as the 1970s were finalized in 2004 when the Department of Computer Science moved to the Kumpula campus. In May, the Exactum building was finished in accordance with the Kumpula IV development project. During the summer, the departments of Mathematics and Statistics, Seismology and smaller university, campus administration and faculty units, as well as our own department were housed in the Exactum building.

The physical move was carried out in June-July, from installing the department information technology in June, to packing at the beginning of July, and transferring the packing crates from Teollisuuskatu to Exactum during the latter part of July. Before that, in May, the department library had already moved to the Kumpula Science Library. In the end, the relocation was surprisingly easy, and the department was (almost) fully operational by the end of August, before the start of the autumn term.

Two events were arranged to celebrate the move and Exactum being finished. The more traditional of the two was the inauguration of the building (17 September), where speeches were given by myself, Minister of Education Tuula Haatainen, the university's Vice-Rector Hannele Niemi and Student Terhi Hautala, and where the mathematician Lars V. Ahlfors' Fields' medal donated to the university was presented by Academician Olli Lehto. In connection with the inauguration, Exactum had an event open to the general public, where the department was presented to students and (invited) guests.

The other event gained considerably more media attention than most academic events; the staff, students and invited guests travelled from Vallila via Kerava to the Kumpula campus with a classic train pulled by a steam engine on 13 August. As a grand finale, the passengers marched to Exactum to the tunes of a brass band and heard speeches and enjoyed refreshments on the roof terrace.

The move has brought not just a physical change to the department, but a mental one as well. For the first time, the department is now part of a larger scientific community, since the whole Faculty of Science – except the Department of Astronomy – is situated at Kumpula. As the campus expands in coming years (in 2005 the Meteorological Institute and the Institute of Marine Research will move in across the street), the department will find itself in an environment that creates excellent setting for co-operation in teaching and research in the fields of exact sciences and their application areas. In this co-operation, the department will no doubt have a crucial role.

Jukka Paakki
Department Head



2. AN OVERVIEW OF YEAR 2004

Staff and funding

To support its strategic plans, during 2004 the department appointed Professor Samuel Kaski and University Lecturer Juho Rousu to the bioinformatics and computational biology sub-programme, University Lecturer Juha Taina to an empirical research post in the software engineering sub-programme and University Lecturer Jukka Manner to the distributed systems and data communications sub-programme as well as for teaching in English. In addition, for positions without defined specialisation areas, PhD Assistant Marko Salmenkivi and Assistants Anna Pienimäki, Antti Leino and Tuomo Malinen were appointed. The latter of them was killed in an accident in summer 2004, which was a tragic loss for the department. The administrative services of the department were enforced with the appointment of PR and Communications Officer Lotta Lounasmeri, IT Designer Sanna Kettunen and IT Specialist Mikko Rauhala.

The scientific competence of the researchers at the department is evident in such events as Research Director Heikki Mannila's appointment to Academy Professor, and the appointments of Aapo Hyvärinen and Eero Hyvönen to Docents. The national Centre of Excellence, FDK (From Data to Knowledge) continued with its cutting edge research, as did the Helsinki Institute for Information Technology (HIIT) in co-operation with the Helsinki University of Technology. Professor Esko Ukkonen was appointed Research Director of the Basic Research Unit, as the previous director, Heikki Mannila, was appointed Academy Professor and thereby had a lawful excuse.

The number of staff at the department continued to increase rapidly: while in year 2003, 155 person-years were completed at the department, the number in 2004 was 174. This increase consists mostly of researcher input, which is also evident in the department funding as an increased additional research funding. The total funding of the department appears to have increased since year 2003, but a closer analyse will show this conclusion to be false: the slight increase of available funding is caused by the allocated funding of the previous year being carried over, while the new allocated funding for year 2004 was, in fact, decreased by nearly 10 % compared to 2003. This downward trend is caused by the discontinuation of the IT programme of the Ministry of Education and the end of the upgrading studies programme, and unfortunately, it will continue in coming years.

Results in teaching and research

In terms of number of degrees, year 2004 was a good one for the department. The number of doctoral degrees, which has remained at a low level in recent years in spite of the extent of post-graduate education at the department, increased significantly this year; while in the years 2001-2003, three, four and seven doctors graduated, in year 2004 the department issued a record nine doctoral degrees (and one person dissertated). This even surpasses the official goal of strategy period 2004-2006, six doctoral degrees per year.



The number of Master's degrees (68) also increased from the previous year (60). However, this was not a new record, as 72 Master's degrees were passed in 2002. Progress towards the department's goal of 80 Master's degrees per year is evident.

At the end of the year, the department gave awards for good teaching and good research as is traditional. Aristides Gionis was given the reward for senior researcher and Kimmo Palin that of junior researcher. Auvo Häkkinen (established teacher) and Ismo Puustinen (junior teacher) were given the awards for good teaching.

The total number of publications was about the same as year 2003, but the number of journal publications increased markedly. Since scientific journals are generally more valued than conference publications, this trend shows that the quality of publications produced at the department has improved.

Department structure

In 2004, the department's operations were based on an established organisation with separate sectors in research, teaching and administration, each led by its own manager. The operations of the sectors was improved and coordinated through team meetings and the planning and development talks that cover the whole staff.

The Helsinki University administrative charter that was renewed in 2003, and the Science Faculty's delegation resolutions that were based on it, transferred considerably more responsibilities and power of decision to the departments from the beginning of 2004. This led to new practices at the Department of Computer Science, and especially its steering committee; the number of meetings and administrative decision-making increased, and Professor Timo Alanko, Lecturer Hannu Erkiö and Office Manager Päivi Karimäki-Suvanto were appointed presenting officers to the steering committee.

The steering committee of the department had the following members in 2004:

Professor Jukka Paakki, chair

Professor Hannu Toivonen, assistant chair (deputy: Professor Seppo Sippu)

Professor Jyrki Kivinen (Professor Matti Nykänen)

Professor Lea Kutvonen (Professor Kimmo Raatikainen)

Assistant Jan Lindström (Researcher Juha Gustafsson)

University Lecturer Pirjo Moen (Lecturer Markku Kojo)

Secretary Inka Kujala (1 Jan – 31 Aug 2004: IT Specialist Mikael Jokela, 28 Oct – 31 Dec 2004: Research Secretary Tiina Väisänen)

Student member Otso Kivekäs (student Eeva Nevalainen)

Student member Panu Mäntylahti (student Misa Munde)

Student member Timo Oksala (student Sampo Lehtinen)

Department Secretary Sirkka Palander has acted as secretary for the steering committee.

Statistics

Staff

Department of Computer Science / Person-years in 1998-2004

Staff (person-years)	1999	2000	2001	2002	2003	2004
Teaching	49.0	60.0	53.5	63.1	65.1	66.4
Professors	9.0	9.6	12.1	12.3	13.2	13.5
Senior and PhD Assistants	3.0	3.4	1.4	2.6	3.9	4.1
(University) Lecturers	11.0	12.8	14.2	17.0	17.9	18.3
Assistants	9.0	12.9	10.4	8.3	9.1	9.0
Full-time teachers	7.0	4.4	4.2	5.3	6.1	5.2
Part-time teachers	10.0	16.9	11.2	16.6	15.0	16.4
Post-graduates	11.0	14.9	17.7	17.1	16.8	15.7
Researchers and research staff	37.0	37.2	39.0	55.8	56.4	73.7
Administration	13.0	13.0	16.5	17.0	17.0	18.2
Total	110.0	125.1	126.7	152.9	155.4	174.0

Person-years in per cent of funding sources

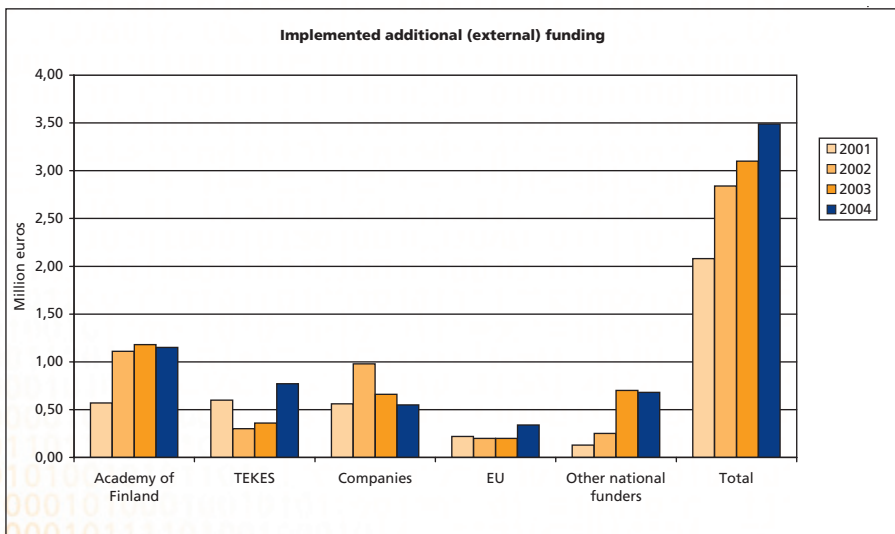
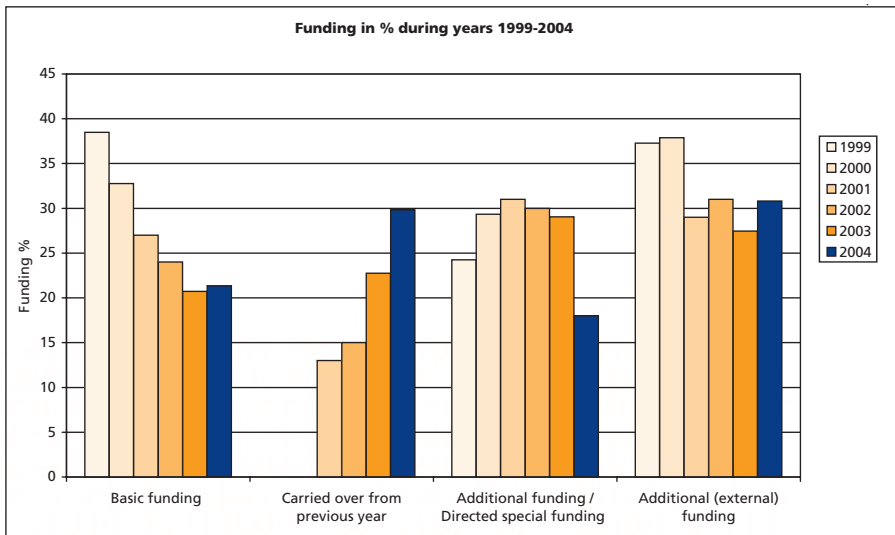
	1999	2000	2001	2002	2003	2004	Change from previous year
Budgeted Funding	65.3	76.1	69.9	83.8	92.5	104.4	11.9
EU Funding	4.5	2.5	4.4	1.2		2.5	2.5
Paid Business Income	12.7	10.7	8.7	16.9	9.7	11.5	1.9
Trust Funds and Foundations			1.4				
Other Ministry of Education	8.2	10.6	11.7	11.6	8.9		-8.9
Academy of Finland	8.3	9.6	14.3	25.7	23.1	26.0	2.8
Employment Funding		0.3					
Communal Funding (e.g. Tekes)	11.3	12.4	15.1	12.9	21.2	29.7	8.5
University Funding	1.0	0.4					
University Foundation	1.1	2.6	1.90	1.0			
Person-years total %	112.4	125.1	126.7	152.9	155.4	174.0	18.7

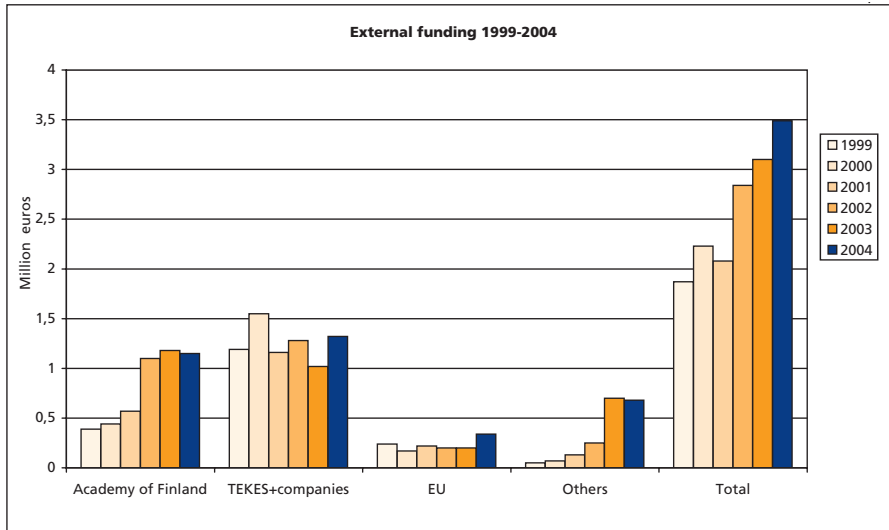
Average age and gender distribution of staff at the Department of Computer Science years 2002-2003

	2002	2003	2004
Gender distribution (%)			
- women	20.8	20.7	21.2
- men	79.2	79.2	78.8
Average age in years	32.8	33	33.8
Foreign employees (%)	10.3	10.9	13.0

Funding

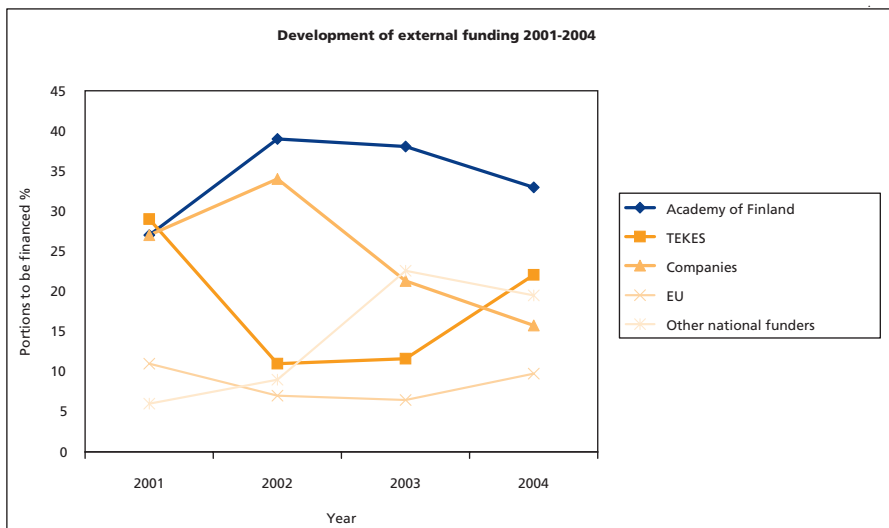
Funding (Million Euros)	1999	2000	2001	2002	2003	2004
Basic funding	1.92	1.92	1.93	2.24	2.34	2.42
Carried over from previous year			0.94	1.43	2.57	3.38
Additional funding/Directed special funding	1.21	1.72	2.14	2.78	3.28	2.04
Additional (external) funding	1.86	2.22	2.09	2.84	3.10	3.49
Total	4.99	5.86	7.10	9.29	11.29	11.33





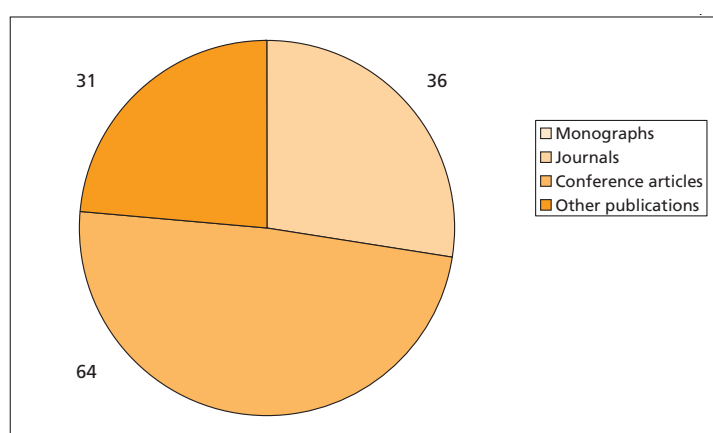
Implemented additional (external) funding

Funding	2001	2002	2003	2004
Academy of Finland	0.57	1.11	1.18	1.15
TEKES	0.60	0.30	0.36	0.77
Companies	0.56	0.98	0.66	0.55
EU	0.22	0.20	0.20	0.34
Other national funders	0.13	0.25	0.70	0.68
Other state funding		0.21	0.70	0.67
Foundations and trust funds		0.04	0.00	0.01
Total	2.08	2.84	3.10	3.49



Publications

Publications	1999	2000	2001	2002	2003	2004
Monographs	3	0	0	4	2	0
Journals	11	8	6	22	23	36
Conference articles	46	49	49	46	68	64
Other publications	49	50	42	74	41	31
Total	109	107	97	146	134	131



Studying and teaching

Student body	1999	2000	2001	2002	2003	2004
Admission quota	270	270	235	235	235	180
Freshman registrations	258	267	243	264	197	188
Students chosen on the basis of earlier studies	42	61	61	82	34	64
Upgrading students	40	81	78	71	–	–
All registered students	1982	2110	2230	2351	2364	2462
Female students percentage	22	20	20	19	19	19

Teaching	1999	2000	2001	2002	2003	2004
Completed credits	21345	20554	22004	20512	19841	17244
Teachers in person-years	47	60	54	63	65	66
Credits/person-year	401	343	408	326	305	261
Students/person-year	43	35	41	37	36	37

Degrees

Master's theses and degrees	1999	2000	2001	2002	2003	2004
Theses	63	63	75	70	60	73
Master's degrees	55	64	61	72	60	68

Post-graduate degrees	1999	2000	2001	2002	2003	2004
Licentiate	2	5	6	4	2	7
PhD	3	4	4	3	7	9

Events 2004

January

13th-14th

The annual strategy-planning event at Evitskog in Kirkkonummi. Nearly a hundred members of staff and student body were present to improve departmental functions in the areas of teaching, status of students, research and administration.

22nd

Guest lecture: On the size of Subsequence Automaton Professor Ayumi Shinohara, Department of Informatics, Kyushu University, Japan

29th

Guest lecture: Superlink: A new Genetic Linkage Analysis Software
Professor Dan Geiger, Israel Institute of Technology

30th

Thesis defence: "Sum-Product Algorithms for the Analysis of Genetic Risks"
MSc Mikko Koivisto

February

4th

Information technology: now! Studia Generalia lecture series: "Ohjelmistobusiness tänään - huomioita sijoittajan ja yrittäjän näkökulmasta" (Software business today – observations from the investor's and entrepreneur's viewpoint)
Artturi Tarjanne, Nexit Ventures

11th

Information technology: now! Studia Generalia lecture series: "Millaisen osaamisen avulla saan it-alalta töitä?" (What kind of knowledge will give me a job in IT?)
Personnel consultant Annukka Kostiainen, WM-data Novo, personnel unit

17th

Guest lecture: Formal verification of large industrial circuits with inductive invariants
Roope Kaivola, Intel Corporation and the University of Helsinki

20th

FDK seminar: Juha Kärkkäinen: "A Tale of Three Algorithms: Linear Time Suffix Array Construction".

25th

Information technology: now! Studia Generalia lecture series: "Tietoturvauhat ja reaali maailma" (Security risks and the real world)
Mikko Hyppönen, Research Manager, F-Secure Oyj

March

3rd

Information technology: now! Studia Generalia lecture series: "Mitä Suomessa pitäisi tutkia juuri nyt eikä vasta huomenna?" (What should Finland study right now and not tomorrow?)
Arto Karila, Karila A. & E. Oy

10th

Information technology: now! Studia Generalia lecture series: "Epäsymmetriset uhat tietojärjestelmissä - suojaautuminen tietojärjestelmäsodankäynniltä" (Unsymmetrical risks in data systems – protecting against data system warfare)
Lt Col Kalevi Halonen, Armed forces

10th

Mini seminar on modelling of wireless networks.
Lecturers:
Yevgeni Koucheryavy: Overview of groups research activities
Andrey Krendzel: Network planning solutions for 3G/4G mobile systems
Dmitri Moltchanov: Packet level performance evaluation of NG All-IP networks

17th

Guest lecture: "Analysis of natural images by independent quadratic forms and temporally coherent quadratic forms". Dr. Wakako Nakamura, RIKEN Brain Science Institute (Laboratory for Advanced Brain Signal Processing).
Information technology: now! Studia Generalia lecture series: "50 vuotta tietotekniikkaa" (50 years of information technology)
Osma A. Wiio, Professor Emeritus

24th

Information technology: now! Studia Generalia lecture series: "Informaatioyhteiskunnasta bioyhteiskuntaan? Teknologian tutkimus ja yhteiskunnallinen muutos" (From information society to biosociety? technology research and social change)
Toni Ahlqvist, Researcher, University of Turku

31st

Guest lecture: Challenges of Bioinformatics. Professor Khuri

Information technology: now! Studia Generalia lecture series: "Median dramaturgiat" (Dramaturgies of the media)
Jussi Parviainen, entertainment specialist

April

7th

Information technology: now! Studia Generalia lecture series: "Mobiiliviihdeyhteiskunta" (Mobile entertainment society)
Reidar Wasenius, Senior Project Manager, Nokia Mobile Phones / Entertainment and Media Business Unit

21st

Public trial lectures: University Lecturers in the field of data analysis and its applications in bioinformatics

Patrik Hoyer

Jarmo Hurri

Tomi Pasanen

Marko Salmenkivi

Janne Sinkkonen

Information technology: now! Last lecture in the Studia Generalia series: "Habbo Hotel ja muut monen pelaajan verkkopelit" (Habbo Hotel and other online games for multiple players)

Sampo Karjalainen, Game Development Director, Sulake Labs Oy

26th

Public trial lectures: University Lecturers in the field of distributed systems and data communications as well as data analysis and its applications in bioinformatics
Distributed systems and data communications:

Jukka Manner

Jan Lindström

Data analysis and its applications in bioinformatics:

Kjell Lemström

Veli Mäkinen

Tomi Seppälä

Thesis defence: "Efficient Data Transport in Wireless Overlay Networks"

PhLic Andrei Gurtov

26th-29th

HeCSE graduate school course: An introduction to Kolmogorov complexity and its applications. Professor Paul Vitanyi (CWI)

29th

Conference simulation for the course Scientific Writing
The students taking the Scientific Writing course presented their work at a conference simulation event.

May

6th

Demonstration of the spring's software engineering projects

6th

Guest lecture: Online Amnesic Approximations of Streaming Time Series
PostDoctorate fellow Themis Palpanas, University of California, Riverside

17th

Public Docent trial lecture
Aapo Hyvärinen

The department library started to move. Since 2001, the library has been an administrative part of the Kumpula Science Library, and after the move, it has operated in the Science Library's localities.

31st

Thesis defence: "Computational methods and models for paleoecology"

MSc Kari Vasko

June

4th

Guest lecture: Invariants in Pattern Recognition - New Results for a Classical Problem

Professor Dr. Hans Burkhardt, Albert-Ludwigs-Universitaet Freiburg

14th

Guest lecture: A multi-parametric and redundancy-filtering approach to pattern identification

Olivier Lartillot-Nakamura, PhD, Music Cognition Group, University of Jyväskylä

July

16th

Guest lecture: Entropy Minimization in the Analysis of Genomic Variation

Professor Richard Karp, University of California & ICSI, Berkeley

June 21st at 12.00, Unioninkatu 34, University main building, Auditorium XII

Thesis defence: "Algorithms for Association-Based Gene Mapping"

MSc Petteri Sevon

19th – 21st

Relocating to Exactum. The new building houses the following units of the University of Helsinki: the Department of Computer Science (including Helsinki Institute for Information Technology HIIT, Basic Research Unit), the Department of Mathematics and Statistics and the Institute of Seismology.

August

13th

With steam engine Ukko-Pekka from Teollisuuskatu to Kumpula!

Relocation event: taking a steam engine to the Kumpula campus.

16th

Guest lecture: Reductions in Machine Learning
John Langford, PhD, Toyota Technological Institute at Chicago

27th

Thesis defence: "Applying Formal Concept Analysis to Extract Framework Reuse Interface Specifications from Source Code"

PhLic Jukka Viljamaa

September

2nd

Science Centre Heureka, Vantaa
WEB INTELLIGENCE
Symposium at the Finnish Artificial Intelligence event
(STeP 2004)

3rd

Guest lecture: Bit-parallel techniques in computing
longest common subsequences. Heikki Hyyrö, PhD,
University of Tampere and Kyushu University

17th

EXACTUM INAUGURATION
At 10-13.30 the Exactum event for students, staff and
invited guests
Starting 14 formal inauguration

October

7th

Guest lecture: On the Bowtie Structure of the Web
Debora Donato, University of Rome "La Sapienza"

9th

Thesis defence: "Computational Methods for
Reconstructing Macromolecular Complexes from Cryo-
Electron Microscopy Images"
MSc Janne Ravantti

19th

Guest lecture: Anatomy of a worst-case efficient
priority queue
Professor Jyrki Katajainen, Performance Engineering
Laboratory, University of Copenhagen

22nd

Thesis defence: "Learning Small Trees and Graphs that
Generalize"
MSc Matti Kääriäinen



November

5th

Thesis defence: "Computational Tools for a Novel Transcriptional Profiling Method"
MSc Teemu Kivioja

11th

MuseoSuomi gains second place in an international competition for web applications
The web service MuseoSuomi – Finnish museums on the semantic web developed by the Department of Computer Science and HIIT was awarded second prize in the Semantic Web Challenge Award competition in Hiroshima, Japan. The Semantic Web Challenge Award is an application award widely appreciated in the research community of the field.

19th

Guest lecture: Game research as part of computer science - Case: LudoCraft
Researcher Tony Manninen, PhD, LudoCraft game research unit, University of Oulu

18th

Trial lecture for docentship: Using multi-step relevance for evaluating information retrieval systems
Professor (fixed term), Jaana Kekäläinen, DSocSc, Department of Information Studies, University of Tampere

23rd

The Prime Minister awarded MuseoSuomi with an honourable mention for an innovative web service
Prime Minister Matti Vanhanen awarded the portal "MuseoSuomi – Finnish museums on the semantic web" with an honourable mention as the most innovative web service in a competition that was part of the IT society programme Laatu verkko (quality on the web) arranged by the Cabinet. The competition was arranged by the Ministry of Finance and it is part of the Prime Minister's award process for best practices.

December

1st

Prize for quality teaching to the Department of Computer Science
The Rector awarded the Department of Computer Science a 27,000 euro profitability grant for high-quality teaching. The profitability grant was given to six units, three of which were awarded the grade 'excellent'.

8th

Conference simulation for the course Scientific Writing

9th

Guest lecture: A Computational Neuroscience Approach to Visual Cognition, Attention, and Working Memory
Professori Gustavo Deco, Universitat Pompeu Fabra, Barcelona, Spain

10th

Guest lecture: The FIRE Station: an environment for finite automata and regular languages
Professor Bruce W. Watson, TU Eindhoven, The Netherlands

10th

Thesis defence: "On Minimality and Size Reduction of One-Tape and Multitape Finite Automata"
Hellis Tamm

3. EDUCATION

3.1 Computer science

3.1.1 Algorithms

The specialisation area studies the algorithmic and theoretical aspects of formulating and solving computational problems in different application areas. The focus is on discovering efficient solutions for specific problems. The interaction between theory and practice is also of central interest. The application of well-motivated algorithms to real-world problems is within the scope of the area.

Contact persons for Algorithms:

Professors Jyrki Kivinen and Esko Ukkonen

Teaching (in Finnish):

<http://www.cs.helsinki.fi/algoritmit/>

Research (in English):

<http://www.cs.helsinki.fi/research/fdk/>

The basic teaching in the algorithms specialisation area offers courses aimed at all students of computer science. The courses teach the basic algorithms and data structures, with exercises in applying mathematical deduction to computer science problems. The specialised courses of the area develop the students' knowledge of methods in algorithmics and computer science theory. Students can choose a subject from one of the on-going research projects or one of the focus areas, such as computer graphics or combinatorial optimisation.

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On the research front the current main focus areas are combinatorial pattern matching and its applications in computational biology, theory and practice of machine learning with interest in the application of the methods to data mining, data structures for biological databases, and computational geometry. An analytical approach to diverse problems is the common factor in the many different research projects within the specialisation area.

3.1.2 Intelligent systems

Future data systems will incorporate more and more adaptive and intelligent features, and this sub-programme concentrates on developing computational methods for the design of and research on such systems. This field comprises several areas in computer science, such as artificial intelligence, computational intelligence, artificial life, heuristic optimization algorithms and intelligent information-retrieval methods.

The sub-programme for intelligent systems contains many specialised courses. These courses typically call for an analytical mindset as well as good programming and problem-solving skills. Furthermore, studies in the automation of intelligent behaviour are often multidisciplinary in nature. In addition the methodological courses on the three basic concepts of the sub-programme, suitable courses are available from the application areas (such as robotics, string

Contact person for Intelligent systems:

Professor Petri Myllymäki.

Teaching:

<http://www.cs.helsinki.fi/alykkaat/>

Research:

<http://cosco.hiit.fi/>

matching and data mining) or the introductory courses on artificial intelligence and machine learning. The course 'Graphical models' in this sub-programme is mainly aimed at post-graduates.

Research in intelligent systems mainly focuses the basic problems in modelling and learning, including their application in various fields from engineering to social sciences and

medicine. A large part of the research is carried out in co-operation with the Complex Systems Computation Group (CoSCo), which studies theoretical and applied topics in probabilistic and information-theoretical modelling and stochastic search methods. Current research is applied to such areas as user profiling and personalisation, adaptive learning environments, autonomous satellite diagnosis systems, telecommunications and next generation search engines.

3.1.3 Software engineering

The specialisation area of software engineering studies the problems related to the development of large and complex software systems. Under study are, on the one hand, systematic software engineering methods and the tools they require for ensuring software quality at all stages of the work process, and on the other hand, project work and management as well as software business aspects.

The curriculum of the specialisation area is rather broad, containing courses and seminars on all of the themes mentioned above. There are four compulsory courses in this specialisation area: Software engineering, Software engineering lab, software architectures, and software processes and quality. In addition, special courses and seminars can be selected on topics such as programming languages, compilers, testing, software performance, user interfaces and project management. The importance of the software business perspective has been taken into account by offering a minor subject on this topic in co-operation with Helsinki University of Technology and Helsinki School of Economics.

The research on software engineering focuses on the planning stage and on software architectures, a crucial feature of software quality. The research projects develop methods and techniques for measuring software quality and ensuring it at the planning stage, before the implementation and testing stages. The projects study and utilize object-oriented software methods like design patterns, application frameworks and the UML modelling language. A new sub-area in the research is empirical software research. A new position of University Lecturer has recently been established to further this branch. The software engineering projects, where we can use parallel project groups to compare different processes and methods, offer the specialisation area an excellent basis for research in this sub-area.

Contact persons for Software engineering:

Professors Jukka Paakki and Inkeri Verkamo

Teaching:

<http://www.cs.Helsinki.fi/ohjelmistot/>

Research in English:

<http://www.cs.helsinki.fi/research/roosa/>

3.1.4 Distributed systems and data communications

The specialisation area of Distributed Systems and Data Communication studies how systems can be divided into independently working parallel parts, and how these parts communicate with each other. The research concentrates on examining the basic components and the protocols of communication between such systems. The goals of the group are twofold. On one hand, tools based on theory are developed for analysing and modelling systems. On the other hand, more powerful services are developed for the application platform based on operating systems, data communication, distribution algorithms and effective information management solutions.

Graduates from this specialisation area are familiar with the operational principles of computer equipment, and on the basis of this knowledge, they can evaluate the suitability of different system and data communications solutions for different purposes. In addition, they know the verification and specification methods needed to ensure the proper functioning of the systems, and are able to evaluate the performance of them. If there are no suitable systems available, they have learned to specify and implement the functions needed.

Supported by the long-term research carried out in the NODES group, the specialisation area offers in-depth education in new data communication technology mobile computing in the form of specialised courses and seminars. There is also specialised teaching in other areas, such as middleware, data security and verification methods.

The needs of foreign students have been taken into account by arranging exercise sessions in English for several of the introductory courses. Some of the special courses in data communications have been taught completely in English, along with some seminars. During the past year, two events for post-graduate students were arranged to focus on the main questions of this research area: a research seminar and the course “Foundations for future mobile computing”, both held in autumn 2004.

Research in this specialisation area is divided into four sub-areas: the projects on wireless internet pertain both to the protocols of wireless data communication and support for mobility on the middleware level. Quality-of-service issues in heterogeneous environments and spontaneous data communications networks have been central topics.

The open distributed software systems group develops middleware services to support inter-organizational co-operation and networking. Partners in the cooperation are application components, which have been developed independently and which are under separate autonomous authorities, so the system must be capable of automatic contract negotiations, among other features. This work entails both conceptual development and constructive testing.

The operating system enhancements group currently focuses on real-time systems with high availability requirements.

Formal specification and verification of distributed systems is studied in the group on modelling of concurrent systems. The research methods of the group are based on process algebras, temporal logic and automata theory. The results are applied to software engineering tools.

Contact persons for Distributed systems and data communications:

Professor Kimmo Raatikainen and Tiina Niklander, PhLic

Teaching (in Finnish):

<http://www.cs.helsinki.fi/hajautetut/>

Research (in English):

<http://www.cs.Helsinki.FI/research/nodes/>

3.1.5 Information systems

The specialisation area of Information Systems studies methods, techniques, and tools needed in manipulating large volumes of data, often implemented as a database, frequently also using structured representations such as XML. The education in the specialisation area covers database management, text and document management, information retrieval, and data mining.

The courses of this specialisation area are designed to teach conceptual and physical data models, choosing the data-management methods best suited to specific problems, and implementing challenging data systems. In addition, the Laudatur-level courses give instructions on issues such as how to analyse large data collections and on designing systems to manage text collections. More specific subareas are covered by seminars on varying topics.

The research in information systems is strongly focused on data mining and document management, including language technology. Techniques of analyzing and mining data from various sources for useful information are the key research topics. The research includes both method development and applications, for instance in gene technology (gene mapping and diagnostics), proactive computing (context recognition by user situation data analysis), and information retrieval and publishing industry (cross-language question answering, topic detection and tracking). Research in the database area is focused on database structures and transaction management. Computer-aided teaching environments have been developed for database courses.

Contact persons for Information systems:

Professors Hannu Toivonen, Helena Ahonen-Myka, and Seppo Sippu

Teaching (in Finnish):

<http://www.cs.helsinki.fi/info/>

Research:

<http://www.cs.helsinki.fi/research/fdk/>

<http://www.cs.helsinki.fi/research/doremi/>

<http://www.cs.helsinki.fi/group/context/>



3.2 Teacher in computer science

The sub-programme for teachers educates information technology teachers. In addition to junior and secondary school and college, vocational schools and the educational units in private enterprises also need IT teachers. The curriculum contains a pedagogical component (35 cu), which lessens the required advanced computer science studies. The studies in pedagogy are typically carried out during one academic year of full-time study at the Department of Applied Sciences of Education in the Faculty of Behavioural Sciences.

Students majoring in computer science can apply to the teacher sub-programme by separate application. Participation has been limited to ten new students per year, and five additional students who have already completed their basic degree and later return to pursue their teacher qualification. In 2004, a total of 15 applied to the sub-programme, all of them undergraduates. All of them were admitted, since the total of applicants did not exceed the quota for new students. At the same time, computer science became the second discipline in our faculty to fulfil its quota of teacher education. Earlier, only the joint teacher education of the departments of biology and geography has filled their quota, while other disciplines have remained unfilled. There is a clear basis for the heightened interest of the students: in future, our schools face a shortage of teachers in math and science subjects as the baby-boomers reach retirement age, and when these positions are filled, candidates with qualifications in computer science in addition to more traditional subjects will take priority. However, only one student graduated as information technology teacher in 2004.

In spite of the heightened interest shown by students, the department pondered discontinuing this sub-programme during 2004. This would be accomplished so that when the new degree requirements come into force from the beginning of the academic year 2005-2006, they would no longer include the teacher degree structure with its shorter advanced studies. For the department, the problem with this sub-programme has been that it has no teaching positions of its own, but the teaching and other work has had to be incorporated with positions where the original job description has been entirely different. The Finnish school system has also been averse to computer science: as an example, Finland, Ireland and Italy are the only EU countries where information technology is not an independent subject in the national school curriculum, but at best, a tool for teaching traditional subjects. (Source: T. Kavander and T. Salakoski, "Where Have All the Flowers Gone? - Computer Science in General Upper Secondary Schools", Proceedings of the 4th Finnish / Baltic Sea Conference on Computer Science Education, report of Helsinki University of Technology, Laboratory of Information Processing Science TKO-A42/04, pp. 112-115.) Thus, a change in attitudes at a higher level than the department is needed before the education of IT teachers can be further developed.

The course "Computer uses in education" is compulsory for this sub-programme. In addition, the course "IT for teachers" is intended for students in this sub-programme. Other courses, seminars and the subject for the Pro gradu (Master's) thesis may be chosen from the area of another sub-programme. During 2004, the sub-programme course Computer-aided learning environments and seminar Online learning communities were mainly carried out as online courses, because the person in charge of them, University Lecturer Jaakko Kurhila, spent the year at the Asian Institute of Technology in Thailand. Online teaching is one of the focal areas of the sub-programme.

Contact person for the sub-programme:

Professor Matti Nykänen

Teaching:

<http://www.cs.helsinki.fi/opettaja/>

LUMA:

<http://www.helsinki.fi/LUMA/>

In 2004, the department participated in planning the new Science and Mathematics (Luonnontieteet ja Matematiikka, LUMA) centre. The purpose of the centre is to support the teaching of physics, chemistry, mathematics and information technology in schools by arranging special classes for pupils and their teachers. The centre operates at the Kumpula campus, where all the departments for the disciplines above had moved by August 2004. In computer science, such interdisciplinary co-operation seems natural, since IT teachers typically teach another mathematically oriented subject as their second subject.

3.3 Applied computer science

The sub-programme Applied Computer Science is targeted to students who want to specialise in some specific application area. Each student has an individual study plan.

Contact person for the sub-programme:

Professor Samuel Kaski

Teaching:

<http://www.cs.helsinki.fi/sovellettu/>

Applied research is pursued in the Semantic Computing group, for instance. Most of the sub-programmes of the department have research projects with applied aspects.

3.4 Computer mathematician

The sub-programme for computer mathematicians resembles the sub-programme for applied computer science with a large minor in mathematics. The teaching is implemented in co-operation with the Department of Mathematics.

Teaching in mathematics and computer science are equally important in this sub-programme. The only difference is the Pro gradu (Master's thesis), which is written on the student's major subject. The aim is a balanced whole where the courses in mathematics and computer science

support each other, forming a basis for different work tasks where one needs, on the one hand, deep mathematical knowledge, and on the other hand, the ability to solve problems with the help of a computer.

Contact person for the sub-programme:

Professor Samuel Kaski

Teaching:

<http://www.cs.Helsinki.FI/matemaatikko/>



3.5 Bioinformatics and computational biology

Both modern biological sciences and many branches of medicine are based heavily on computational methods. Molecular biology, genetics, and ecology, for instance, require complicated computational methods, and new methods are constantly needed.

The sub-programme on bioinformatics and computational biology educates developers of such methods, and specialists on managing and processing biological data. The sub-programme is methodologically related to the specialization areas on algorithms, information systems, and intelligent systems. The focus of studies can be flexibly tuned between data analysis and bioinformatics.

The studies combine firm skills in mathematics and statistics, and basic knowledge in biology, with advanced knowledge in at least one branch of bioinformatics. After that the students can specialize on either one subfield of computer science or gain general knowledge of several subfields, and finally apply the skills within bioinformatics research and applications.

Activities in the field developed in several ways in 2004. A new professor was nominated to the field, the curriculum was revised and several new courses and seminars were introduced, several bright and enthusiastic students enrolled into the sub-programme, and co-operation in bioinformatics education was tightened both within the Faculty and the University. A new degree programme on biotechnology, administered by Faculties of Biosciences and of Agriculture and Forestry, started. The Department of Computer Sciences participated in planning of the programme, and offers courses and minor studies.

Several groups within the department and its research units carry out research in the field.

3.6 Minor in software business

The Department of Computer Science, Helsinki University of Technology and the Helsinki School of Economics offer their major subject students the possibility to take software business as a minor subject. This minor subject module consists of general courses in software engineering, software production, business skills, marketing and computer legislation, as well as a project in the field. Of the students at the department, 15 at the most are chosen for this minor subject module annually.

Contact person for the sub-programme:

Professor Samuel Kaski

Teaching in the department:

<http://www.cs.helsinki.fi/bioinformatiikka/>

Bioinformatics pages of the University:

<http://www.helsinki.fi/bioinfo/>

3.7 Graduate schools

3.7.1 HeCSE

The Helsinki Graduate School in Computer Science and Engineering (HeCSE) is a post-graduate programme jointly offered by the University of Helsinki and Helsinki University of Technology. HeCSE is a relatively large graduate school. There are nearly 100 post-graduates in the school, and 23 of them have funded positions. In addition to the funded positions, HeCSE offers these students other benefits, like special courses and annual student meetings.

The research interests of the students cover most sub-areas in computer science. The post-graduates can choose any of the sub-fields represented by the graduate school professors as their own specialisation area. The focus areas of HeCSE are adaptive and intelligent systems, especially modern data analysis and its applications, as well as neural networks; theoretical computer science, especially modelling and verification based on formal methods, and computational logics; software engineering for future networks, especially ubiquitous computing, the Internet, wireless data communication, security and multimedia, and in connection with them, the main software tools, technologies and methodology, like software engineering and usability research.

These focus areas were evident in this year's curriculum as three special courses in the field of adaptive and intelligent systems. These courses gathered students from outside HeCSE, as well. Students from other graduate schools in both Finland and Estonia participated in these courses.

Homepage: <http://www.cs.helsinki.fi/hecse/>

3.7.2 ComBi

The Graduate School in Computational Biology, Bioinformatics, and Biometry (ComBi) is a postgraduate program jointly offered by the University of Helsinki, the Helsinki University of Technology, the University of Turku and the University of Tampere. The Department of Computer Science at the University of Helsinki coordinates the school. The research goal of ComBi is to develop computational, mathematical, and statistical methods for biological sciences. To that end, ComBi will educate PhDs with high-quality methodological expertise. In their thesis work the students are expected to apply this expertise to computational, data analysis or modelling problems in biology or in some related field. The thesis projects are carried out in cooperation with one or more research groups in the application area (such as biochemistry, molecular biology, microbiology, ecology, evolution research and systematics, geography, public health).

Computational biology is a new field of research which develops methods and software implementations for computational problems in molecular biology, biotechnology, and genetics. Bioinformatics refers to the development and use of (molecular) biological databases. Biometry investigates statistical modelling problems related for example to genetic mapping, to the genetic and environmental risk factors of complex diseases, or to the spreading of infectious diseases. Further topics include population dynamics and numerical taxonomy of ecological and genetic phenomena.

Homepage: <http://www.cs.helsinki.fi/combi/>

3.7.3 The national graduate school for language technology (Kieliteknologian valtakunnallinen tutkijakoulu, KIT)

The KIT graduate school is a multi-disciplinary national research school for language technology that operates as a part of the emerging Scandinavian language technology post-graduate education. The school was established in 2002 and at the moment funds the work of five students. In addition, a few students participate in the school on other funding.

Homepage: <http://www.ling.helsinki.fi/kit/tutkijakoulu/>

3.8 Other education

3.8.1 Upgrading studies

A temporary programme, funded by the Ministry of Education, for upgrading studies in computer science started in the autumn of 1999. It is a computer science Master's programme for persons who have already completed a degree in another subject. The last students were accepted into the programme in the separate entrance exam held in 2002. The extra evening and weekend courses aimed at upgrading students, as well as the study circles, ended in 2004.

3.8.2 The co-operation with upper secondary schools

The department has co-operated with upper secondary schools in the Helsinki region to teach computer science since the academic year 1999–2000. Originally arranged with six schools in Helsinki, there are now 14 schools in the programme.

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In practice the co-operation means that pupils in the designated schools may attend computer science courses at the university after passing the entrance exam. This means they can become familiar with one academic field before starting their actual academic careers. The programme is also intended to interest and motivate pupils to choose computer science and the department after they finish school. The goal is to smooth out the difference between university and school and make the transition from one to the other easier. For the pupils, the programme can clarify study interests and future career choices, motivate present-day studies and emphasize the pupils' own responsibilities in studying. The participants in the programme can raise the school profile, utilize scientific expertise, and promote co-operation between university and upper secondary school teachers.

A total of 23 pupils participated in the spring 2004 entrance exam, and 18 of them passed. Of the pupils that entered the programme in 2003, two announced their interest in continuing for their second year.

School pupils also compete in information technology on both national and international levels. The Department of Computer Science is responsible for arranging these competitions in Finland during the academic years 2002–2005.

The competitions are intended to promote and enhance the interest of pupils in information technology, especially in designing and implementing algorithms. Currently, IT education at schools is more focused on the practical side of computer use, and not on scientific or technical problems.

The national competition is called Datatähti (“data star”) and is arranged by the department in co-operation with the Finnish National Board of Education and the union for teachers in mathematical subjects (MAOL ry, Matemaattisten Aineiden Opettajien Liitto). Pupils who are successful in the competition can choose to enter either the Helsinki University Department of Computer Science, the Turku University Department of Information Technology, or the Tampere University Department of Computer and Information Sciences. On an international level, competitions are held for the Baltic area and for the world-wide IT Olympics, both attended by a team from Finland. The Datatähti competition finds gifted pupils to coach at two training camps at the department. The coach chooses the national teams among the members this group on the basis of their work during training. In 2004, five lower-secondary and 15 upper-secondary school pupils qualified for the Datatähti finals on the basis of the qualifying competition. A total of 13 pupils attended the training camp.

Professor Matti Nykänen is in charge of the competitions and training at the department.

Additional information of the school co-operation:

<http://www.cs.helsinki.fi/abinfo/lukiot.html>

Additional information on the competitions:

<http://www.cs.helsinki.fi/matti.nykanen/datatahti/>

3.8.3 The language technology network KIT

By language technology (human language technology, natural language processing), we mean applying linguistic theories to IT applications that handle natural languages. The application areas of language technology include using spoken language in computer interfaces, computer-aided language education, writing aids (spell-checkers, hyphenation etc), information retrieval and document management, automatic translation, speech-recognition and -production, interactive network applications and electronic dictionaries.

The Department of Computer Science belongs to the national network for language education (KIT) that enables broad, multidiscipline language technology studies at several universities. Computer science undergraduates can include language technology courses in their degree as a minor subject or as separate courses. The subject of language technology courses at the department is how to design systems that can manage texts. In addition, they discuss computational methods for isolating applicable information on real language use, such as data on certain words that often appear together, and can thereby be interpreted as idiomatic.

Contact person for the network:

Professor Helena Ahonen-Myka

Teaching:

<http://www.cs.helsinki.fi/u/hahonen/ktekno/>

Research:

<http://www.cs.helsinki.fi/research/doremi/>

4. RESEARCH

4.1 Research groups

4.1.1 From Data to Knowledge - FDK

The From Data to Knowledge research unit (FDK) develops computing methods for forming useful knowledge from large masses of data. The unit is multidisciplinary, combining in its research groups expertise in algorithmics, statistical methods and application fields such as bioinformatics and human language processing. The unit was appointed a Centre of Excellence of the Academy of Finland for a six year period starting from 1 January 2002.

The FDK unit is shared by the University of Helsinki and Helsinki University of Technology. Most of its operations are located at the Department of Computer Science at the University of Helsinki. Professor Esko Ukkonen is the director of the unit, and Professors Helena Ahonen-Myka, Jaakko Hollmen (HUT), Heikki Mannila (Basic Research Unit/HIIT, Academy Professor) and Hannu Toivonen are members of it. In 2004 the personnel of the unit consisted of about sixty researchers and postgraduate students.

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The core competence area of the unit is algorithmics for data analysis. The unit's areas of expertise on an international level are combinatorial pattern recognition and string matching on the one hand, and machine learning and data mining on the other. The unit emphasizes in its activities the interaction between theory development and practical applications. The goal is to find research problems, whose conceptual basis and solution algorithm have a wider application potential. The unit develops original algorithms and prototype implementations of them, and then studies their usage and performance.

The unit functions as several closely connected main projects. The same persons are active in several projects. This facilitates internal communication and the utilisation of expert knowledge for different applications.

The first main theme is data mining and machine learning. The project develops original concepts and algorithms to strengthen a core area of the unit. We aim at results in theoretical basic research. The relevance of the results is tested in various applications. Text databases and document collections as well as event sequences in telecommunication networks are examples of the data we use. Information-filtering from the Internet and other human language technology belong to the area of this project as well as using machine learning in image analysis.

The second main theme focuses on applying the first theme in the field of bioinformatics. It studies the methods for medical genetics and for analysing data on genomics, proteomics,

and metabolisms. The spectrum of collaborators is wide ranging from UCLA to the European Bioinformatics Institute and to several Centres of Excellence in Finland. We develop computational methods for example for locating the genetic basis of multifactorial diseases as well as for synthesizing gene regulatory networks from data. The latest research focuses on such areas as haplotypes, mapping the overall architecture of genes and system biology.

Combinatorial pattern-matching and information retrieval belong to the focal areas of the unit. The main research questions include approximate pattern matching, efficient index structures, and the synthesis of patterns from data. Implementing string algorithms as a software library was started. Applications of this include retrieval from symbolically encoded music and analysis of the result with the help of string methods.

For computational anatomy the unit has developed tomographic methods to create three-dimensional models of biological macromolecules from electron microscope slides. Interesting sub-structures are found in the models with the help of generalisations of string methods.

In addition to the basic research and doctoral education, the FDK unit also wants to serve as an algorithm 'atelier' that develops computational solutions to new problems in different fields. The unit is always in search for new partners who could pose computational problems in the forefront of the research.

During 2004 a total of 7 doctoral dissertations were completed in the unit, and its researchers are partners in two new patents.

Contact person for the unit:

Professor Esko Ukkonen

Homepage:

<http://www.cs.helsinki.fi/research/fdk/>



Main publications

T. Elomaa and J. Rousu: Efficient multisplitting revisited: Optima-preserving elimination of partition candidates. *Data Mining and Knowledge Discovery* 8, 2 (2004), 97-126.

J. Makkonen, H. Ahonen-Myka, and M. Salmenkivi: Simple semantics in Topic Detection and Tracking. *Information Retrieval* 7 (3): 347-368, Kluwer Academic Publishers, 2004.

H. Tamm and E. Ukkonen: Bideterministic automata and minimal representations of regular languages. *Theoretical Computer Science*, 328, 1-2 (2004), 135-149.

F. Afrati, A. Gionis, and H. Mannila: Approximating a collection of frequent sets. 10th International Conference on Knowledge Discovery and Data Mining (KDD) 2004.

L. Eronen, F. Geerts, and H. Toivonen: A Markov Chain Approach to Reconstruction of Long Haplotypes. In *Proceedings of the 9th Pacific Symposium on Biocomputing (PSB'04)*, pp. 104-115, January 2004. World Scientific.

Research projects in 2004:

Data mining and algorithmic machine learning
Information extraction
Paleoecological data analysis
APRIL II
PASCAL

Computational biology and bioinformatics
Computational methods for analysing genome structure and function in mammals
System biological analysis of physiological regulation
Finding predisposition genes in case-control material
A global molecular approach in the study of microbial stress
Yeast systems biology - Integrated analysis of metabolism-related data
BIOSAPIENS (EU NoE)
REGULATORY GENOMICS (EU)

Combinatorial pattern-matching and information retrieval
C-BRAHMS - music information retrieval
GLAS - Generic software library of algorithms on strings
Mobile and multilingual maintenance man

Computational structural biology
Structure, assembly and dynamics of biological macromolecular complexes

International visits:

Professor Stefan Arnborg, KTH, Stockholm
Professor Hans Burkhardt, Universität Freiburg
Professor Dan Geiger, Technion
Professor Robert Giegerich, Universität Bielefeld
Professor Richard M. Karp, University of California, Berkeley & ICSI
Dr. Yoan Pinzon, King's College
Professor John Shawe-Taylor, University of Southampton
Professor Arno Siebes, Universiteit Utrecht & CWI
Professor Jens Stoye, Universität Bielefeld
Professor Bruce Watson, TU Eindhoven

Visits from the unit:

Veli Mäkinen, Universität Bielefeld
Juho Rousu, Marie Curie Individual Fellowship, Royal Holloway University of London

4.1.2 Helsinki Institute for Information Technology – Basic Research Unit (HIIT/BRU)

The Helsinki Institute for Information Technology (HIIT) is a joint research unit of the University of Helsinki and Helsinki University of Technology. The unit aims at significantly enhancing strategic research in the field of computer science, while improving the co-operation between the University of Helsinki and the Helsinki University of Technology. HIIT consists of two units: the Advanced Research Unit (headed by Martti Mäntylä), which works in co-operation with the industries and functions primarily at the University of Technology, and the new Basic Research Unit (headed by Heikki Mannila, and starting from September 2004, Esko Ukkonen).

Some fifty researchers work in BRU. The unit is mostly located at the Department of Computer Science at the Kumpula campus. Part of it operates at the Helsinki University of Technology in Otaniemi. The Basic Research Unit (BRU) carries out first-rate basic research in the field of computer science, in close co-operation with end-users in other disciplines and in the industries. Its main research areas are theory and applications in data analysis, adaptive computing and neuroinformatics.

One of the significant research achievements of the unit in 2004 was the international break-through of the ContextPhone software developed by Professor Hannu Toivonen's research group. The software collects, saves and relays context information for S60 mobile phones. The neuroinformatics group produced the open-source program package Icasso, which analyses the reliability of the independent component (ICA) method.

Contact person for the research unit:

Professor Esko Ukkonen, Academy Professor Heikki Mannila

Homepage:

http://www.cs.helsinki.fi/hiit_bru/, <http://www.hiit.fi/>



Main publications in 2004:

A. Hyvärinen and J. Hurri: Blind separation of sources that have spatiotemporal variance dependencies. *Signal Processing*, 84 (2): 247-254, 2004.

M. Koivisto and K. Sood: Exact Bayesian Structure Discovery in Bayesian Networks. *Journal of Machine Learning Research*, 5(May): 549-573, 2004.

F. Geerts, H. Mannila, and E. Terzi: Relational link-based ranking. 30th International Conference on Very Large Databases (VLDB) 2004, Toronto, Canada.

K. Laasonen, M. Raento, and H. Toivonen: Adaptive On-device Location Recognition. *Pervasive Computing: Second International Conference (Pervasive 2004)*, LNCS 3001, 287-304, Vienna, Austria, April 2004. Springer Verlag.

P. Tsaparas: Using Non-Linear Dynamical Systems for Web Searching and Ranking. In *Principles of Database Systems (PODS)*, Paris, June 2004.

Research projects in 2004

Networks and architecture for proactive systems - algorithmics
Software Platform and Component Environment for yoU
MobiLife - Mobile Life
Advanced data analysis in vision research
Statistical modelling of image and video data
Independent component analysis and its extensions
Computational methods for the analysis of genome structure and function in mammals
APRIL II
Context-awareness with the help of user location data mining
Searching for predisposition genes in case control data

International visits

Visits to the unit
Professor Foto Afrati, National Technical University of Athens
Professor Christos Faloutsos, Carnegie-Mellon University
Wakako Nakamura, postdoctoral researcher in Research and Education Center for Brain Science, Lab of Electromagnetic Sensing, Research Institute for Electronic Science Hokkaido University, Japan.
Ydo Wexler, PhD student in Technion - Israel Institute of Technology, Computer Science Department, Haifa, Israel.
Spiros Papadimitriou, PhD student in Carnegie Mellon University, Computer Science Department, Pittsburgh, USA.
Asuncion Vicente
Michael Gutmann
Debora Donato
Shohei Shimizu, University of Osaka, Japan

4.2 Research groups

4.2.1 Complex Systems Computation Research Group – CoSCo

The CoSCo research group studies computational problems in complex systems, especially regarding prediction and modelling. Its research areas include stochastic modelling and data analysis, Bayesian networks and related probabilistic model families, such as finite mixture models and Bayesian multinets, information-theoretical approaches to inference (MDL) and stochastic optimisation algorithms like simulated annealing and genetic algorithms. The work has a strong basic research component, being at the intersection of computer science, information theory and mathematical statistics. There is also a dimension of applied research in the work of the group, as theoretical results are applied in many areas, such as social sciences, criminology, ecology, medicine and industrial engineering. Recent research has focused on personalisation of the internet, diagnostics for space satellites, next-generation search engine techniques and modelling for location-aware services.

The members of the group possess varied abilities, from theoretical research to excellent programming skills. To name one concrete example of the group's broad field of expertise, we can mention the unique B-Course data analysis server (<http://b-course.hiit.fi>) developed and maintained by the group. It applies the latest research results from the field of probability modelling. In two years, the server has been accessed by over 10,000 users world-wide, and the results from the analysis service have been used e.g. for the development of a vaccine against HIV, analysing birdsong and studying gene data.

In 2004, next-generation search engines became one of the most important focuses of the group's work (please see <http://cosco.hiit.fi/search>). CoSCo looks to become an important international operator in the development of open-source code in this field, and is the co-ordinator of a large EU project that started in the area in 2004 (Alvis, please see <http://cosco.hiit.fi/search/alvis.html>).

The work on the E-learning tools that the group has developed (see <http://cosco.hiit.fi/edutech/>) continued in 2004, and they were increasingly used both at the department and at other universities.

The more theoretical aspects of the research group are represented by the www.mdl-research.org server that the group continued to maintain in 2004. This website endeavours to collect the main results of research on the Minimum Description Length (MDL) theory developed by Jorma Rissanen in one place. Rissanen also co-operates actively with the group.

CoSCo works as part of the HIIT Advanced Research Unit, and at the recent evaluation of the scientific board of HIIT, the group was pronounced to be on the cutting edge internationally. The group has excellent international research contacts to the leading groups working on probabilistic modelling and co-operates with many top researchers overseas.

Person in charge of the research group:

Until 1 August 2004: Professor Henry Tirri,
from 1 August 2004: Professor Petri Myllymäki

Homepage:

<http://cosco.hiit.fi>

Selected publications:

W. Buntine, J. Löfström, J. Perkiö, S. Perttu, V. Poroshin, T. Silander, H. Tirri, A. Tuominen, V. Tuulos, A Scalable Topic-Based Open Source Search Engine. Pp. 228-234 in Proceedings of the IEEE/WIC/ACM Conference on Web Intelligence (WI 2004).

T. Roos, H.Wettig, P.Grünwald, P.Myllymäki, H.Tirri, On Discriminative Bayesian Network Classifiers and Logistic Regression. To appear in Machine Learning.

W. Buntine, A. Jakulin, Applying Discrete PCA in Data Analysis. Pp. 59-66 in Proceedings of the 20th Conference on Uncertainty in Artificial Intelligence (UAI'04), edited by M. Chickering and J. Halpern. AUAI Press 2004.

P.Kontkanen, P.Myllymäki, T.Roos, H.Tirri, K.Valtonen, H.Wettig, Probabilistic Methods for Location Estimation in Wireless Networks. Chapter 11 in Emerging Location Aware Broadband Wireless Adhoc Networks, edited by R.Ganesh, S.Kota, K.Pahlavan and R.Agustí. Kluwer Academic Publishers, 2004.

P.Nokelainen, H.Tirri, Bayesian Methods that Optimize Cross-cultural Data Analysis. Pp. 141-158 in Cross-cultural Research: Basic Issues, Dilemmas, and Strategies, edited by J.R.Campbell, K.Tirri, P.Ruohotie and H.Walberg. Research Centre for Vocational Education, University of Tampere, Finland, 2004.

Research projects

MINOS: Minimum Description Length Modeling in Computer Science and Statistics

PRIMA: Proactive Information Retrieval by Adaptive Models of Users' Attention and Interests

PROSE: Scalable Probabilistic Methods for Next Generation Internet Search Engines

SIB: Search-ina-Box

WIRNE: Personalized Location-Dependent Services in Wireless Networks

Cepler: Computationally Efficient Probabilistic Learning and Reasoning

PMMA: Probabilistic methods for microarray data analysis

Alvis: Superpeer Semantic Search Engine

Pascal: Pattern Analysis, Statistical Modelling and Computational Learning

International visits

Henry Tirri was Visiting Research Fellow at Berkeley, and made several shorter and one month-long visits there in June 2004. Two post-graduate students from Professor Michael Jordan's research group reciprocated with month-long visits to Helsinki: Simon Lacoste-Julien on 20 May – 20 June and Guillaume Obozinsky on 1 August – 5 September.

The group started co-operating with the research group of Professor Lizhu Zhou (Tsinghua University, China) on next-generation search engines. Henry Tirri, Wray Buntine, Sami Perttu, Ville Tuulos and Jukka Perkiö from CoSCO visited Tsinghua in spring 2004, and Qiang Zhou, PhD, made a month-long reciprocal visit in Helsinki (1 – 30 November). At the same time, one of Professor Zhou's postgraduates, Hang Guo, started a six-month visit (1 November 2004 – 30 April 2005) to Helsinki. Rudi Cilibrasi from Professor Vitány's group at the CWI research institute in Amsterdam visited the group on 15 – 29 August 2004.

In 2004, researchers in the group gave the following invited presentations at international conferences:

Henry Tirri: Fundamental Challenges of Next Generation Information Retrieval, ICETE 2004,

Henry Tirri: Networked: the new science of collaborative giftedness, ECHA 2004,

Henry Tirri: Topics in Probabilistic Location Estimation in Wireless Networks, PIMRC 2004,

Wray Buntine: Open Source Search: A Data Mining Platform, ICDM 2004.



4.2.2 Networking in Open Distributed Environments - NODES

The NODES group initiates and coordinates research on distributed and networked systems. The group's scope of interests includes concurrency, data communication software, and distributed systems. The current research focus lays on the design and development of infrastructure for mobile computing, on performance evaluation of distributed and networked systems, and on open distributed software architectures and services. The research projects coordinated by NODES can further be grouped into four broad categories: wireless internet, open distributed systems, operating systems, and formal specification and verification.

The wireless-internet group is especially interested in IP protocol quality of service and in internet session protocols. The IIP Mixture project focuses on the challenges of heterogenic communications. The TranSat project developed improvements for TCP and link protocols for satellite connections. The SESSI project developed a version of the internet's SIP protocol that is applicable to spontaneous networks. Under the auspices of the ANWIRE project, the group has participated in academic co-operation in Europe. The co-operation was extended through the MiNEMA project of the ESP.

The open and distributed systems group develops middleware services that support the co-operation and networking between companies. Partners in the co-operation are application components, which have been developed independently and which are under separate autonomous authorities, which means that the system must have facilities for publishing services, for automatic negotiations about agreements, and for internal management to fulfil the agreements. Middleware services must conceptually be capable of working in parallel on several application platforms.

In the Operation systems enhancement group, the active project investigates the capabilities of Linux in environments where high availability and timeliness are required.

Formal specification and verification of distributed systems is studied in the Modelling of concurrent systems group. The theoretical results of the group are based on process algebras, temporal logic, and theory of automata. The results are applied to software engineering tools.

Contact person for the research group:

Professor Kimmo Raatikainen

Homepage:

<http://www.cs.helsinki.fi/research/nodes/>

Selected publications

K. Raatikainen: Wireless Access and Terminal Mobility in CORBA. International Journal on Wireless and Optical Communications, Vol 1, No 2 (December 2003), 147-163.

J. Manner & K. Raatikainen: Research Challenges in IP QoS and Session Management in Mobile Ad-Hoc Networks. Proceedings of the International Workshop on Wireless Ad-hoc Networks (IWVAN), Oulu, Finland, May 31 – June 3, 2004.

M. Kojo, D. Astuti, L. Daniel, A. Nyrhinen & K. Raatikainen: Improving TCP Performance over Wireless WANs using TCP/IP-Friendly Link Layer. Proceedings of the 1st International Conference on E-Business and Telecommunication Networks (ICETE), Setúbal, Portugal, August 24-28, 2004.

S. Arbanowski, P. Ballon, K. David, O. Droegehorn, H. Eertink, W. Kellerer, H. van Kranenburg, K. Raatikainen & R. Popescu-Zeletin: I-centric Communications: Personalization, Ambient Awareness, and Adaptability for Future Mobile Services, IEEE Communications Magazine, September 2004, pp. 63-69.

K. Raatikainen, F. Hohl & S. Tarkoma, S: Generic Service Elements for Adaptive Applications. In Technologies for the Wireless Future, R. Tafazolli, ed. Wiley, 2005, pp. 157-170.

Research projects

ANWIRE
IIP Wireless
Interop
LiSAD
MiNEMA
Sessi
Transat
TuBE
web-Pilarcos

4.2.3 Object-based software architectures - ROOSA

The ROOSA research group studies software architectures and the object-based forms, and develops methods and tools for architecture-based software engineering. Its main research areas are the management of object-based application frameworks, evaluating software architectures on the basis of metrics and design models, and testing software product families on the basis of their architecture and components. The group has developed the JavaFrames tool for developing and managing application frameworks, the Maisa tool for evaluating architectures and the Rita tool for testing product families.

The research group has branched out into empirical software research as its new focus area. This entails studying how different software processes, methods and tools function in software engineering projects with the help of various testing arrangements. At the beginning of the research, software engineering projects at the department are used as the basis for testing.

Homepage:

<http://www.cs.helsinki.fi/research/roosa/>

Contact persons for the research group:

Professors Jukka Paakki and Inkeri Verkamo

Research projects

Techniques for UML-Based Software Development (UML++)
Fact-based Maturity through Institutionalisation Lessons-learned and Involved Exploration of System-family Engineering (FAMILIES)

4.2.4 Document Management, Information Retrieval and Data Mining (Doremi)

The Doremi research group is active in the areas of document management, information retrieval, data mining and human language technology. The group has developed methods for document assembly, event detection and tracking, data retrieval from XML documents, text mining, and question-answering systems.

The idea of QA systems is that users can ask them questions in a natural language, and the systems finds the answer in a large body of text. depending on the requirements, the answer is either a piece of text from which the reader can find the answer, or an exact answer, like a proper noun. During 2004, we have participated in the QA part of the evaluation project Cross-Language Evaluation Forum (CLEF) with the object of offering experiment material and an evaluation environment for QA systems where the questions and text collections are in different languages. We have built a system to which you can pose questions in Finnish, but the system searches for answers in an English newspaper text collection. Ours is the first QA system made for the Finnish language.

The project Mobile and Multilingual Maintenance Man (4M) incorporates several of our research problems, and is a co-operation between the University of Helsinki and several project groups at the Helsinki University of Technology, as well as VTT Information Technology (the national technology research centre). The project is a part of the FENIX project on interactive computing, funded by TEKES (The National Technology Agency in Finland). The 4M project aims at developing a knowledge support system that communicates with natural languages to aid maintenance workers repairing machinery. The Doremi team is in charge of developing methods for producing knowledge from text documents, e.g. to extract concepts of machine ontology and different instructions from the user manuals of the machinery. In addition, we are researching information retrieval that will fit on a small screen and give exact results while utilising the ontologies and previous discussions.

A new project, Pattern-based Learning and Understanding System (PLUS), branches out to develop a system to aid infectionists (medical). The system collects new announcements of infectious diseases in the world from a mailing list for doctors, retrieves the facts in the announcement (place, disease type, number of patients etc) and saves them in a database where the general public can fetch information through the WWW. The project has the special mission of adding to the reliability of retrieval results by analysing the database as a whole. Knowledge is usually only retrieved from one document at a time, so this kind of retrieval that spans several documents is still very new.

Other on-going research issues in the group are topic detection and tracking, text mining, and information retrieval from XML documents.



Contact persons for the research group:

Professor Helena Ahonen-Myka and researcher Roman Yangarber, PhD.

Homepage:

<http://www.cs.helsinki.fi/research/doremi/>

Research projects

Mobile and Multilingual Maintenance Man (4M)

Selected publications

J. Makkonen, H. Ahonen-Myka, M. Salmenkivi. Simple Semantics in Topic Detection and Tracking. *Information Retrieval* 7,3-4(2004), p. 347-368.

L. Aunimo, R. Kuuskoski and J. Makkonen. Cross-Language Question Answering at the University of Helsinki. In *Proceedings of the Cross Language Evaluation Forum (CLEF) 2004 Workshop*, September 2004, Bath, United Kingdom. pp. 361-370.

A. Doucet and H. Ahonen-Myka, Non-Contiguous Word Sequences for Information Retrieval. *Proceedings of the 42nd annual meeting of the Association for Computational Linguistics (ACL-2004)*, Workshop on Multiword Expressions: Integrating Processing, Barcelona, Spain, July 21-26, 2004, p. 88-95.

A. Doucet, Utilisation de Séquences Fréquentes Maximales en Recherche d'Information. *Proceedings of the 7th International Conference on the Statistical Analysis of Textual Data (JADT 2004)*, Louvain-la-Neuve, Belgium, March 10-12, 2004, p. 334-345.

A. Doucet, L. Aunimo, M. Lehtonen and R. Petit, Accurate Retrieval of XML Document Fragments using EXTIRP in *Proceedings of the Second Annual Workshop of the Initiative for the Evaluation of XML retrieval (INEX)*, ERCIM Workshop Proceedings, 2004, 8 pages.

International visits

Antoine Doucet. University of Caen, GREYC Laboratory, France 17 – 24 November 2004

Roman Yangarber. New York University, Courant Institute of Mathematical Sciences, USA 9 – 10 December 2004

4.2.5 The Semantic Computing Research Group SeCo

In 2004, the Semantic Computing research group (SeCo) consisting of 16 members has been focusing its research on the technologies and applications of the semantic web. The team works at both HIIT (Helsinki Institute for Information Technology) and at the Department of Computer Science.

The group carried out two research projects during 2004:

Ontologies of the semantic web in Finland is a national research project to develop broad Finnish open-source ontologies and the maintenance tools and applications for them. The project is a part of the Fenix research programme of Tekes, and comprises 16 different partners, private and public. The publishing concept and semantic portal, 'MuseoSuomi – Finnish museums on the semantic web' was awarded with the internationally esteemed application prize, the Semantic Web Challenge Award, in Japan in November, and domestically with the Prime Minister's commendation for the most innovative web application in the competition arranged by the Cabinet, Laatusverkko ('quality on the web'). The application also qualified for the finals in the competition Nordic Digital excellence in Museums.

The Intelligent Web Services project is part of the Fenix research project, and it had three partners from the business world at the beginning of the year (Fonecta, TeliaSonera and TietoEnator). The main focus of the project is creating service indexes like the yellow pages

by combining the semantic web and web services. The project was extended in August, when Stakes (National Research and Development Centre for Welfare and Health) and the Ministry of Finance joined it. At the same time, the project branched out into eHealth (ontologies for social and health services) and eGovernment (with the goal of changing the Suomi.fi national portal into a semantic portal).



Homepage:

<http://www.cs.helsinki.fi/group/seco/>

Contact person for the research group:

Professor Eero Hyvönen

Selected publications

E. Hyvönen, M. Salminen, M. Junnila: Annotation of Heterogeneous Database Content for the Semantic Web. Proceedings of the 4th International Workshop on Knowledge Markup and Semantic Annotation (SemAnnot 2004), Hiroshima, Japan, Nov. 8, 2004.

E. Mäkelä, E. Hyvönen, S. Saarela, K. Viljanen: OntoViews -- A Tool for Creating Semantic Web Portals. Proceedings of the 3rd International Semantic Web Conference (ISWC 2004), Hiroshima, Japan, 2004, Springer-Verlag, 2004.

E. Hyvönen, S. Saarela, K. Viljanen, E. Mäkelä, A. Valo, M. Salminen, S. Kettula, M. Junnila: A Semantic Portal for Publishing Museum Collections on the Web. Proceedings of ECAI/PAIS 2004, Valencia, Spain, 2004.

E. Hyvönen, M. Junnila, S. Kettula, E. Mäkelä, S. Saarela, M. Salminen, A. Syreeni, A. Valo, K. Viljanen: Finnish Museums on the Semantic Web. User's Perspective on MuseumFinland. Proceedings of Museums and the Web 2004 (MW2004), Arlington, Virginia, USA, March 31 - April 3, 2004. Selected Papers.

E. Hyvönen, S. Saarela, K. Viljanen: Application of Ontology Techniques to View-Based Semantic Search and Browsing. In C. Bussler, J. Davies, D. Fensel, R. Studer (eds.): The Semantic Web: Research and Applications. Proceedings of the First European Semantic Web Symposium (ESWS 2004), Springer-Verlag, LNCS 3053, 2004.

Research projects

Ontologies of the Finnish Semantic Web
Intelligent Web Services

International visits

Eero Hyvönen participated in research project evaluations in Austria at the invitation of the Forschungsförderungs fonds fuer die gewerbliche Wirtschaft (FFF) organisation.

4.2.6 Mining of statistical bioinformatics data

This research group studies machine learning methods for data mining, information-visualization and statistical modelling. Methods are especially developed for the first data-based stage of data analysis with the goal of finding previously unknown regularities in the data. The hypotheses found at this stage are verified at later stages of the analysis.

The group currently focuses on methods that search for dependencies between data sets in order to concentrate on the interesting or important features of the material. The group has developed component models, supervised clustering and adaptive distance measures. The methods are used especially in applications for bioinformatics, the analysis of functional genomic data, but also for pro-active information retrieval and analysis of bankruptcy risks.

The research group operates partly at the University of Helsinki (Department of Computer Science and partly at Helsinki University of Technology (Laboratory of Computer and Information Science).

Contact person for the research group:

Professor Samuel Kaski

Homepage:

<http://www.cis.hut.fi/projects/mi/>

Selected publications in 2004:

S. Kaski and J. Sinkkonen. Principle of learning metrics for exploratory data analysis. *Journal of VLSI Signal Processing*, special issue on Machine Learning for Signal Processing, 37:177-188, 2004.

J. Nikkilä, C. Roos, and S. Kaski. Exploring dependencies between yeast stress genes and their regulators. *Proceedings of IDEAL04, Intelligent Data Engineering and Automated Learning*, pp. 92-98. Springer, Berlin, 2004.

J. Peltonen, A. Klami, and S. Kaski. Improved learning of Riemannian metrics for exploratory analysis. *Neural Networks*, 17:1087-1100, 2004. Invited paper.

J. Peltonen, J. Sinkkonen, and S. Kaski. Sequential information bottleneck for finite data. In *Proceedings of ICML 2004, the Twenty-First International Conference on Machine Learning*, pp. 647-654. Omnipress, Madison, WI, 2004.

J. Sinkkonen, J. Nikkila, L. Lahti, and S. Kaski. Associative clustering. In *Machine Learning: ECML'04. Proceedings of the 15th European Conference on Machine Learning*, pages 396-405. Springer, Berlin, 2004.

4.3 Projects

Algorithms

Project: Networking and Architecture for Proactive Systems - Algorithmics (NAPS)
Period: January 2003 – December 2005
Researchers: Patrik Floréen, Jukka Kohonen, Petteri Nurmi
Funding: The Academy of Finland, PROACT research programme

This project at HIIT/BRU is part of the Networking and Architecture for Proactive Systems (NAPS) consortium, to which belongs the research groups of Prof. Pekka Orponen (Laboratory for Theoretical Computer Science, TKK) and Prof. Jorma Virtamo (Networking Laboratory, TKK). It is part of the Proactive Computing (PROACT) research programme of the Academy of Finland.

The network computing and communication models underlying proactive applications give rise to new opportunities and challenges in the fields of algorithm design and analysis. The project approaches, among others, multiobjective optimisation problems in topology control and routing of ad hoc and sensor networks.

In 2004 the project has continued research on energy-efficient designs, now concentrating on data gathering problems in sensor networks. We have studied balanced data gathering, where the task is to maximise the amount of data received at the sink, while simultaneously ensuring that a minimum amount of data is forwarded from all sensors. The results were published in [1] and also presented at the workshop of the PROACT programme in [2]. A faster algorithm for the balanced data gathering problem has since been obtained and the results have been offered for publication as a journal version of article [1].

In 2004, also work on applying game theory to routing in ad hoc networks [3] was initiated. Based on earlier work on lifetime maximisation in ad hoc networks, an article [4] was accepted for publication and will appear in the beginning of 2005.

References:

- [1] E. Falck, P. Floréen, P. Kaski, J. Kohonen, P. Orponen: "Balanced data gathering in energy-constrained sensor networks." Proc. Algosensors 2004: First International Workshop on Algorithmic Aspects of Wireless Sensor Networks (Turku, Finland, July 2004), 59-70. Springer-Verlag, Berlin, 2004.
- [2] J. Kohonen: "Data gathering in sensor networks." Proactive Computing Workshop (PROW2004, Helsinki, Nov 2004), 32-36. Helsinki University Press, 2004.
- [3] P. Nurmi: "Modelling routing in wireless ad hoc networks with dynamic Bayesian games". Proc. 1st IEEE Intl. Conference on Sensor and Ad Hoc Communications and Networks (IEEE SECON, Santa Clara, Calif., Oct 2004), IEEE 2004.
- [4] P. Floréen, P. Kaski, J. Kohonen, P. Orponen: Lifetime maximization for multicasting in energy-constrained wireless networks. IEEE J. on Selected Areas in Communications, 2005.

Project: Software Platform and Component Environment for yoU (Space4U)
Period: July 2003 – June 2005
Researchers: Patrik Floréen, Otso Virtanen (-09/04), Michael Przybilski (08/04-), Teemu Kurppa (11/04-)
Funding: Nokia Research Center

The EUREKA ITEA project Space4U (Software Platform and Component Environment for yoU) builds on the foundations established by the previous ITEA project ROBOCOP. Whereas ROBOCOP provided a component-based software architecture for the middleware of embedded appliances, Space4U aims to extend the framework in the areas of power management, fault management and remote terminal management. HIIT/BRU works as a subcontractor to Nokia Research Center. The work focuses on the terminal management and context-aware configuration part of Space4U. Specifically, this part of the project develops context-aware selection, download and execution of software components on resource constrained terminals.

The project has been undertaken in two parts: the first “Terminal Software Management System Design/Development” during 07/03-06/04, and the second “Terminal Management Demonstrator Development” during 07/04-06/05. In 2004, the group at HIIT/BRU developed a context-aware extension of the ROBOCOP middleware platform for Symbian terminals, based on a blackboard architecture approach, together with prototype applications to demonstrate the provided functionality.

Results have been published in a workshop paper: J. Muskens, O. Virtanen, M. Chaudron and R. Mac Lavery, “Maintaining terminal integrity and context-aware reconfiguration.” In the workshop Component-Oriented Approaches to Context-Aware Computing at the European Conference on Object-Oriented Programming (ECOOP 2004, Oslo, Norway, June 2004), 2004.

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Project: MobiLife - Mobile Life
Period: September 2004 – December 2006
Researchers: Patrik Floréen, Petteri Nurmi, Michael Przybilski, Mika Raento
Funding: EU 6th Framework Programme IST-priority Integrated Project

The objective of MobiLife is to bring advances in mobile applications and services within the reach of users in their everyday life by innovating and deploying new applications and services, applying a user-centred approach. The MobiLife project is coordinated by Nokia and has 22 partners from nine countries. The group at HIIT / BRU focuses on the context-awareness aspects of the project and researches context reasoning methods and context aware software architectures. HIIT/BRU is task leader of the task “Context management”.

Besides collecting and reporting the state-of-the-art, the work in 2004 has concentrated on the initial design of the Context Management Framework, including work on requirements and architecture. The areas we are working on in addition to context management are personalisation, group awareness and proactive service provisioning.

Project: Application of Probabilistic Inductive Logic Programming II (APrIL II)
Period: January 2004 – December 2006
Researchers: Heikki Mannila, Taneli Mielikäinen
Funding: EU

The overall goal of the project is to develop a sound theoretical understanding of probabilistic logic learning that enables one to develop effective learning systems and to apply them on significant real-life applications. There are five partners in the project: Albert-Ludwigs-Universität Freiburg, Imperial College of Science, Technology and Medicine, University of Helsinki/Institute of Information and Technology, INRIA Rocquencourt and University of Florence. The research in Helsinki is focusing on algorithmics of probabilistic logic learning, especially for segmentation problems.

Intelligent systems

Project: Computationally Efficient Probabilistic Learning and Reasoning - (CEPLER)
Period: February 2000 – December 2004
Researchers: Petri Myllymäki, Tomi Silander, Pekka Uronen, Petri Kontkanen, Jorma Rissanen, Jussi Lahtinen
Funding: The Academy of Finland

The theory of probability calculus offers a solid yet diversified theoretical framework for building models on the basis of empirical data and/or expert knowledge. Although the advantages of probabilistic models have been largely recognized, the approach has often been neglected as a theoretically correct, but computationally infeasible methodology. The aim of the research is to develop computationally efficient methods that are well based in theory for probabilistic modelling, and to develop methods for solving issues of both prediction (regression issues, classification) and data analysis (data-mining, visualisation, causal deduction).

The research focuses both on theory and methodology. The theoretical part of the work strives to construct a perfect chain of processing raw data to the final analysis of data so that each link in the chain is well based in theory. To achieve this goal, issues such as model-discovery, model-election (with various utility functions), objective priorities and causal deduction have to be addressed.

The methodological part developed methods that were implemented and tested on material from different application areas. In addition, the project took over the responsibility of developing and maintaining the public B-Course service in 2004. B-Course is a unique web-based server that offers a state-of-the-art tool for modelling probabilistic and causal data. B-Course is available teaching and research purposes at <http://b-course.cs.helsinki.fi> or <http://b-course.hiit.fi>. By the end of 2004, over 10,000 users world-wide had availed themselves of the server, and the result of the analyses have been utilised for the development of an HIV vaccine, the analysis of birdsong, and the study of gene data.

Project: Probabilistic Methods for Microarray Data Analysis (PMMA)
Period: January 2004 – November 2005
Researchers: Petri Myllymäki, Jussi Lahtinen, Petri Kontkanen, Teemu Roos, Tomi Silander
Funding: Tekes

The goal of this project is to develop new probabilistic methods for analysis of micro chip data. The research especially focuses on the following sub-areas: removing noise from micro chip images, developing compression estimations (comprestimation) methods, grouping and classification of genes, building gene regulation networks and evaluation of results.

The research consortium consists of three participant groups from the following: 1) the Laboratory for Computational Engineering, Helsinki University of Technology (in charge of Jukka Heinonen, DSc (Tech)), 2) the Institute of Biomedicine, University of Helsinki (in charge of Professor Tomi Mäkelä) and 3) Department of Computer Science (in charge of Professor Petri Myllymäki). The University of Helsinki started participating at the end of 2004.

Project: Pattern Analysis, Statistical Modelling and Computational Learning (PASCAL)
Period: January 2003 – November 2007
Researchers: Petri Myllymäki, Wray Buntine, Patrik Floréen, Jyrki Kivinen, Jorma Rissanen, Henry Tirri, Esko Ukkonen
Funding: EU

Pascal is a Network of Excellence funded by the EU and comprising 57 European research institutions. The Department of Computer Science at the University of Helsinki is one of the thirteen core sites of the network, and a representative from the University of Helsinki has a seat in the steering committee of the network. The basic idea of the network is to gather the foremost experts on statistical modelling and machine learning in Europe. On the website of the network (www.pascal-network.org), its goals are formulated as follows:

“The objective is to build a Europe-wide Distributed Institute which will pioneer principled methods of pattern analysis, statistical modelling and computational learning as core enabling technologies for multimodal interfaces that are capable of natural and seamless interaction with and among individual human users.

At each stage in the process, machine learning has a crucial role to play. It is proving an increasingly important tool in Machine Vision, Speech, Haptics, Brain Computer Interfaces, Information Extraction and Natural Language Processing; it provides a uniform methodology for multimodal integration; it is an invaluable tool in information extraction; while on-line learning provides the techniques needed for adaptively modelling the requirements of individual users. Though machine learning has such potential to improve the quality of multimodal interfaces, significant advances are needed, in both the fundamental techniques and their tailoring to the various aspects of the applications, before this vision can become a reality.

The institute will foster interaction between groups working on fundamental analysis including statisticians and learning theorists; algorithms groups including members of the non-linear programming community; and groups in machine vision, speech, haptics, brain-computer interfaces, natural language processing, information-retrieval, textual information processing and user modelling for computer human interaction, groups that will act as bridges to the application domains and end-users.”

Software engineering

Project: Techniques for UML-Based Software Development - (UML++)
Period: May 2001 – December 2004
Researchers: Juha Gustafsson
Funding: The Academy of Finland

The project develops methods for the measurement of software quality at the design level, and the Maisa tool to support these methods. The quality measurement is based on different design patterns and pattern-matching, as well as computing the software metrics from the system's architectural description given in UML.

In 2004, the research has focused on the evaluation of size and performance of software, as well as the description and discovery of patterns that cover large parts of the architecture (or program code).

Distributed systems and data communication

Project: Improving Internet Protocols for Heterogeneous Traffic on Wireless Links (IIP Mixture)
Period: March 2003 – March 2005
Researchers: Kimmo Raatikainen, Markku Kojo, Davide Astuti, Laila Daniel, Lauri Hyttinen, Ilpo Järvinen, Simone Leggio, Aki Nyrhinen, Oriana Riva, Jarno Saarto
Funding: Tekes, Nokia Research Center, TeliaSonera Finland

The research project IIP Mixture focuses on Internet solutions that are able to manage heterogeneous traffic smoothly over wireless links. The key areas of interest include studies on how different types of competing traffic behave and how the behaviour can be managed with IP QoS-mechanisms such as differentiated packet treatment (DiffServ). In particular, how co-existence of active queue management and DiffServ-based packet treatment is best arranged. In addition, the project works on enhancing the TCP protocol and algorithms for a wireless environment (2.5G and 3G) and studies how different applications should implement the application protocol in order to allow the most efficient operation at the transport layer. The results are contributed to the Internet protocol standardization work of the Internet Engineering Task Force (IETF). The development of the Seawind real-time network emulator also continues. By the end of year 2004, the Seawind software has been licensed by more than twenty universities and research institutes worldwide.

In 2004, the project focused on three major activities:

- 1) The experimental study on the behavior of the Internet instant messaging and e-mail access protocols,
- 2) The behaviour and performance of heterogeneous traffic load consisting of competing TCP and UDP flows, and
- 3) IETF contributions.

In addition, the project has collaborated with the ICSI/ICIR research unit at Berkeley to improve the performance of Internet transport protocols with novel co-operation between the transport and network layer.

Project: Transport Protocol and Resource Management for Mobile Satellite Networks (TranSat)

Period: October 2001 – February 2004

Researchers: Kimmo Raatikainen, Markku Kojo, Davide Astuti, Laila Daniel, Aki Nyrhinen

Funding: (ESA) Alcatel Space

The TranSat project was carried out in collaboration with the academic research institutes (INRIA, ENSICA) and satellite industry (Alcatel Space) in France. The goal of the project is to develop the operation and performance of Internet transport protocols in a DVB/RCS satellite environment.

The project focuses on two main fields:

1) The enhancements to the TCP protocol by improving the TCP sender and receiver algorithms and the enhancements to the link level service offered to the transport level so that the link service better suits to the satellite environment

2) The enhancements to the resource management for the satellite link and the coupling of differentiated packet treatment (IP QoS) at the IP level to the differentiated services offered by a satellite link.

In 2004, the project work focused on an extensive experimental study to measure the performance gain elicited by the features implemented in the TranSat architecture.

Project: Middleware for Network Eccentric and Mobile Applications (MiNEMA)

Period: September 2003 – August 2008

Researchers: None. (Co-operation project between European academic institutes)

Funding: European Science Foundation / the Academy of Finland

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ESF's MiNEMA projects boosters European academic co-operation in the area of middleware in ad hoc networks. The project supports mobility of Ph.D. students and senior researchers, and arranges summer schools of top quality.

Professor Kimmo Raatikainen is the national delegate in the steering group.

Project: Production and integration of large scale systems in web services environment (web-Pilarcos)

Period: January 2004 - January 2005

Researchers: Lea Kutvonen, Toni Ruokolainen, Janne Metso, Ilja Ponka, Juha-Pekka Haataja

Funding: co-operation project with VTT, funding TEKES, Elisa, SysOpen and Tellabs

Electronic business networks have become necessary for the success of enterprises. Architectures and tools for lowering the cost of collaboration establishment and improving the facilities for managing and maintaining the networks are under active development. The web-Pilarcos project provides B2B middleware that is designed for interoperability of autonomous enterprise applications in interorganisational context. The approach is a federated one: All business applications are developed independently, and the B2B middleware services are used for ensuring that technical, semantic, and pragmatic interoperability is maintained in the business network. In the design, attention has been given on the dynamicity and evolution aspects of the network.

The web-Pilarcos project has developed prototypes for some essential B2B middleware services based on the concepts of eCommunity and eCommunity contract, business policies,

and operational time conformance to the contracted business network model, and layers of eContract breach management. The middleware includes services for business network lifecycle management (population, joining and leaving, termination, negotiations), service type conformance verification, and application level network monitoring.

Project: Trust based on evidence (TUBE)
Period: January 2004 – March 2005
Researchers: Lea Kutvonen, Lea Viljanen, Sini Ruohomaa
Funding: Tekes, Nixu, StoneSoft

At present, enterprise computing is directed towards more open, collaborative systems. It is essential for enterprise success that their ICT systems are able to join business networks for a low cost despite of technical and semantical interoperability problems. As no business network is feasible without trust between partners, the supporting technology has to provide concepts and mechanisms for forming trust relationships, and observing the business peers for malicious or incorrect behaviour on interactions.

Our goal is to develop middleware level services that provide for automating routine trust decisions in inter-enteprise collaborations. Such middleware should also provide monitoring of potential violations of contracted, trusted behaviour. We consider trust to be a subjective concept, with feed-in from the trustees environment, that expresses the extent to which a party is willing to participate a collaborative interaction in a specific situation.

The first phases of the TUBE project have performed various surveys on this still immature but important area, concentrated on conceptual and architectural development, and preparation of prototyping some essential elements of the architecture for experimentation.

Project: Interoperability Research for Networked Enterprises Applications and Software (INTEROP NoE)

Period: November 2003 - December 2006

Researchers: Lea Kutvonen, Toni Ruokolainen, Sini Ruohomaa. The network has also partners from 50 organisations.

Funding: EU 6th Framework Programme

INTEROP is a Network of Excellence supported by the European Commission for a three-year-period. INTEROP aims to create the conditions of an innovative and competitive research in the domain of Interoperability for Enterprise Applications and Software by bringing together research from the areas of Ontology, Enterprise Modelling, and Architectures.

Our participation in the network have concentrated on Architectures and computing platforms. During the first year, the network has produced a number of state of the art surveys, and is now forming a second phase work plan based on those results.

Information systems

Project: Gene mapping and diagnostics: computational tools for new high-throughput laboratory technologies (Altti)
Period: March 2003 – February 2005
Researchers: Hannu Toivonen, Päivi Onkamo, Bart Goethals, Petteri Hintsanen, Petteri Sevón, Lauri Eronen, Juho Muhonen
Funding: Tekes, GeneOS, Jurilab, Cyberell

The laboratory methods for biotechnology are developing quickly. With the new methods, it is possible to produce large collections of genetic data for e.g. case control studies for epidemiologic purposes. The project develops new computational methods with which to analyse large data collections. The goal is to be able to haplotype case control data and discover disease associations (predisposing genes) in this data. The methods developed will make genetic analysis in laboratories easier and more effective.

During 2004, the project has continued to develop the haplotyping. The current HaploRec method can manage genetically broad data with precision and speed. The project had developed population simulation methods and tools, with which diverse comparisons of different gene-mapping combinations and methods have been made. One interesting discovery is that the haplotyping method developed by the project functions very well as the initial stage of gene-mapping. This is important in practice, as the gathering of data can be made much easier without interfering with the accuracy of mapping.

With the help of the HPM mapping method developed by the group, a new asthma gene (Science 9.4 2004) was found and the method was licensed to several corporations. The TreeDT method was patented.

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Project: Context recognition by user situation data analysis (Context)
Period: January 2003 – December 2005
Researchers: Mika Raento, Kari Laasonen, Renaud Petit, Hannu Toivonen
Funding: The Academy of Finland

This project studies the characterisation and analysis of user contexts, and the adaptation of context data in pro-active computing. The research issues of the project include the users' concepts of their contexts, automatic conclusions based on context information, as well as how to present context data to the user. The project is a co-operation with the User Experience group at the Applied Research Unit at HIIT.

During 2004, the Context-Phone software has matured. The software collects, saves and relays context information in normal S60 mobile phones. It can also automatically annotate the pictures taken with camera phones with context information and move them e.g. to a website. With the help of this software, the project has studied the effect of relaying context information on user communications and developed methods for refining cell-based positioning data into a more graphic form. The ContextPhone software is used as a research tool at places like Berkeley, MIT and the University of Art and Design, and it has been noted in the New Scientist magazine, among others.

Project: Mobile and multilingual maintenance man - (4M)
Period: August 2003 – July 2007
Researchers: Reeta Kuuskoski, Helena Ahonen-Myka. Co-operation project, other partners: HU/language technology, HU/Department of Translation Studies, HUT/TAI research centre, HUT/Sober IT/usability group, HUT/knowledge engineering, VTT Tietotekniikka
Funding: Tekes, Fujitsu Services, Nokia Research Center, Nokia Business Infrastructure ja Pasanet/Lingsoft

The project aims at developing a prototype of a knowledge support system that helps maintenance personnel in mending different equipment. The basic structures of different machines are fed into the system along with data on typical problems and their solutions. The knowledge is structured with the help of ontologies. Furthermore, an event database of earlier solutions and other text-based background information, such as user manuals, are available. Special goals include developing a user interface that converses in a natural language. The contents of the conversation of the user interface is managed partly by ontologies. It combines several unstructured data sources with a strictly structured ontology knowledge to ensure that the system remains up to date. The project team at the Department of Computer Science concentrates on producing answers from the background information if a straight answer cannot be produced on the basis of the ontologies. The team also produces pre-processing methods to identify the concepts of the ontologies and to denote them in the background information. The annotation helps in finding the exact answer to questions in real-time problem situations.

Project: Coordination of the Research Programme on Proactive Computing - (PROACT)
Period: February 2002 – May 2006
Researchers: Greger Lindén, Project Coordinator; Heikki Mannila, Project Manager
Funding: The Academy of Finland

The Basic Research Unit at HIIT co-ordinates the shared Proactive Computing project (PROACT) of the Academy of Finland, TEKES and the French Ministry of Research. PROACT funds 14 research projects with a total of 41 Finnish and French research partners. The projects last three years and started at the beginning of 2003. The research programme will end in December 2005, and its total budget is eight million euros.

Academy Professor Heikki Mannila is the managing director of the programme and Specialist Researcher Greger Lindén acts as its co-ordinator. The goal of the co-ordination is to promote co-operation between the projects that are part of the programme, as well as international co-operation with other research programmes, to arrange seminars and to inform the general public about the programme. The co-ordinator also informs the financiers about the progress of the programme.

The co-ordinating unit participated in preparing the programme and choosing the projects in 2002. In years 2003 and 2004, the co-ordinators have visited all the projects and arranged seminars in connection with the programme. Various media and events have been informed about the programme, both through the programme website and e-mail. The co-ordinators maintain a site on the research programme at www.aka.fi/proact with additional information on the programme and its coordination.

Bioinformatics

Project: Experimental and computational analysis of physiological regulation at transcriptome, proteome and metabolome level. (SYSFYS)
Period: January 2004 – December 2007
Researchers: Ari Rantanen, Esa Pitkänen, Markus Heinonen, Juho Rousu, Esko Ukkonen
Funding: The Academy of Finland

SYSFYS is a shared project between the Helsinki University Department of Computer Science, Institute of Biotechnology, and VTT (Technical research Centre of Finland). The project is funded by the Academy of Finland as a part of the SYSBIO research programme.

The team at the Department of Computer Science studies the modelling of cell metabolism, especially the computation of metabolic fluxes. The project has developed a computational method for better utilisation of measuring data from isotope marking.

Another field of interest has been the automatic identifying of metabolic fragments created in tandem mass spectrometry. The project has developed a software prototype to make interpretations of mass spectrums easier and quicker.

Thirdly, the project has developed new methods for analysing the structure of metabolic networks. We have developed new distance measures for metabolites, which allow for the non-linearity of the metabolic fluxes, as well as efficient computational methods for these measures.

Project: Advanced data analysis in vision research
Period: January 2003 – December 2005
Researchers: Ilmari Kurki, Aapo Hyvärinen
Funding: The Academy of Finland

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In the field of vision research, the similarities in research issues on computer vision and biological vision systems have lately become more pronounced. On the other hand we can assume that if we are familiar with the human vision system, that will give us new methods for developing computer vision systems; then again, the development of computational computer vision methods will probably promote the development of relevant hypotheses on the human vision system, which can then be studied experimentally.

This project studies new ways to analyse performance data on the human vision system, enabling new computational models of the human vision system as well as inspiring new methods for computer vision. Our approach is based on a recently developed experimental paradigm, so-called classification images. They give us extremely multi-dimensional data which it is very challenging to analyse.

This is a co-operation with the Helsinki University Department of Psychology.

Project: Statistical modelling of image and video data
Period: April 2003 – December 2007
Researchers: Aapo Hyvärinen, Patrik Hoyer, Jarmo Hurri, Jussi Lindgren, Jukka Perkiö, Urs Köster
Funding: HIIT/BRU, the Academy of Finland

The goal of the project is to develop new statistical models of image and video data. Lately it has been found that such models have two important application fields. On the one hand, they enable new models of the human vision system, and on the other, new methods for computer vision and for image processing can be based on them. It has become apparent that both application fields are useful for describing vision in a coherent framework based on statistical estimation and deduction. On the one hand, our models are based on new models of factor analysis, like independent component analysis (ICA) and positive matrix factoring, and on the other hand on a new kind of analysis methods for multi-dimensional data.

Project: Independent component analysis and its extensions
Period: April 2003 – December 2005
Researchers: Aapo Hyvärinen, Patrik Hoyer, Shohei Shimizu, Elina Karp
Funding: HIIT/BRU, The Academy of Finland, overseas foundations

Independent component analysis (ICA) is a recently developed model for data analysis. It entails presenting multi-dimensional measuring data or a database as the linear sum of hidden, statistically independent components. There are many applications areas for the method, such as neuro- and bioinformatics as well as psycho- and econometry.

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We are developing new and more efficient variants of the method, utilising e.g. time behaviour and interdependencies. The project also studies how the methodology can be applied to causal analysis. A further object of study is the connection between this method and models of multi-dimensional data analysis, such as positive matrix factorisation, models of structure equations and graphical models. We also study ways to analyse the reliability of the ICA method.

Project: Infectious origins of the human genome. Human endogenous retroviruses in health and disease
Period: January 2003 - December 2005
Researchers: Merja Oja, Arto Klami, Samuel Kaski
Funding: The Academy of Finland

The project studies the interaction between viral genetic parasites and symbionts and the human host. Animal and plant genomes become invaded to different degrees by transposons of which retroviral sequences are a major portion. The knowledge is important both in a more long term evolutionary perspective, for the understanding of the future of humans, but also in the shorter term for the understanding of disease mechanisms and the possible use for gene therapy. Bioinformatic techniques are explored and developed to detect and characterize retroviral sequences in the human genome, and the findings are combined with expression data. In particular, supervised machine learning techniques are applied for detection of retroviral sequences, and unsupervised exploratory data analysis methods for discovering their characteristics.

The first step, finished during 2004, has been to construct visualizable atlases of human endogenous retroviruses to reveal new subgroups and refine existing classifications.

Project: Systemic Models for Metabolic Dynamics and Regulation of Gene Expression (SYMBOLIC)

Period: April 2004 - April 2006

Researchers: Tapio Rinnet, Janne Sinkkonen, Samuel Kaski

Funding: Tekes

This is a subproject of a consortium. The subproject searches for potential new regulatory interactions based on gene expression time series measured with gene expression microarrays, and investigates possibilities for dynamic latent variable modeling.

We have developed new dependency exploration techniques, to find what is in common in co-occurring measurements, that is, to find statistical dependencies between the measurements. In this project the methods have so far been applied to find dependencies between gene expression and transcription factor binding patterns, and between gene expression in different stressful measurement to define stress response.

Project: New computational techniques for analysing the structural and functional landscape of the mammalian genomes (CompGenome)

Period: January 2004 – December 2007

Researchers: Heikki Mannila, Aristides Gionis, Niina Haiminen, Jaana Heino, Mikko Koivisto, Jussi Kollin, Kimmo Palin, Panayiotis Tsaparas

Funding: The Academy of Finland

The project studies inter- and intraspecies genetic and functional varieties. The goal is to understand such issues as multifactor diseases. The biological themes include haplotype structures, large-scale genetic changes, clustering of phenotypes and gene expression. Computationally, the themes are probability calculus and Markov Chain Monte Carlo methods, data-mining and pattern discovery, as well as combinatorial algorithms. The project is a co-operation between the Finnish Genome Center, the National Public Health Institute and Karolinska Institutet in Stockholm, and it is part of the SYSBIO programme of the Finnish Academy.

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In its first year, 2004, the project focused on genome segmentation and modelling multi-dimensional phenotype data. This yielded interesting results, especially in a computational context.

Project: Clustering of phenotypic features in schizophrenia and bipolar disorder samples (PhenoClusters)

Period: August 2004 – September 2005

Researchers: Heikki Mannila, Jaana Heino, Mikko Koivisto, Laura Ruotsalainen

Funding: Orion Oyj

It is important to discover the genetic causes of multifactor diseases. When there are a great deal of phenotypes connected with a disease, analysing the data poses a great challenge. This project develops probability models and clustering programs of multidimensional phenotype data. The methods are applied to phenotype and genotype data connected with schizophrenia and bipolar disorder. The project is carried out as a co-operation with the National Public Health Institute.

In 2004, the project calculated basic data and the structure of missing data values, as well as applied simple mixed-modelling methods and main component analysis. Preliminary results still give a quite rough view of the data, although some interesting findings could be already made.

Project: Yeast systems biology (YEASTSYS)
Period: January 2004 – December 2005
Researchers: Esa Pitkänen, Pekko Parikka, Markus Heinonen, Arto Åkerlund, Ari Rantanen, Esko Ukkonen
Funding: TEKES

YEASTSYS is a shared project between the Helsinki University Department of Computer Science, Institute of Biotechnology, VTT (Technical Research Centre of Finland), and several industrial partners. Tekes funds the project as part of the NeoBio research programme.

The YEASTSYS project develops the computational modelling methods for cell metabolism, which the group has produced before, into public web applications. The applications will offer new and easy-to-use tools for constructing the metabolic network of cells on the basis of organism sequences, for modifying the metabolism network towards an optimal state, and for specifying the force of metabolic fluxes with the help of measurements from isotope marking. The usefulness of these applications has been evaluated with yeast as a sample organism.

Applied computer science

Project: Finnish Semantic Web Ontologies
Period: September 2003 – August 2005
Researchers: Markus Holi, Miikka Junnila, Tomi Kauppinen, Suvi Kettula, Ville-Pekka Komulainen, Tuomas Korpilahti, Mirva Salminen, Katri Seppälä, Arttu Valo
Funding: AAC Global Oy, AlmaMedia Oyj, the Antikvaria group, TietoEnator Oyj, Connexor Oy, Leiki Oy, M-Cult ry, the National Board of Antiquities, Kiasma, the Finnish Museum of Photography, the Finnish Terminology Centre, Suomen maatalousmuseo (Finnish agricultural museum), Valokuvataiteen museo (museum of photography), the Finnish National Gallery (Kehys), Yleisradio Oy (public broadcasting company), Tekes
Research co-operation: University of Helsinki Department of General Linguistics, the National library of Finland, University of Tampere Department of Information Sciences

The project is working on an ontology library and its web services for the distributed development of nationally meaningful ontologies of the semantic web. The goal is to move from present-day key word methods towards using the semantically more fruitful ontology techniques for indexing and search functions. This will enable more user-friendly and exact information retrieval, the semantic interoperability of data systems and intelligent services on the Web. For the ontologies, the Yleinen Suomalainen Ontologia (YSO, general Finnish ontology), based on the Yleinen Suomalainen Sanasto (YSA, general Finnish glossary), and several connected cultural and media ontologies are under development. Using ontologies creates new business opportunities and allows more efficient utilisation of valuable data contents than before.

The technology is being applied in concrete case applications, whose usability will be evaluated through testing. The main application produced by the project is the MuseoSuomi portal, which was elected for the finals in the competition Nordic Digital Excellence in Museums (Nodem), as well as awarded the international Semantic Web Challenge Award 2004 in Japan. Furthermore, it gained an honourable mention from the Prime Minister for the most innovative web service in the competition Laatusa verkko (quality on the web) arranged as a part of the IT society programme of the cabinet.

Project: Intelligent Web Services

Period: August 2003 – July 2005

Researchers: Mikko Apiola, Mikko Laukkanen, Petri Lindgren, Eetu Mäkelä, Samppa Saarela, Teemu Sidoroff, Kim Viljanen

Funding: Fonecta Oy, TeliaSonera Finland Oyj, TietoEnator Oyj, Ministry of Finance, Stakes, Tekes

This project develops the technology of intelligent web services by enhancing present-day web services and workflow technologies with the product and service descriptions of the semantic web technologies. The goal is to produce significantly more useful interactive web services for the end user. The technology is being developed in three pilot projects. The application developed by the eCommerce project combines a yellow-pages-like product and service index with a functional web service for the business world and public administration. The eGovernment project studies and develops semantic portals, especially for the semantics of the public Suomi.fi service. In eHealth, the use of ontologies especially in health services for the elderly is studied.

5. SERVICES

5.1 Administration

The department administration offers its staff and students services for the management of personnel, teaching, financial, research and general administration. It is also part of the administrative services to support the department steering committee and chairman in the preparation and implementation of issues in their jurisdiction. At the beginning of 2004, a new steering committee commenced operations at the department. In connection with the summer move, the administration team was located in its own administrative wing of the new building in order to improve customer services. The co-operation between the department administration team and the campus service unit located in Exactum has improved since the move, making the processing of running matters quicker and easier.

The teaching administration, led by Head of Studies Hannu Erkiö, is responsible for matters concerning teaching at the department and manages student counselling. The department's teaching staff is also aided by a teaching assistant, who carries out routine tasks.

The personnel administration manages employment issues and well-being in the workplace. The administration of personnel employment issues changed in 2004 with the coming of a new routine for the reporting of employment issues. As has become traditional, monthly meetings were arranged for the department's staff, offering a forum for discussion and announcements. Measured in person-years, the staff at the department increased over 18 person-years from the previous year.

The financial administration unit is responsible for managing finances and counselling on financing at the department, as well as for assisting the department management in financial planning and reporting. For this unit, the most considerable change in 2004 was the new routine for travel grants that was introduced at the university.

The research administration unit, for its part, supports projects that operate on additional funding at the department with financial planning and reporting services and assisting them in writing funding applications. During 2004, 32 different projects were active at the department. The majority of the projects at the department are funded by the Finnish Academy and TEKES. Noteworthy for the research administration unit in 2004 was the contribution to EU project administration, with the department's five new EU-funded projects.

The general administration assists the department management in drawing up different accounts and reports, offers the department staff proofreading and translation services, clerical services for the students as well as internal and external PR and information services. As an example, in 2004 c. 50% of the department staff availed themselves of the proofreading and translation services, which included everything from translating short announcements to proofreading six PhD theses.

The departmental PR and information officer was very active during 2004, editing the department webzine me@tktl, making new department brochures and slide presentations, as well as arranging various events to celebrate the relocation to Kumpula. Under the management of IT Designer Sanna Kettunen, the Department's website was reformed during 2004 to comply with the university's style recommendations. The contents of the large website were reformed to accommodate new requirements. This work will continue during 2005.

The departmental administration has been active in developing new tools for the administration.

Last year, a program for the management of department offices and other work facilities was designed and implemented.

All in all, nine persons were employed in the administrative team at the end of 2004.

The steering committee of the department had the following members in 2004:

Professor Jukka Paakki, chair
Professor Hannu Toivonen, assistant chair (deputy: Professor Seppo Sippu)
Professor Jyrki Kivinen (Professor Matti Nykänen)
Professor Lea Kutvonen (Professor Kimmo Raatikainen)
Assistant Jan Lindström (Researcher Juha Gustafsson)
University Lecturer Pirjo Moen (Lecturer Markku Kojo)
Secretary Inka Kujala (1 Jan – 31 Aug 2004: IT Specialist Mikael Jokela, 28 Oct – 31 Dec 2004: Research Secretary Tiina Väisänen)
Student member Otso Kivekäs (student Eeva Nevalainen)
Student member Panu Mäntylahti (student Misa Munde)
Student member Timo Oksala (student Sampo Lehtinen)
Department Secretary Sirkka Palander has acted as secretary for the steering committee.

5.2 Library

The collections of the library of the Department of Computer Science were moved into the facilities of the Kumpula Science Library in April-May 2004. The library has been an administrative part of the Kumpula Science Library since 2001, though it has functioned in Vallila, in connection with the department.

In January 2004, long-time Librarian Kirsti Pohjonen transferred to another employer, leaving Library Secretary Virve Similä-Parkkinen to take on far more responsibilities than her original job description had entailed. The library had a third employee, part-time Library Secretary Kari Salmi. Both library secretaries transferred to the Kumpula Science Library after the relocation. Librarian Antti Virrankoski was appointed liaison between Kumpula Science Library and the Department of Computer Science.

Before being merged into the Kumpula Science Library, the library of the Department of Computer Science was a closed departmental library, mainly used by the personnel of the department and students in the final stages of their computer science studies. Since year 2001, the library has opened to the general public and lending practices have been adjusted to conform to those of the university. The relocation in spring 2004 has brought this development to its final point; the library is now to all practical purposes a collection in the Kumpula Science Library.



When it was situated in connection with the department, the library used to sell teaching compendia to students. When the library moved, this function was temporarily transferred to the department, and from the beginning of 2005, the University Press at Exactum has taken over these duties.

In connection with the relocation, some differences in the cultures of the library and the Kumpula Science Library became apparent. To name an example, the Kumpula Science Library emphasizes the circulation of material and its availability to students, with the help of fines and bans, as do the other university libraries. The degree programmes in computer science do not entail large exams based on written material, so the department staff did not see the point of this kind of supervision. The work with conciliating these different cultures has continued since 2004. These matters were discussed in the steering committee for the Kumpula Science Library, where the department was represented by Professor Matti Nykänen and his deputy, Professor Jyrki Kivinen.

The selection of course literature for students was improved with the help of the start-up allowance granted by the Faculty of Science to the Kumpula Science Library. Scientific monographs and journals were acquired with allocations from both the department and the Helsinki Institute for Information Technology (HIIT).

The collections of the library are listed in the HELKA university catalogue, and thereby in the national LINDA union catalogue. The material is classified according to the ACM Computing Classification System (CCS). All the electronic services of FinELib are available at the library, including the online journals and conference reports of the most significant computer science publishers (ACM, IEEE, Elsevier, Academic Press, Springer-Verlag, Kluwer)

5.3 Information technology

The department offers a wide range of state-of-the-art information technology for research, teaching and administration purposes. The facilities are maintained by a technical team of eight, who also assist faculty and students in the use and development of software systems for research projects. Some 4,400 persons have an account for the department systems.

The department workstation network consists of more than 500 PCs running the Linux operating system. Some 70 % of the computers were replaced in connection with the relocation to Exactum in year 2004. Local Windows XP can be used as an alternative to Linux, or remote access to a Windows 2003 server can be formed through Linux. More than 100 of the workstations are mobile laptops that can join and leave the network dynamically

The general computing facilities include a farm of servers: general-purpose computers, a computing cluster, file and database servers and other functionally dedicated servers (e-mail, webmail, WWW, FTP etc.), and servers for different user groups. There are about 50 servers in all at the department. The centralised file servers utilise RAID technology and currently offer over 5 Tera-bytes of storage space. As a whole, these systems support a wide range of services, languages and software tools. The servers are located in the modern protected computer room of the Exactum building. Special attention has been paid to security and reliability. The rising amount of spamming has been a cause of concern, as it has varied between 90 and 95% of all e-mail during year 2004. Due to effective preventive measures, the amount of spam that reaches the users has been kept at a minimum. In spite of their prevalence in the world, viruses and worms have not been able to cause problems at the department, thanks to virus control and the filtering of mail viruses.

Networking is based on a 1 Gbit/s Ethernet with an optical backbone, with desk outlets. There are also 100 Mbit/s Ethernet connections in the student facilities. The mobile laptops can also utilise a departmental IEEE 802.11a type radio network which currently has 40 base stations. In the Linux (and UNIX) environment NFS is used to share common resources. In Windows, we use Samba, which is a Linux network server for Windows users. The workstations are used as tools for software development, in research and on all levels of teaching.

The network of the department is connected through a firewall to the university backbone network, giving access to the facilities of the University IT Department as well as to the FUNET wide area network that links Finnish universities and research institutions. The national FUNET, on its part, has 10 Gbit/s access to the Scandinavian Nordunet, and via that, 10 Gbit/s access to the American and European network infrastructure.

The IT Department also offers modem, ISDN and ADSL connections for remote access. In addition, the department has access to a number of supercomputing facilities at the Finnish IT Center for Science (CSC).



APPENDICES

Publications in 2004

Algorithms

Peer-reviewed journal articles

Falck, Emil & Floreen, P. & Kaski, P. & Kohonen, J. & Orponen, P.: Balanced data gathering in energy-constrained sensor networks. Algorithmic aspects of wireless sensor networks pp. 59-70.

Geerts, F. & Goethals, B. & Mielikäinen, T.: Tiling databases. Discovery science pp. 278-289.

Inenage, S. & Kivioja, T. & Mäkinen, V.: Finding missing patterns. Algorithms in bioinformatics pp. 463-474.

Kääriäinen, M. & Malinen, T. & Elomaa, T.: Selective rademacher penalization and reduced error pruning of decision trees. Journal of machine Learning research 5 (2004), pp. 1107-1126.

Mielikäinen, T.: Inductive databases as ranking. Data warehousing and knowledge discovery pp. 149-158.

Mielikäinen, T.: Privacy problems with anonymized transaction databases. Discovery science pp. 219-229.

Mielikäinen, T.: Separating structure from interestingness. Advances in knowledge discovery and data mining pp. 476-485.

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Accepted theses

PhD theses

Mikko Koivisto: Sum-product algorithms for the analysis of genetic risks. PhD thesis, Series of Publications / Department of Computer Science (A-2004-1).

Andrei Gurtov: Efficient data transport in wireless overlay networks. PhD thesis, Series of Publications / Department of Computer Science (A-2004-2).

Kari Vasko: Computational methods and models for paleoecology. PhD thesis, Series of Publications / Department of Computer Science (A-2004-3).

Sevon, Petteri: Algorithms for association-based gene mapping PhD thesis, Series of Publications / Department of Computer Science (A-2004-4).

Viljamaa, Jukka: Applying formal concept analysis to extract framework reuse interface specifications from source code PhD thesis, Series of Publications / Department of Computer Science (A-2004-5).

Ravantti, Janne: Computational methods for reconstructing macromolecular complexes from cryo-electron microscopy images PhD thesis, Series of Publications / Department of Computer Science (A-2004-6).

Kääriäinen, Matti: Learning small trees and graphs that generalize PhD thesis, Series of Publications / Department of Computer Science (A-2004-7).

Kivioja, Teemu: Computational tools for a novel transcriptional profiling method PhD thesis, Series of Publications / Department of Computer Science (A-2004-8).

Tamm, Hellis: On minimality and size reduction of one-tape and multitape finite automata PhD thesis, Series of Publications / Department of Computer Science (A-2004-9).

PhLic thesis

Eloranta, Satu: Dynamic features of the knowledge base. Series of Publications / Department of Computer Science (C-2004-90)

Master's theses

Algorithmithms

Alanko, Lauri: Types and reflection. (C-2004-86)

Eronen, Lauri: Models and algorithms for haplotype reconstruction on genetically long marker maps. (C-2004-21)

Kiviniemi, Petri: Developing visual presentation of DRG logic. (C-2004-35)

Liukkonen, Panu: Osioverkkokarsinta. (C-2004-43)

Ojames, Petri Tuomas: Kolmiulotteisten tiheysjakaumien kohdistus ja vertailu. (C-2004-25)
Perälä, Antti: Julkisen avaimen kryptografia. (C-2004-70)

Pitkänen, Esa: Metaboliaverkkojen rakentaminen paikallisilla hakumenetelmillä. (C-2004-45)

Rastas, Pasi: Haplotyyppiin määrittäminen. (C-2004-69)

Rinta-Mänty, Janne: Säilyvät jonorakenteet. (C-2004-34)

Siivonen, Samuli: Othello-pelin evaluointifunktion kehittäminen. (C-2004-13)

Toimela, Lasse: Harmaasävykuvien segmentointi halkaise ja yhdistä -menetelmällä. (C-2004-41)

Intelligent systems

Kontkanen, Petri: Exact and approximative computation of the normalized maximum likelihood. (C-2004-40)

Muhonen, Juho: Non-reductant association rules - Deriving the confidence of an association rule. (C-2004-87)

Partanen, Jyri: Automaattinen laboratoriodien laadunarviointi. (C-2004-77)

Tarvainen, Tero: Automatic drum track transcription from polyphonic music. (C-2004-38)

Väliviita, Mika: Verkkohaku ja tekstianalyysi karttamenetelmillä: SOM; GTM; WebSOM, WebGTM. (C-2004-81)

Software engineering

Airamaa, Kimmo: Ohjelmistojen validointi vaatimusanalyysin tulosten perusteella. (C-2004-76)

Hamina-Mäki, Eija: CMMI-malli esimerkkiyrityksen ohjelmistotuotannon arvioinnin ja kehittämisen välineenä. (C-2004-83)

Kiema, Kirsi: Erään web-sovelluksen suorituskyvyn ennustaminen. (C-2004-24)

Marttila, Topias: Aktiiviteettikaavioiden ja suorituspolkujen visualisointi (C-2004-11)

Määttä, Virpi: Projektihallintaprosessien arviointi CMMI-mallin mukaisesti. (C-2004-84)

Pesonen, Juha: Ohjelmistoprosessi suomalaisissa ohjelmistoyrityksissä. (C-2004-54)

Puustinen, Pirkka: Ohjelmiston suorituskyvyn suunnittelu. (C-2004-74)

Saura, Asko: Ohjelmointityön vikatiheys ja tymäärän arviointi PSP-kurssilla. (C-2004-28)

Siren, Janne: Java-ohjelmien muistinkulutuksen mittaaminen ja optimointi 9210 Communicatorille ja muille laitteille. (C-2004-37)

Tapola, Lassi: Selvitys kuluttajille suunnatuista Internet-maksujärjestelmistä Suomessa. (C-2004-46)

Tiili, Tapio: Yhteysvaranto ja välimuisti web-sovellusten suorituskyvyn parantamisen välineenä. (C-2004-10)

Vanne, Seija: Ohjelmistojen evoluutio ja kasvu. (C-2004-12)

Vitikka, Juha: Tilastollinen testaus. (C-2004-18)

Distributed systems and data communication

Colussi, Gian Donato: Equation-based Layered Multicast Congestion Control. (C-2004-71)

Doepel, Patrick: Publish-subscribe middleware for streaming data applications: evaluation of one proprietary solution. (C-2004-39)

Haavisto, Juhani: Palveluhakemistojen käyttäjien yksityisyyden tarpeet ja niiden hallinta. (C-2004-66)

Karjalainen, Arttu: High-availability implementation of the TLS protocol. (C-2004-47)

Kupiainen, Esko: Agenttitekniikan standardointia: FIPA:n abstrakti arkkitehtuuri. (C-2004-44)

Leinonen, Jani: Palveluiden löytäminen tietokoneverkossa. (C-2004-29)

Ojanen, Jouni: Adaptoituvaa rich client -mobiilisovellus-arkkitehtuuri .NET -ympäristössä. (C-2004-82)

Rantala, Taneli: FIFO-piirin spesifointi ja verifointi PVS-teoreemantodistajalla. (C-2004-79)

Ruokolainen, Toni: Ohjelmistokomponenttien yhteentoimivuus. (C-2004-42)

Zhao, Xiaodong: Operating systems for small wireless devices. (C-2004-9)

Information systems

Eidam, Taina: Ryhmäkommunikaation hyödyntäminen tietokannan innokkaassa toisintamisessa. (C-2004-22)

Johansson, Carl: Automatic categorization in web searching. (C-2004-30)

Kauppinen, Tomi: An Ontology Versioning Framework. (C-2004-64)

Kaiju, Susanna: Transaktionaaliset ominaisuudet työkulkujen suorituksessa. (C-2004-7)

Kartio, Hanna-Kaija: XML-kyselyjen optimointi. (C-2004-59)

Lindström, Kai: Sähköisen liiketoiminnan ja toiminnanohjauksen järjestelmien yhteensovittaminen. (C-2004-15)

Masche, Philipp Johannes: Multilingual information extraction. (C-2004-17)

Pennala, Esa: Vesistömallien tietovaraston rakenne ja ylläpito. (C-2004-4)

Puolakka, Mikael: XML-dokumentin funktionaaliset riippuvuudet. (C-2004-73)

Raatikka, Vilho: Cache-conscious index structures for main-memory databases. (C-2004-8)

Ruini, Henri: Dokumenttirakenteisiin sopeutuva XML-editori. (C-2004-49)

Saarela, Samppa: Näkömätö pohjainen RDF-haku. (C-2004-48)

Saijos, Jani: Kontekstittietoinen tiedonhaku. (C-2004-6)

Salinto, Marjo: Metatiedon hallinta ja standardointi tietovarastoympäristössä. (C-2004-57)

Tainio, Olli: Web-palvelutekniikka ja tietoturva. (C-2004-16)

Tanninen, Anu: Tiedon louhinta ja yksityisyys. (C-2004-85)

Teacher in computer science

Josefsson, Kim: SQL-kielen opiskelu SQLTrainer -ohjelmalla: kvantitatiivinen analyysi kurssien lokitiedoista. (C-2004-72)

Juntunen, Sade: Tietokoneella suoritettava adaptiivinen testaus dikotomisesti pisteytettävillä tehtävillä. (C-2004-51)

Kovalainen, Katriina: Ensimmäisen vuoden opiskelijoiden kokemuksia tietojenkäsittelytieteen opiskelusta ja laitoksesta. (C-2004-36)

Applied computer science

Colb, Eevaliisa: Ohjelmiston suorituskykyvaatimusten käsittely vaatimusanalyysin alkuvaiheessa. (C-2004-68)

Hohteri, Harri: Supporting social communication in network communities. (C-2004-14)

Holi, Markus: A Method for modeling uncertainty in semantic web taxonomies. (C-2004-27)

Keränen, Ari: Luottamuksen hallinta Internet-verkoissa. (C-2004-67)

Laamanen, Topi: Julkisen hallinnon sähköiset yhteispalvelut. (C-2004-89)

Laine, Pia: Comparison of the neighbor-joining and maximum likelihood phylogenetic methods using different settings with human rhinovirus and human enterovirus VP1 gene sequence data. (C-2004-80)

Leskinen, Juha-Pekka: Tuotepereharkkitehtuuria käyttävän sovelluksen mallintaminen. (C-2004-56)

Lindell, Antti: Strategies for networking in multiplayer J2ME games over GPRS. (C-2004-33)

Salmensuu, Simo: Televerkon palveluiden provisiointiohjelmien konfiguraatiokyttliittymät. (C-2004-19)

Sorsamo, Hannu: Computing minimal distinctive feature sets. (C-2004-32)

Takala, Petri: Yritysten tietojärjestelmien integrointi XML-perustaisilla standardeilla. (C-2004-52)

Teitto, Eija: Hoidon vaikuttavuuden mittaaminen rekisteripohjaisessa aineistossa. (C-2004-26)

Varis, Anne: WordNet-sanatietokannan hyödyntäminen luonnollisen kielen sovelluksissa. (C-2004-31)

Venäläinen, Helena: Uudellenkäytön nykytila ja edistämismahdollisuudet uudelleenkäyttökokeiden pohjalta. (C-2004-55)

Bioinformatics and computational biology

Lindberg, Anne: Studies on sequence patterns of membrane proteins. (C-2004-78)

Personnel in 2004

Name	Title	Period
Ahonen-Myka, Helena	Professor	1 Jan -31 Dec 2004
Alanko, Timo Olavi	Professor (fixed term)	1 Jan -31 Dec 2004
	Lecturer	1 Jan -31 Dec 2004
Astuti, Davide Nicola	Researcher	1 Jan -31 Dec 2004
Autio, Ilkka	Post-graduate (Research school)	1 Jan -31 Jul 2004
	Researcher	1 Aug-31 Dec 2004
Borras Garcia, Juan Carlos	Researcher	1 Jan -31 Dec 2004
Burkhardt, Stefan	Researcher	1 Mar-31 Jul 2004
Colussi, Gian Donato	Researcher	1 Nov-31 Dec 2004
Daniel, Laila	Researcher	1 Jan -31 Dec 2004
Doucet, Antoine	Researcher	1 Jan -31 Dec 2004
Eloranta, Satu	Senior Assistant	1 Jan -31 Jul 2004
	Assistant	1 Aug-31 Dec 2004
Erkiö, Hannu	Lecturer, Head of Studies	1 Jan -31 Dec 2004
Eronen, Lauri	Researcher	1 Jan -31 Dec 2004
Eskola, Jukka	Assistant	1 Jan -31 Dec 2004
Floréen, Patrik	Senior Researcher	1 Sep-31 Dec 2004
	University Lecturer	1 Jan -31 Dec 2004
Geerts, Floris	Researcher	1 Jan -30 Apr 2004
Gionis, Aristides	Specialist Researcher	1 Jan -31 Jul 2004
	Research PhD	1 Aug-31 Dec 2004
Goethals, Bart	Researcher	1 Jan -30 Sep 2004
Gourtov, Andrei	Assistant	1 Jan -31 Jul 2004
	Lecturer	1 Aug-31 Dec 2004
Gupta, Rashi	Post-graduate (Research school)	1 Jan -31 Dec 2004
Gustafsson, Juha	Researcher	1 Jan -31 Dec 2004
Haataja, Juha-Pekka	Researcher	1 Jan -31 Dec 2004
Haavisto, Juhani	Department Co-ordinator	1 Jan -31 Dec 2004
Haiminen, Niina	Researcher	1 Jan -31 Dec 2004
Hakli, Raul	University Lecturer	1 Jan -31 Jul 2004
Hautakangas, Ville	IT Designer	1 Jan -31 Dec 2004
Heino, Jaana	Researcher	1 Jan -31 Jul 2004
	Post-graduate (Research school)	1 Aug-31 Dec 2004
Heinonen, Oskari	Assistant	1 Jan -31 Dec 2004
Heinonen, Markus	Research Assistant	7 Jun-31 Dec 2004
Hendry, Kai	Research Assistant	1 Jan -31 Jul 2004
Hinneburg, Alexander	Researcher	5 Apr-31 Dec 2004
Hintsanen, Kai Petteri	Researcher	1 Jan -31 Dec 2004
Holi, Markus	Researcher	1 Jan-19 Sep 2004
Hoyer, Patrik	Researcher	1 Jan-31 Jul 2004
	Research PhD	1 Aug-31 Dec 2004
Hulkkonen, Antti	Research Assistant	2 Feb-31 Dec 2004
Huovinen, Marja	Department Co-ordinator	1 Jan-31 Dec 2004
Hurri, Jarmo	Researcher	1 Jan-31 Dec 2004
Hyttinen, Lauri	Trainee	10 May-9 Sep 2004
	Research Assistant	10 Sep-31 Dec 2004
Hyvönen, Eero	Professor (fixed term)	1 Jan-31 Dec 2004
	University Lecturer	1 Jan-31 Dec 2004
Hyvönen, Saara	Researcher	1 Jan-31 Dec 2004
Häkkinen, Auvo	Lab Engineer	1 Aug-31 Dec 2004
	Lecturer	1 Jan-31 Jul 2004
Inenaga, Shunsuke	Researcher	1 Jan-31 Oct 2004
Jaakkola, Jani	IT Specialist	1 Jan-31 Dec 2004
Jokela, Mikael	IT Specialist	1 Jan-31 Aug 2004
Jokipii, Lauri	Research Assistant	25 Oct-31 Dec 2004
Junnila, Miikka	Research Assistant	24 May-31 Dec 2004
Järvinen, Ilpo	Research Assistant	2 Feb-31 Dec 2004
Karimäki-Suvanto, Päivi	Office Manager	1 Jan-31 Dec 2004

Karlstedt, Mika	Researcher	1 Jan-31 Dec 2004
Karp, Elina	Research Assistant	1 Jan-30 Apr 2004
Karvi, Timo	PhD Assistant	1 08-31 Dec 2004
	University Lecturer	1 Jan-31 Jul 2004
Kaski, Samuel	Professor	1 Mar-31 Dec 2004
Kauppinen, Raine	Researcher	1 Jan-31 Dec 2004
Kauppinen, Tomi	Researcher	1 Sep-31 Dec 2004
	Research Assistant	1 Jan-31 Aug 2004
Kerola, Teemu	Lecturer	1 Jan-31 Dec 2004
Kettunen, Sanna	IT Designer	8 Mar-31 Dec 2004
Kivinen, Jyrki	Professor	1 Jan-31 Dec 2004
Kivioja, Teemu	Researcher	1 Jan-7 Nov 2004
Kohonen, Jukka	Researcher	1 Jan-31 Dec 2004
Koivisto, Mikko	Researcher	1 Aug-31 Dec 2004
Kojo, Markku	Lecturer	1 Jan-31 Dec 2004
Kollin, Jussi	Research Assistant	1 Jan-31 Dec 2004
Komulainen, Ville-Pekka	Research Assistant	18 Oct-31 Dec 2004
Kontkanen, Petri	Researcher	1 Jan-31 Dec 2004
Korpilahti, Tuomas	Research Assistant	1 Jan-28 May 2004
Koskinen, Susanna	Researcher	3 May-30 Jun 2004
Kujala, Inka	Scientific Assistant and Secretary	1 Jan-31 Dec 2004
Kujala, Teija	Amanuensis	1 Jan-31 Dec 2004
	Researcher	1 Jan-31 Dec 2004
Kulikova, Yevgeniya	Researcher	5 1 -31 Dec 2004
Kurhila, Jaakko	University Lecturer	1 Jan-29 Feb 2004
	University Lecturer	1 Mar-31 Dec 2004
Kurki, Ilmari	Researcher	1 Jan-31 Dec 2004
Kurtén, Marina	Translator	1 Jan-31 Dec 2004
Kutvonen, Petri	IT Manager	1 Jan-31 Dec 2004
Kutvonen, Lea	Lab Engineer	1 Jan-31 Dec 2004
	Professor (fixed term)	1 Jan-31 Jul 2004
	University Lecturer	1 Aug-31 Dec 2004
Kuuppelomäki, Päivi	Assistant	1 Jan-31 Jul 2004
	PhD Assistant	1 Aug-31 Dec 2004
Kuuskoski, Reeta	Researcher	1 Dec-31 Dec 2004
Kyrö, Jaakko	Researcher	1 Jan-31 Dec 2004
Kärkkäinen, Juha	PhD Assistant	1 Jan-31 Dec 2004
	Researcher	1 Jan-31 Dec 2004
Kääriäinen, Matti	Post-graduate (Research school)	1 Jan-31 Dec 2004
Köster, Urs	Researcher	19 Jul-31 Dec 2004
Laakso, Sari	University Lecturer	1 Jan-31 Dec 2004
Laasonen, Kari	Specialist Researcher	1 Jan-31 Aug 2004
	Post-graduate (Research school)	1 Sep-31 Dec 2004
Laczak, Olaf	Teacher, full-time	1 Jan-31 Dec 2004
Lahti, Olli	Teacher, full-time	1 Jan-31 Jul 2004
Lahtinen, Jussi	Researcher	1 Jul-31 Dec 2004
Laine, Harri	Lecturer	1 Jan-29 Feb 2004;
		1 Mar-31 Dec 2004
	University Lecturer	1 Mar-31 Dec 2004
Leggio, Simone	Researcher	1 Jan-31 Dec 2004
Lehtinen, Sami	IT Designer	1 Jan-31 Dec 2004
Lehtonen, Miro	Post-graduate (Research school)	1 Jan-31 Dec 2004
Leino, Antti	Assistant	1 Aug-31 Dec 2004
	Researcher	1 Jan-31 Jul 2004
Lemström, Kjell	PhD Assistant	1 Jan-31 Jul 2004
	Researcher	1 Aug-31 Dec 2004
Lepola, Tuomas	Post-graduate (Research school)	1 Jan-31 Dec 2004
Lindén, Greger	Specialist Researcher	1 Jan-31 Dec 2004
	University Lecturer	1 Jan-31 Dec 2004
		1 Jan-31 Dec 2005
Lindgren, Jussi	Researcher	1 Jan-31 Jul 2004
	Post-graduate (Research school)	1 Aug-31 Dec 2004
Lindholm, Heikki	Research Assistant	1 Apr-31 Dec 2004
Lindström, Jan	Assistant	1 Jan-31 Dec 2004

Liuhto, Lauri	Research Assistant	20 Sep-31 Dec 2004
Lokki, Heikki	Lecturer	1 Jan-31 Dec 2004
Lonardi, Marja-Liisa	Research Secretary	1 Jan-30 Sep 2004
Lounasmeri, Lotta	PR and Information Officer	1 Jan-31 Dec 2004
Lukk, Margus	Researcher	1 Jan-31 Dec 2004
Luukkainen, Matti	Assistant	loa 1 Jan-31 Jul 2004
	PhD Assistant	1 Jan-31 Jul 2004
	University Lecturer	1 Aug-31 Dec 2004
Makkonen, Juha	Researcher	1 Sep-31 Dec 2004
	Post-graduate (Research school)	1 Jan-31 Aug 2004
Malinen, Paula	Trainee	1 Jun-31 Aug 2004
Malinen, Tuomo Antti	Assistant	1 Jan-6 Jun 2004
Manner, Jukka	Lab Engineer	1 Jan-30 Apr 2004
	Researcher	1 May-31 Jul 2004
	University Lecturer	1 Aug-31 Dec 2004
Mannila, Heikki	Research Director	1 Jan-31 Jul 2004; loa 1 Aug-31 Dec 2004
	Academy Professor	1 Aug-31 Dec 2004
Marttinen, Liisa	Lecturer	1 Jan-31 Jul 2004
	Senior Assistant	1 Aug-31 Dec 2004
Metso, Janne	Research Assistant	1 Jan-31 Dec 2004
Michael, Morris	Researcher	1 Oct-31 Dec 2004
Mielikäinen, Taneli	Post-graduate (Research school)	1 Jan-31 Dec 2004
Mikkilä, Niko	Research Assistant	8 Mar-31 Dec 2004
Moen, Pirjo	University Lecturer	1 Jan-31 Dec 2004
Mononen, Tommi	Assistant	1 Jan-31 Dec 2004
Muhonen, Juho	Research Assistant	1 Jan-31 Dec 2004
Myllymäki, Petri	Professor (fixed term)	1 Jan-31 Dec 2004
Mäkinen, Veli	PhD Assistant	1 Jan-31 Aug 2004; loa 1 Sep-31 Dec 2004
Mäntyniemi, Samu	Post-graduate (Research school)	1 Jan-31 Dec 2004
Mäntysaari, Ville	Research Assistant	20 Sep-31 Dec 2004
Niklander, Pekka	IT Specialist	1 Jan-31 Dec 2004
Niklander, Tiina	Amanuensis	loa 1 Jan-31 Dec 2004
	University Lecturer	1 Jan-31 Dec 2004
Nurmi, Otto	Lecturer	loa 1 Jan-31 Jul 2004; 1 Aug-31 Dec 2004
	Professor (fixed term)	1 Jan-31 Jul 2004
Nurmi, Petteri	Research Assistant	2 Jan-31 Dec 2004
Nykänen, Matti	Professor (fixed term), Assistant Department Chair	1 Jan-31 Dec 2004
	University Lecturer	loa 1 Jan-31 Dec 2004
Nyrhinen, Aki	Research Assistant	1 Jan-31 Dec 2004
Oja, Merja	Researcher	1 Oct-31 Dec 2004
Ojamies, Petri	Researcher	1 Jan-31 Dec 2004
Oksanen, Jukka	Research Assistant	1 Oct-31 Dec 2004
Onkamo, Päivi	Researcher	1 Jan-31 Dec 2004
Paakki, Jukka	Professor, Department Chair	1 Jan-31 Dec 2004
Palander, Sirkka	Department Secretary	1 Jan-31 Dec 2004
Palhoma, Sami	IT Designer	24 May-31 Dec 2004
Palin, Kimmo	Post-graduate (Research school)	1 Jan-31 Dec 2004
Parikka, Pekko	Trainee	3 May-30 Sep 2004
	Research Assistant	1 Oct-31 Dec 2004
Pasanen, Tomi	University Lecturer	1 Jan-31 Dec 2004
Perkiö, Jukka	Researcher	1 Jan-31 Dec 2004
Perttu, Sami	Post-graduate (Research school)	1 Jan-31 Jul 2004
Petit, Renaud	Researcher	1 Jan-31 Dec 2004
Pichugin, Dmitry	Research Assistant	1 Jan-31 Aug 2004
Pienimäki, Anna	Assistant	1 Jan-31 Dec 2004
Pietiläinen, Olli	IT Support	3 May-31 Aug 2004
Piitulainen, Jussi	University Lecturer	1 Jan-31 Dec 2004
Pitkänen, Esa	Post-graduate (Research school)	1 Jan-31 Dec 2004
Ponka, Ilja	Research Assistant	1 Jan-23 Sep 2004

Preoteasa, Diana	Post-graduate (Research school)	1 Aug-31 Dec 2004
Przybilski, Michael	Researcher	2 Aug-31 Dec 2004
Päiväniemi, Tomi	Post-graduate (Research school)	1 Jan-31 Dec 2004
Raatikainen, Kimmo	Professor	1 Jan-31 Dec 2004
Raatikka, Vilho	Assistant, Researcher	1 Jan-31 Jul 2004
	Researcher	1 Aug-31 Dec 2004
Raento, Mika	Researcher	1 Jan-31 Dec 2004
Rantanen, Ari	Researcher	1 Jan-31 Dec 2004
Rastas, Pasi	Researcher	1 Jan-31 Dec 2004
Rauhala, Mikko	IT Specialist	1 Aug-31 Dec 2004
	Teacher, full-time	1 Jan-31 Jul 2004
Rinnet, Tapio	Research Assistant	4 Oct-31 Dec 2004
Rinta-Mänty, Janne	Teacher, full-time	1 Jan-31 Dec 2004
Riva, Oriana	Researcher	1 Jan-30 Sep 2004
Roos, Teemu	Post-graduate (Research school)	1 Jan-31 Dec 2004
Rousu, Juho	PhD Assistant	loa 1 Jan-31 Dec 2004
	University Lecturer	loa 1 Aug-31 Dec 2004
Ruohomaa, Sini	Research Assistant	1 Apr-31 Dec 2004
Ruokolainen, Toni	Research Assistant	1 Jan-31 Oct 2004
	Researcher	1 Nov-31 Dec 2004
Ruotsalainen, Laura	Researcher	1 Sep-31 Dec 2004
Rytkönen, Anni	Lecturer	1 Jan-31 Dec 2004
Saarikoski, Harri	Researcher	1 Jan-31 Dec 2004
Saarinen, Janne	PR and Information Officer	loa 1 Jan-14 Mar 2004
Saarto, Jarno	Researcher	1 Jan-31 Jul 2004
Salmela, Elina	Post-graduate (Research school)	1 Jan-31 Dec 2004:loa 2
Nov-31 Dec 2004		
Salmenkivi, Marko	PhD Assistant	1 Aug-31 Dec 2004
	Research PhD	1 Jan-31 Jul 2004
Salmi, Joni	Teacher, full-time	1 Jan-31 Dec 2004
Salminen, Mirva	Research Assistant	2 Aug-31 Dec 2004
Sarolahti, Pasi	Researcher	26 Jul-7 Nov 2004
Seppälä, Katri	Researcher	9 Feb-31 Dec 2004
Sevon, Petteri	Researcher	1 Jan-31 Dec 2004
Silander, Tea	Research Assistant	16 Sep-31 Dec 2004
Silander, Tomi	Assistant	1 Jan-31 Jul 2004
	Researcher	1 Aug-31 Dec 2004
Sinkkonen, Janne	University Lecturer	1 Aug-31 Dec 2004
Sippu, Seppo	Professor	1 Jan-31 Dec 2004
Siren, Jouni	Assistant	1 Mar-31 Jul 2004
Siven, Reijo	Co-ordinator	1 Jan-31 Dec 2004
Strandell, Toni	Researcher	1 Jan-31 Jul 2004
Suomela, Jukka	Research Assistant	1 Nov-31 Dec 2004
Suontaa, Katriina	Department Secretary	1 Jan-31 Dec 2004
Taina, Juha	University Lecturer	1 Jan-31 Dec 2004
Tamm, Hellis	Researcher	1 Jan-31 Dec 2004
Terzi, Evimaria	Post-graduate (Research school)	1 Jan-31 Dec 2004
Tevanlinna, Antti	Researcher	1 Jan-31 Dec 2004
Tirri, Henry	Professor	loa 1 Jan-31 Dec 2004
Toivonen, Hannu	Professor	1 Jan-31 Dec 2004
Toivonen, Jarkko	Researcher	15 Jan-31 Dec 2004
Tsaparas, Panayiotis	Researcher	1 Jan-31 Jul 2004
	Research PhD	1 Aug-31 Dec 2004
Tuohiniemi, Turjo	Teacher, full-time	1 Jan-31 Dec 2004
Tuominen, Heikki	Researcher	1 Jan-31 Jul 2004
Ukkonen, Esko	Academy Professor	1 Jan-31 Jul 2004
	Professor	loa 1 Jan-31 Jul 2004; 1
Aug-31 Dec 2004		
Uronen, Pekka	Researcher	1 Aug-31 Sep 2004
	Post-graduate (Research school)	1 Jan-31 Jul 2004
Valo, Arttu	Research Assistant	1 Oct-31 Dec 2004
Valo, Samuli	IT Designer	1 Jan-31 Dec 2004

Verkamo, Inkeri	Professor	1 Jan-31 Dec 2004
Vettenranta, Pasi	IT Designer	1 Jan-31 Dec 2004
Wettig, Johannes	Researcher	1 Dec-31 Dec 2004
Vihavainen, Juha	Lecturer	1 Jan-31 Dec 2004
Wikla, Arto	Lecturer	1 Jan-31 Dec 2004
Viljamaa, Antti	Assistant	1 Jan-31 Dec 2004
Viljamaa, Jukka	Assistant	1 Jan-31 Dec 2004
Viljanen, Lea	Researcher	1 Apr-31 Dec 2004
Virtanen, Otso	Researcher	1 Jan-30 Sep 2004
Vähäkangas, Teemu Taneli	Researcher	1 Jan-31 Dec 2004
Väisänen, Tiina	Research Secretary	loa 1 Jan-30 Sep 2004; 1 Oct-31 Dec 2004
Yangarber, Roman	Researcher	16 Aug-31 Dec 2004
Ylikoski, Jussi	Trainee	17 May-16 Jul 2004; 2 Aug-1 Sep 2004
Åkerlund, Arto	Research Assistant	4 Jun-31 Dec 2004

loa=leave of absence

Part-time Teachers 2004

Department of Computer Science Part-time teachers* in 2004

Alm, Olli Markus	Narayanan, Krishnan	
Aunimo, Lili Annika	Nenonen, Jaakko Pekka	
Campadello, Stefano	Niinivaara, Olli	
Chande, Balakrishnan Suresh	Nikiforow, Roman	
Eklund, Satu Ranja Hannele	Nurro, Antti Jaakko Juhani	
Gustafsson, Jarkko Joonas	Olin, Mikko Tapani	
Haaajanen, Jyrki	Paalanen, Jussi Sakari	
Hassinen, Mikko Valtter	Pohjalainen, Pietu	
Heimola, Mikko Juhani	Puustinen, Ismo Henrik Mikael	
Helin, Heikki Juhani	Puustjärvi, Juha P	
Helin, Petri Juhani	Rajala, Tommi	
Hohtio, Jani Mikael	Ranta, Juha	
Hyppänen, Riku Mikko	Rautanen, Anna Leena	
Iso-Markku, Juho Viljami	Räisänen, Hannu Juhani	
Jokinen, Olli Markus	Saarela, Katja Maaret Regina	
Jokisalo, Kirsi Maria	Saaresto, Anne Maarit	
Junnila, Miikka Johannes	Saaristo, Jaakko Olavi	
Kaipiaainen, Pertti Samuli	Sidoroff, Teemu	
Kangasharju, Jaakko Juhani	Simola, Kimmo Kalevi	
Karvonen, Vesa Arto Juhani	Simola, Pekka Juhani	
Kaven, Riikka Maria Karoliina	Siren, Jouni Leo Tapio	
Kivenheimo, Jari Petri Päiviö	Sjöblom, Teemu Ilkka Tapio	
Korpela, Marianne Kristina	Suominen, Jari Alex Kalevi	
Kuisma, Jouni Ville Petteri	Syreeni, Ahti Heikki Kalervo	
Kujala, Veli-Matti Johannes	Tarkoma, Sasu Arimo Olavi	
Laakso, Karri-Pekka Antero	Teuho, Juho Erkki	
Laamanen, Heimo	Tuovinen, Antti-Pekka	
Latva-Koivisto, Antti Mikael	Vainio, Vesa	
Lehtimäki, Jarno Mikael	Valorinta, Jenni Maria	
Lehtonen, Johanna Elisa		
Majuri, Erica Inkeri		
Majuri, Minna Elisabet		
Mansikka, Harri		
Miettinen, Pauli Aleks		
Mäkinen, Vesa-Matti Samuli		
	Total	64

*This list only contains the part-time teachers who have not been employed fulltime by the department in 2004.