Helsinki Institute for Information Technology HIIT

Annual Report 2008

Visa Noronen and Heikki Mannila (eds.)

HELSINKI
INSTITUTE FOR
INFORMATION
TECHNOLOGY

Contact Information

Helsinki Institute for Information Technology HIIT (in English)
Tietotekniikan tutkimuslaitos HIIT (in Finnish)
Forskningsinstitutet för Informationsteknologi HIIT (in Swedish)

E-mail: info(a)hiit.fi
Home Page: www.hiit.fi

Spektri Site
Postal address: Helsinki Institute for Information Technology HIIT,
PO Box 9800, 02015 TKK, Finland
Street address: Spektri Business Park, Pilotti Building,
Metsänneidonkuja 4, 02130 Espoo
Telephone: +358 9 4511
Fax: +358 9 694 9768

Kumpula Site
Postal address: Helsinki Institute for Information Technology HIIT,
PO Box 68, 00014 University of Helsinki, Finland
Street address: University of Helsinki, Department of Computer Science, Exactum, Gustaf Hällströmin katu 2b, 00560 Helsinki
Telephone: +358 9 1911
Fax: +358 9 191 51120

Otaniemi Site
Postal address: Helsinki Institute for Information Technology HIIT,
PO Box 5400, 02015 TKK, Finland
Street address: Helsinki University of Technology, Computer Science Building, Konemiehentie 2, 02150 Espoo
Telephone: +358 9 4511

Yliopistopaino, Helsinki 2009

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1 Review of year 2008

In 2008 HIIT was involved in over 60 major research projects. The activities of the joint research institute of Helsinki University of Technology and the University of Helsinki continued in the form established in previous years. The core of the activities is formed by collaborative projects with industry and with other sciences, supported by funding from Tekes - the Finnish Funding Agency for Technology and Innovation - the Academy of Finland and the European Union.

Strongly internationalized institute

In the last years, the role of the European Union funded projects has grown remarkably in HIIT. For instance, in the 7th Framework Programme of the EU strategically important Publish-Subscribe Internet Routing Paradigm (PSIRP) has been operated very successfully since the launch in the beginning of 2008.

With several other projects, HIIT is now firmly integrated with European research activities. The A new funder of HIIT, the U.S. National Institutes of Health, commenced funding a bioinformatics project.

HIIT's co-operation with the University of California at Berkeley has continued strongly in the format of the Finland-ICSI Center for Novel Internet Architectures (FICNIA). Hosted by HIIT and the International Computer Science Institute at Berkeley, the mission of the Center is to conduct fundamental research in novel Internet architectures. It aims at a significant contribution towards the future development of the Internet.

Tekes funding growing

Tekes is the biggest single funder of the research in HIIT. In 2008 HIIT took part in around 20 Tekes funded projects having in total around 40 industrial partners.

The role of Tekes in the strategic research in HIIT is growing through HIIT's participation in the operation of a national Strategic Centre of Excellence in Science, Technology and Innovation (in Finnish the acronym is SHOK) for the ICT domain (ICT SHOK - Tivit Ltd). The SHOKs are intended to form a new instrument for facilitating long-term research co-operation between academia and industry.

HIIT was the academic co-ordinator of the Future Internet programme, facilitating the preparation of the Strategic Research Agenda (SRA) of the programme and the build-up of the research consortium. Their first year of operation has been an interesting and encouraging experience in a new way of organizing multi-party collaboration between industries and academia.

Success in the Academy

HIIT researchers have been very successful in the highly competitive area of obtaining funding from the Academy of Finland. For example, in the research program for "Ubiquitous computing and diversity of communication" staff of HIIT is participating in four projects out of a total of 15.

Also, there were two Academy Research Fellows and one Academy Professor in HIIT: these prestigious positions form a central part of the support of basic research. The Finnish Centre of Excellence in Algorithmic Data Analysis Research, directed by Esko Ukkonen, forms the core of HIIT's ADA program.

SAB evaluation

The Scientific Advisory board of HIIT conducted a thorough evaluation of HIIT's research in May 2008. The very positive and useful evaluation report gives indications of the strengths and weaknesses of HIIT, and forms a solid basis for the continuing development of the institute.

The publication record of HIIT researchers has continued to develop favourably. Especially important is the growing impact of HIIT's work in the top conferences and publications.

New organizational model

The implementation of HIIT's strategy continued during the year on the basis of the decisions that HIIT Board reached in 2005. The adoption of the new organizational model already launched in 2006 was fully realised during the year. With this, the operation, administration, and reporting of the nine-year-old institute are now organised according to the research programmes, and conduced through institute-wide internal administrative bodies.

The institute operates in three locations: Spektri Business Park (next to TKK campus), Otaniemi (TKK campus) and Kumpula (UH campus).

In 2008, the institute was lead by Professor Martti Mäntylä and Professor Esko Ukkonen. At the end of the year the two universities selected Heikki Mannila as the new director of the institute.

Number of staff growing

The number of HIIT staff has been growing in 2008 - as well as the share of the non-Finnish citizens in the staff.

In spring 2008 Professor Kimmo Raatikainen passed away. Raatikainen has been a remarkable person in developing HIIT since the early years of the institute. Raatikainen's passing was a heavy blow to the colleagues in the institute and the Future Internet research programme he led in the last years.

HIIT in brief

The Helsinki Institute for Information Technology HIIT is a joint research institution of Helsinki University of Technology and the University of Helsinki for basic and strategic research on information technology.

Its research ranges from fundamental methods and technologies to novel applications and their impact on people and society. HIIT's key competences are in Internet architecture and technologies, mobile and human-centric computing, user-created media, analysis of large sets of data, and probabilistic modeling of complex phenomena.

HIIT is multidisciplinary, with scientists from computer, natural, behavioural and social sciences, as well as humanities, design, and art. The projects are conducted with private companies, universities and research institutions.

Total numbers	**2008**	**2007**
Funding M€	8.6	7.5
External funding of total funding	76%	78%
Person-years	165	129
Original publications	327	197

2 Research

2.1 Algorithmic Data Analysis (ADA)

The mission of the Algorithmic Data Analysis research programme at the HIIT is to develop useful algorithmic data analysis methods for other sciences and for industry. The work involves both basic research in computer science and applied work on problems arising from applications.

The core of the programme is formed by the Algodan Center of Excellence.

Research challenges

Example challenge 1
Learning Network Structures. Network-like structures are numerous in various domains including molecular processes, social interactions and the Internet. New computational methods are needed for finding the structure of such networks and for understanding their dynamic behaviour.

Example challenge 2
The Vocabulary, Grammar and History of Genomes. The genome codes information identifying the species and the individual. Computational techniques are needed for the description and the analysis of variation. Segmentation methods using recurrent sources can be used to find components with similar underlying structure; latent variable techniques for sequences can also be used.

Example challenge 3
Computational Modelling of Ecosystems. The environment can be measured in many ways on different scales ranging from remote-sensing based satellite images of landscapes to chemical compositions of nutrients in individual plants. The complex interactions in both the spatial and temporal domains across different scales are largely unknown, and their importance is growing.

Example challenge 4
Sensor and Context Data Management. To realize a vision of ubiquitous information processing, services and applications make use of a wide variety of context data, including sensor readings. The challenges are to efficiently gather sensor data, to perform context reasoning, and to take into consideration the resource constraints of the devices and the distributed nature of the environment.

Research groups

- **Adaptive Computing**, Senior Research Scientist Patrik Floréen
- **Combinatorial Pattern Matching**, Professor Esko Ukkonen
- **Data Mining: Theory and Applications**, Professor Heikki Mannila
- **Discovery Group**, Professor Hannu Toivonen
- **Parsimonious Modelling**, Chief Research Scientist Jaakko Hollmén
- **Statistical Machine Learning and Bioinformatics**, Professor Samuel Kaski

Research projects

- **Algorithmic and Probabilistic Methods in Data Mining**, Heikki Mannila
- **Inductive Queries for Mining Patterns and Models (IQ)**, Heikki Mannila
- **New Computational Methods for Analyzing the Structural and Functional Landscapes of Mammalian Genomes (CompGenome)**, Heikki Mannila
- **Computational Methods for the Analysis of Palaentological data**, Heikki Mannila
- **Whole genome association analysis strategies for multiple phenotypes**, Heikki Mannila
- **Data mining tools for changing modalities of communication (Dammoc)**, Heikki Mannila
- **Algorithmic Bayesian data analysis with applications in bioinformatics**, Mikko Koivisto
- **Algorithmic Data Analysis (Algodan) - Centre-of-Excellence**, Esko Ukkonen, Heikki Mannila
- **European network of genome annotation (Biosapiens)**, Esko Ukkonen
- **Regulatory Genomics**, Esko Ukkonen
- **Optimising Data Gathering in Resource-Constrained Networks (Geru)**, Patrik Floréen
- **Personalised Ubiservices in Public Spaces (PUPS)**, Patrik Floréen
- **Local and User-Created Services (LUCRE), as part of the Flexible Services programme of the ICT SHOK**, Patrik Floréen
- **Methods for Combinatorial Construction (MOCCA)**, Petteri Kaski
- **Intelligent Structural Health Monitoring System (ISMO)**, Jaakko Hollmén
- **Molecular markers for asbestos-exposure related lung cancer**, Jaakko Hollmén
- **Analysis of dependencies in environmental time-series (AD/ED)**, Jaakko Hollmén
- **Computational data fusion of multiple biological information sources and background data (MULTIBIO)**, Samuel Kaski
- **Computational translation from model organisms to humans (TRANSCENDO)**, Samuel Kaski
- **Bisociation Networks for Creative Information Discovery (Bison)**, Hannu Toivonen
- **Knowledge discovery in biological databases (Biomine)**, Hannu Toivonen

Programme management

Programme Director:
Professor Heikki Mannila

Programme Manager:
Dr Greger Lindén

Programme Management Group
- Professor Heikki Mannila
- Dr Patrik Floréen
- Dr Jaakko Hollmén
- Professor Samuel Kaski
- Professor Hannu Toivonen
- Professor Esko Ukkonen

2.2 Future Internet

The aim of the Future Internet research programme is to enhance the Internet infrastructure in order to enable efficient, secure and trusted always-on connectivity and services.

The objective is to develop concepts, technologies, and supporting theories and methodologies needed to design and implement future mobile and ubiquitous computing services and products for the Internet of the future.

Research challenges

The future progress of the Internet is constricted by several bottlenecks: unwanted traffic, choking of the routing system, mobility and multi-homing, compensation and congestion, privacy and attribution, and trust and reputation. The current bottlenecks and deficiencies are limiting the potential utility of the Internet.

The core theme of the Future Internet programme is to find ways to remove these obstacles. These include the creation of new service concepts, context-sensitive services, enabling technologies for building adaptive and reconfigurable applications, personal digital asset management and mobile Internet middleware solutions that address the specific needs of mobile and ubiquitous computing.

Research groups

- **Adaptive Computing,** Professor Hannu Toivonen, Dr Patrik Floréen
- **Distributed Applications**, Dr Ken Rimey
- **Mobile Computing**, Professor Sasu Tarkoma
- **Networking Research**, Adjunct Professor Andrei Gurtov, Dr Pekka Nikander, Dr Arto Karila, Dr Kristiina Karvonen
- **Distributed Networking and Security**, Professor Antti Ylä-Jääski, Professor Sasu Tarkoma

Current research projects

- **FICNIA Finland-ICSI Center for Novel Internet Architectures**, Jussi Kangasharju, Kristiina Karvonen
- **ICT SHOK FI SRA**, Jukka Manner
- **InfraHIP II Infrastructure for Host Identity Protocol II**, Martti Mäntylä, Antti Ylä-Jääski
- **IPOS Information Processing in Overlay Systems**, Sasu Tarkoma
- **NordicHIP**, Andrei Gurtov, Antti Ylä-Jääski
- **PSIRP Publish-Subscribe Internet Routing Paradigm**, Arto Karila
- **TrustInet Trustworthy Internet: Overlay Infrastructure for Trusted Computing and Communications**, Martti Mäntylä, Antti Ylä-Jääski
- **UbiLife Foundations**, Sasu Tarkoma
- **WISEciti: Wireless Community Services for Mobile Citizens Project**, Andrei Gurtov

Programme management

Programme Director:
Professor Jussi Kangasharju

Programme Manager:
Dr Kristiina Karvonen

Programme Management Group
- Professor Patrik Floréen
- Adjunct Professor Andrei Gurtov
- Professor Heikki Hämmäinen
- Professor Riku Jäntti
- Professor Raimo Kantola
- Dr Arto Karila
- University Lecturer Markku Kojo
- Professor Jukka Manner
- Dr Pekka Nikander
- Professor Jörg Ott
- Dr Ken Rimey
- Professor Sasu Tarkoma
- Professor Antti Ylä-Jääski

2.3 Network Society

The objective of the Network Society is to pioneer and develop human-centric, multidisciplinary, ubiquitous information and communication technology based on comprehensive understanding of needs and practices in the everyday life and social relations of a network society.

Research domains

1. Mobile and ubiquitous interaction
2. Open media creation, management and distribution
3. Tools and methodology for service innovation
4. Development of a sustainable network society

Research groups

The Network Society programme continues with new structure and focus the research of two older research programmes, the Digital Economy and the Media Convergence programmes.

Five partially overlapping research groups collaborate in the research:

- **Digital Content Communities**, Professor Marko Turpeinen, Professor Timo Saari
- **Distributed Applications**, Dr Ken Rimey
- **Experimental Law & Economy**, Dr Olli Pitkänen, Professor Jukka Kemppinen, Professor Pekka Himanen, Dr Perttu Virtanen
- **Self-Made Media**, Dr Risto Sarvas
- **Ubiquitous Interaction**, Dr Antti Oulasvirta, Dr Giulio Jacucci, Ann Morrison, Dr Tommi Ilmonen, Dr Esko Kurvinen, Professor Martti Mäntylä

Current research projects

AMOVEO - Work Practises and the Transition to Ubicomp, Antti Oulasvirta
AVEA, Kai Huotari
BeAware - Boosting Energy Awareness with Adaptive Real-Time Environments, Giulio Jacucci
CALLAS, Giulio Jacucci
ContextCues, Martti Mäntylä
Creative Commons Finland, Herkko Hietanen
Enactive Social Media and Gaming, Marko Turpeinen
eXdesign, Kai Kuikkaniemi
FUGA - Fun of Gaming, Marko Turpeinen
GAS - Games as Service, Marko Turpeinen
Global Network Society, Pekka Himanen
Hydrosys, Antti Nurminen
Innoguard - Detecting patented software, Perttu Virtanen
IPcity, Ann Morrison
LUCRE, Antti Oulasvirta
Mobile City Moments, Risto Sarvas
PASION, Antti Oulasvirta
PUPS - Personalised and Ubiquitous Public Services, Peter Peltonen
P2P-Fusion: Multimedia Archives and Community Content in P2P Networks, Ken Rimey
THESEUS, Antti Oulasvirta
UDOI BOOSTER, Olli Pitkänen

Programme management

Programme Director:
Professor Marko Turpeinen

Programme Manager:
MSc Kai Huotari

Programme Management Group:
- Professor Pekka Himanen
- Dr Giulio Jacucci
- Professor Martti Mäntylä
- Dr Antti Oulasvirta
- Dr Olli Pitkänen
- Dr Ken Rimey
- Dr Risto Sarvas / Asko Lehmuskallio

2.4. Probabilistic Adaptive Systems

Our goal is to automate intelligent behavior by building robust probabilistic models for a complex world. The work has a strong basic research component that intersects artificial intelligence, machine learning, computer science, information theory and mathematical statistics. The results of this methodological work are applied to both scientific and industrial applications.

Research challenges

Theoretical frameworks for probabilistic modeling
To develop computationally efficient, general-purpose methods for probabilistic modeling, focusing on issues related to model selection, parameter estimation and inference.

Models for intelligent information access
In many modern information networks (like the Internet and various sensor networks), the data can not be found in a well structured format, and accessing the information may be a problem even if the information is in principle available. The goal is to apply probabilistic models to perform information retrieval tasks in these kinds of environments.

Models for image analysis
To develop probabilistic methods for processing two- or three-dimensional measurement data, with applications in data visualization and de-noising, and in the analysis of brain imaging data.

Models for information processing in the visual system of the brain
To develop probabilistic computational models that show how vision is possible in the brain, and to generalize these principles to different domains of computational neuroscience and computational intelligence.

Models for probabilistic data fusion
To develop probabilistic methods for combining inputs originating from heterogeneous data sources.

User modeling
To develop probabilistic modeling methods for personalization, profiling and segmentation.

Research groups

- **Complex Systems Computation Group (CoSCo)**, Professor Petri Myllymäki
- **Neuroinformatics**, Professor Aapo Hyvärinen
- **Statistical Machine Learning and Bioinformatics**, Professor Samuel Kaski

Current research projects

- **CIVI: Cognitively Inspired Visual Interfaces for Representing Multidimensional Information,** Petri Myllymäki
- **PMMA: Probabilistic Methods for Microarray Data,** Petri Myllymäki
- **KUKOT: MDL-Based Methods for Image Denoising,** Petri Myllymäki
- **CLASS: Cognitive-Level Annotation using Latent Statistical Structure,** Petri Myllymäki
- **Neuroinformatics**, Aapo Hyvärinen
- **PinView: Personal Information Navigator Adapting Through Viewing**, Samuel Kaski
- **SULRSL: Supervised Unsupervised Learning and Relevant Subtask Learning**, Samuel Kaski
- **UI-ART: Urban contextual information interfaces with multimodal augmented reality**, Samuel Kaski

Programme management

Programme Director:
Professor Petri Myllymäki

Programme Manager:
Dr Teemu Roos

Programme Management Group:
- Professor Petri Myllymäki
- Professor Aapo Hyvärinen
- Professor Samuel Kaski

3 Research training and research visits

3.1 Doctoral degrees earned by the HIIT personnel

Autio, Ilkka
Modeling efficient classification as a process of confidence assessment and delegation.
Doctoral dissertation, University of Helsinki, Faculty of Science, Department of Computer Science, 2008.

Haiminen, Niina
Mining Sequential Data - in Search of Segmental Structures.
Doctoral dissertation, University of Helsinki, Faculty of Science, Department of Computer Science, 2008.

Hietanen, Herkko
The Pursuit of Efficient Copyright Licensing How Some Rights Reserved Attempts to Solve the Problems of All Rights Reserved.
Doctoral dissertation, Lappeenranta University of Technology, School of Business, Business Economics and Law, 2008.

Kangasharju, Jaakko
XML Messaging for Mobile Devices.
Doctoral dissertation, University of Helsinki, Faculty of Science, Department of Computer Science, 2008.

Klami, Arto
Modeling of mutual dependencies.
Doctoral dissertation, Helsinki University of Technology, Faculty of Information and Natural Sciences, Department of Information and Computer Science, 2008.

Koponen, Teemu
A Data-Oriented Network Architecture.
Doctoral dissertation, Helsinki University of Technology, Faculty of Information and Natural Sciences, Department of Computer Science and Engineering, 2008.

Lindgren, Jussi
Learning Nonlinear Visual Processing from Natural Images.
Doctoral dissertation, University of Helsinki, Faculty of Science, Department of Computer Science, 2008.

Ruosaari, Salla
Microarrays in Lung Cancer Research: From Comparative Analyses to Verified Findings.
Doctoral dissertation, University of Helsinki, Faculty of Biosciences, Department of Biological and Environmental Sciences, 2008.

Salojärvi, Jarkko

Inferring Relevance from Eye Movements with Wrong Models.
Doctoral dissertation, Helsinki University of Technology, Faculty of Information and Natural Sciences, Department of Information and Computer Science, 2008.

Sulkava, Mika

Learning from Environmental Data: Methods for Analysis of Forest Nutrition Time Series.
Doctoral dissertation, Helsinki University of Technology, Faculty of Information and Natural Sciences, Department of Information and Computer Science, 2008.

Tatti, Nikolaj

Advances in Mining Binary Data: Itemsets as Summaries.
Doctoral dissertation, Helsinki University of Technology, Faculty of Information and Natural Sciences, Department of Information and Computer Science, 2008.

Tikka, Jarkko

Input variable selection methods for construction of interpretable regression models.
Doctoral dissertation, Helsinki University of Technology, Faculty of Information and Natural Sciences, Department of Information and Computer Science, 2008.

Ukkonen, Antti

Algorithms for Finding Orders and Analyzing Sets of Chains.
Doctoral dissertation, Helsinki University of Technology, Faculty of Information and Natural Sciences, Department of Information and Computer Science, Espoo 2008.

Ylitalo, Jukka

Secure Mobility at Multiple Granularity Levels over Heterogeneous Datacom Networks.
Doctoral dissertation, Helsinki University of Technology, Faculty of Information and Natural Sciences, Department of Computer Science and Engineering, Espoo 2008.

3.2 Post-graduate courses arranged by HIIT

Spring 2008 courses

- Biological Sequence Analysis (Esko Ukkonen)
- Computational Data Analysis II (P. Hoyer, Jyrki Kivinen)
- High-throughput bioinformatics (Janne Nikkilä, Petri Auvinen, Leo Lahti)
- Information visualization (Kai Puolamäki, Antti Ukkonen)
- Modelling of Vision (Aapo Hyvärinen)
- Peer-to-Peer Networks (Jussi Kangasharju)
- Programming Mobile Devices (J. Järvensivu (TUT), Michael Przybilski)
- Seminar on Congestion Control and Fairness (Jussi Kangasharju)
- Seminar on Predicting Structured Data (Huizhen Yu, Juho Rousu)
- Spatial Data Mining (Antti Leino)
- Special course in bioinformatics I: Modeling of proteomics data (Samuel Kaski, Sophia Kossida, Ilkka Huopaniemi)
- Special Course on Data Mining (Marko Salmenkivi)
- T-61.5140 Machine Learning: Advanced Probabilistic Methods (Jaakko Holmén, Tapani Raiko)
- Three Concepts: Probability (Tomi Silander)
- Three Concepts: Utility (Tei Laine)
- Tiedon louhinnan seminaari (Hannu Toivonen)

Autumn 2008 courses

- Algorithmic methods of data mining (Heikki Mannila, Niko Vuokko)
- Biological Sequence Analysis (Esko Ukkonen)
- Causal analysis (Patrik Hoyer)
- Distributed Systems (Jussi Kangasharju)
- Introduction to Machine Learning (Matti Kääriäinen, Marko Salmenkivi)
- Jatko-opintoseminaari (Hannu Toivonen, Jussi Kangasharju, Juho Rousu)
- Modeling biological networks (Samuel Kaski, Mark Girolami, Antti Honkela, Matej Oresic)
- Peer-to-Peer Networks (Jussi Kangasharju)
- PhD student seminar
- Scientific Writing (Antti Leino)
- Seminar on Future Internet and Other Hot Topics in Networking (Jussi Kangasharju)
- Seminar on Neuroinformatics (Aapo Hyvärinen)
- Special Course in Bioinformatics II: High-throughput sequencing and its applications (Jarkko Salojärvi, Leo Lahti)
- Special Course in Computer and Information Science IV: Clustering Algorithms (Gemma Garriga, Kai Puolamäki, Petri Savola)
- Usability Evaluation (Antti Oulasvirta)

3.3 Research visits

Visits to HIIT

Aidos, Helena
Technical University of Lisbon, Portugal
12 months

Antanasijevic, Bratislava
University of Nis, Serbia
3 monts

Arvestad, Lars
Kungliga Tekniska Högskolan (KTH), Sweden

Baeza-Yates, Ricardo, Director
Yahoo! Research Barcelona, Spain and Latin America, Santiago, Chile
1 week

Bhattacharya, Sourangshu
Indian Institute of Science, India
4 months

Chakraborty, Sounak
University of Missouri-Columbia, USA
2 months

Gehlenborg, Nils
Cambridge University, UK
2 months

Gonzalez Marcos, Ana, PhD
University of La Rioja, Spain
3 months

Gutmann, Michael
1 month

Hong, Luo, Doctor, Associate Professor
Beijing University of Posts and Telecommunications, China
2 months

Hota, Chittaranjan, Doctor, Group Leader
Birla Institute of Technology & Science-Pilani, India
1 month

Hummen, René
Klaus Wehrle's Distributed systems group, RWTH Aachen, Germany
6 months

Jaakkola, Tommi
MIT, USA
1 week

Jursic, Matjaz
Josef Stefan Institute, Ljubljana, Slovenia
1 week

Kim, Joondong
US
2 weeks

Korman, Matias
Graduate School of Information Sciences, Tohoku University, Japan
1 week

Krämer, Nicole
Berlin Technische Universität, Germany
1 week

Lacerda, Gustavo, PhD Student
Carnegie Mellon University, Pittsburgh, USA
3 weeks

Laxman, Srivatsan, Dr
Microsoft Research India, Bangalore, India
1 week

Lijffijt, Jeffrey, PhD
1 week

Lähdesmäki, Harri
Tampere University of Technology, Finland
3 weeks

Martinez-Ruiz, Alba
Universitat Politècnica de Catalunya, Spain
3 months

Mavroeidis, Dimitris
Athens University of Economics and Business, Greece
3 weeks

Mitchell, Joseph, Professor
State University of New York at Stony Brook, USA
1 week

Moskowitz, Robert
ICSAlabs, An Independent Division of Verizon Business Systems, USA
1 month

Natau, Robert
ETH Zurich, Switzerland
1 month

Nijssen, Siegfried
Katholieke Universiteit, Leuven, Belgium
1 week

Nock, Richard, Professor
Université des Antilles et de la Guyane, Pointe-à-Pitre, Guadeloupe
1 month

Rogers, Simon
University of Glasgow, UK
1 week

Saunders, Craig, Dr
University of Southampton, School of Electronics and Computer Science, Southampton, UK
4 weeks

Scheffer, Tobias
Max-Planck-Institut für Informatik, Germany

Soma, Hayuru
Department of Computer Science,Waseda University, Japan
1 month

Terzi, Evimaria
Palo Alto, USA
2 weeks

Xiong, Hao
Texas A&M University, USA
1 week

Yaslan, Yusuf
Istanbul Technical University, Turkey
6 months

Zhang, Kun, PhD
Chinese University of Hong Kong, China
2 years

Visits from HIIT

Caldas, José
European Bioinformatics Institute (EBI), Cambridge, UK
1 month

Komu, Miika
RWTH Aachen, Germany
1 month

Lehdonvirta, Vili
Department of Computer Science, Waseda University, Japan
4 months

Lindqvist, Janne
Cambridge, UK
2 weeks

Miettinen, Pauli
Dipartimento di Informatica e Sistemistica Antonio Ruberti, Università degli Studi di Roma "La Sapienza", Italy
2 months

Morrison, Ann
University of Queensland, Australia
1 month

Nechaev, Boris
International Computer Science Institute, UC Berkeley, USA
6 months

Nurmi, Petteri
National ICT Australia, Canberra, Australia, 2 months and 1 week
National ICT Australia, Sydney, Australia, 2 weeks and 1 week
Sungkyunkwan University, Seoul, South-Korea, 3 months

Oulasvirta, Antti
UC Berkeley, USA
6 months

Peltonen, Peter
Australian National University, Australia
3 weeks

Pitkänen, Olli
K.U.Leuven/ICRI, Belgium
1 week

Ponomarev, Oleg
Swedish Institute of Computer Science, Sweden
1 month

Reti, Tommo
UC Berkeley, USA
7 months

Roos, Teemu, PhD
UC Berkeley, USA
4 months

Salovaara, Antti
Brunel University, Department of Information System and Computing, UK
8 months

Vihavainen, Sami
UC Berkeley, USA
7 months

Vuokko, Niko
IBM, Almaden Research Center San Jose, USA
3 months

4 Administration

4.1 Overview

HIIT is a joint research centre of Helsinki University of Technology TKK and the University of Helsinki.

The HIIT Board, nominated by the universities, decides on its overall research strategy and research programmes.

The Scientific Advisory Board, nominated by the Board, provides scientific guidance and criticism for the Board.

In 2008, HIIT consisted of two administrative units. Spektri Unit in Espoo is associated with TKK, and Kumpula Unit in Helsinki is associated with UH. Each unit had a Director nominated by the Board.

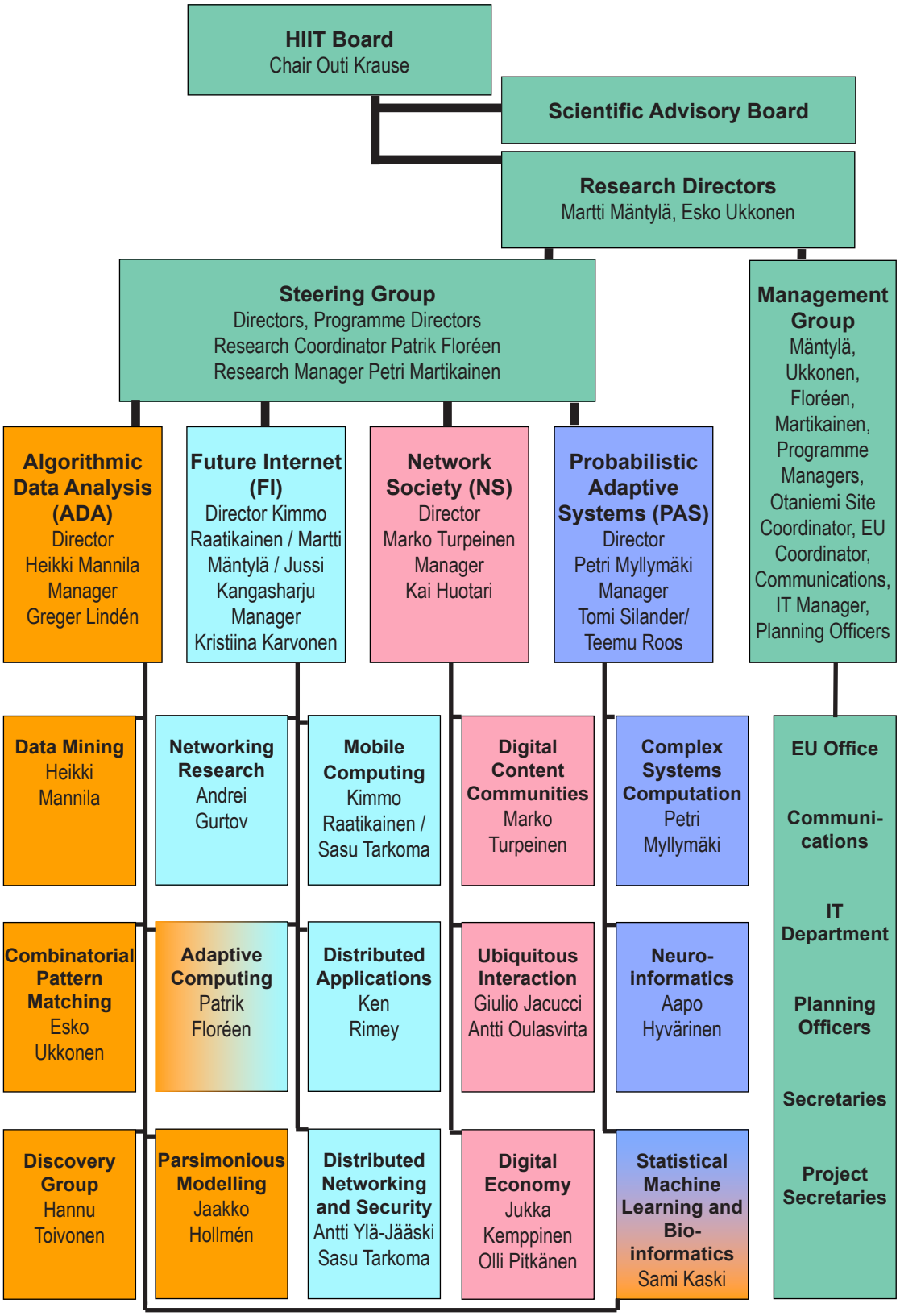
Research programmes are led by the Programme Directors. Together with the Directors, they constitute the Steering Group responsible for inter-programme co-ordination and planning. The Steering Group also accepts new research groups to HIIT.

The Management Group has been responsible for the coordination of the administrative processes such as planning, budgeting, and reporting; communications; and preparation of joint events.

Each research programme has a Programme Management Group consisting of the senior researchers of the research groups contributing to the work. The Research Programme Manager facilitates the operation of the programme management group and co-ordinates the joint activities of the programme.

A Programme Advisory Board (PAB), consisting of invited members from industry and academia, provides feedback on programme results and advises on their vision, mission, and key research lines.

HIIT's administration team provides administrative services. The IT department is responsible for the IT infrastructure and key services of the institute.


HIIT Board
Chair Outi Krause
Scientific Advisory Board
Research Directors
Martti Mäntylä, Esko Ukkonen
Steering Group
Directors, Programme Directors
Research Coordinator Patrik Floréen
Research Manager Petri Martikainen
Management Group
Mäntylä, Ukkonen, Floréen, Martikainen, Programme Managers, Otaniemi Site Coordinator, EU Coordinator, Communications, IT Manager, Planning Officers
Algorithmic Data Analysis (ADA)
Director Heikki Mannila
Manager Greger Lindén
Future Internet (FI)
Director Kimmo Raatikainen / Martti Mäntylä / Jussi Kangasharju
Manager Kristiina Karvonen
Network Society (NS)
Director Marko Turpeinen
Manager Kai Huotari
Probabilistic Adaptive Systems (PAS)
Director Petri Myllymäki
Manager Tomi Silander/ Teemu Roos
Data Mining
Heikki Mannila
Networking Research
Andrei Gurtov
Mobile Computing
Kimmo Raatikainen / Sasu Tarkoma
Digital Content Communities
Marko Turpeinen
Complex Systems Computation
Petri Myllymäki
EU Office
Communi-cations
IT Department
Planning Officers
Secretaries
Project Secretaries
Combinatorial Pattern Matching
Esko Ukkonen
Adaptive Computing
Patrik Floréen
Distributed Applications
Ken Rimey
Ubiquitous Interaction
Giulio Jacucci
Antti Oulasvirta
Neuro-informatics
Aapo Hyvärinen
Discovery Group
Hannu Toivonen
Parsimonious Modelling
Jaakko Hollmén
Distributed Networking and Security
Antti Ylä-Jääski
Sasu Tarkoma
Digital Economy
Jukka Kemppinen
Olli Pitkänen
Statistical Machine Learning and Bio-informatics
Sami Kaski

4.2 Board

The highest decision-making body of HIIT is the Board.

The Board consists of nine full members of whom eight are appointed by the parent universities and represent the academic community and the main industrial partners of HIIT. One member of the board represents and is elected by HIIT personnel. In addition, the Board invites members from industrial companies with whom HIIT co-operates to participate in the work of the Board.

The decision-making power is invested in the full members, whereas the invited members have the right to attend and to speak at the meetings. In 2007 the Board convened four times. In addition, the members of the Board met, sans HIIT personnel, in November to discuss HIIT's future after the three year transition period ending this year.

Apart from dealing with the statutory tasks (i.e. approving the annual budgets and activity plans of both units, approving the HIIT annual report, following up the work of the units through regular activity updates given by the two Research Directors of HIIT, etc.), the major theme for the Board's work in 2007 was to discuss the future strategy of HIIT and its implementation after 2008.

Board Members 2008 and their personal deputies

Vice Rector Outi Krause	**TKK, Chairman of the Board**
(Vice Rector Kalevi Ekman)	TKK
Professor Olli Simula,	TKK
(Professor Heikki Saikkonen)	TKK
Vice Rector, Johanna Björkroth	UH, Vice-Chairman of the Board
(Vice Rector Matti Tikkanen)	UH
Professor Jyrki Kivinen	UH
(Docent Lea Kutvonen)	UH
Raimo Vuopionperä,	Oy L M Ericsson Ab
(Björn Melén)	Oy L M Ericsson Ab
Aimo Maanavilja	Elisa Communications Oyj
(Pertti Hölttä)	Elisa Communications Oyj
Juha Aaltonen	TeliaSonera Finland Oyj
(Martin Mäklin)	TeliaSonera Finland Oyj
Henry Tirri	Nokia Oyj
(Petteri Alinikula)	Nokia Oyj
Patrik Floréen	HIIT
(Kai Huotari)	HIIT

Invited Members

Ari Hirvonen	TietoEnator Oyj
(Olli Lötjönen)	TietoEnator Oyj
Eskoensio Pipatti	Sanoma Oyj
Juha Vesaoja	Yleisradio Oy
Pekka Järvinen	Nordea
(Juha Toivari)	Nordea

The Research Directors of HIIT Martti Mäntylä and Esko Ukkonen have been responsible for preparing and submitting propositions to the Board. In addition, the Research Manager Petri Martikainen had the right to attend meetings.

Board Secretary: Planning Officer Päivi Saarinen

4.3 Scientific Advisory Board (SAB)

The objective of the Scientific Advisory Board (SAB) is to provide critical guidance about HIIT's research activities and to advise the HIIT Board on strategic planning for future research directions of HIIT.

The SAB consists of internationally prominent scholars who are invited by the HIIT Board.

SAB Members 2008

Dr Ross Anderson	University of Cambridge
Professor Alberto Apostolico	Georgia Tech
Professor Richard Buxbaum	University of California at Berkeley
Professor Christos Faloutsos	Carnegie Mellon University
Professor Bengt Jonsson	Uppsala University
Professor Randy Katz	University of California at Berkeley
Professor Martin Kersten	University of Amsterdam and CWI*
Professor Kari-Jouko Räihä	University of Tampere
Professor Mart Saarma	University of Helsinki
Professor Angela Sasse	University College London
Professor John Shawe-Taylor	University of Southampton
Professor Hal Varian	University of California at Berkeley
Dr Martin Vingron	Max Planck Institute for Molecular Genetics

* National Research Institute for Mathematics and Computer Science in the Netherlands

The SAB met in Helsinki and Espoo on 26-28 May 2008 and visited all three sites of HIIT. The meeting included presentations of HIIT's four research programmes, poster exhibitions and software demonstrations.

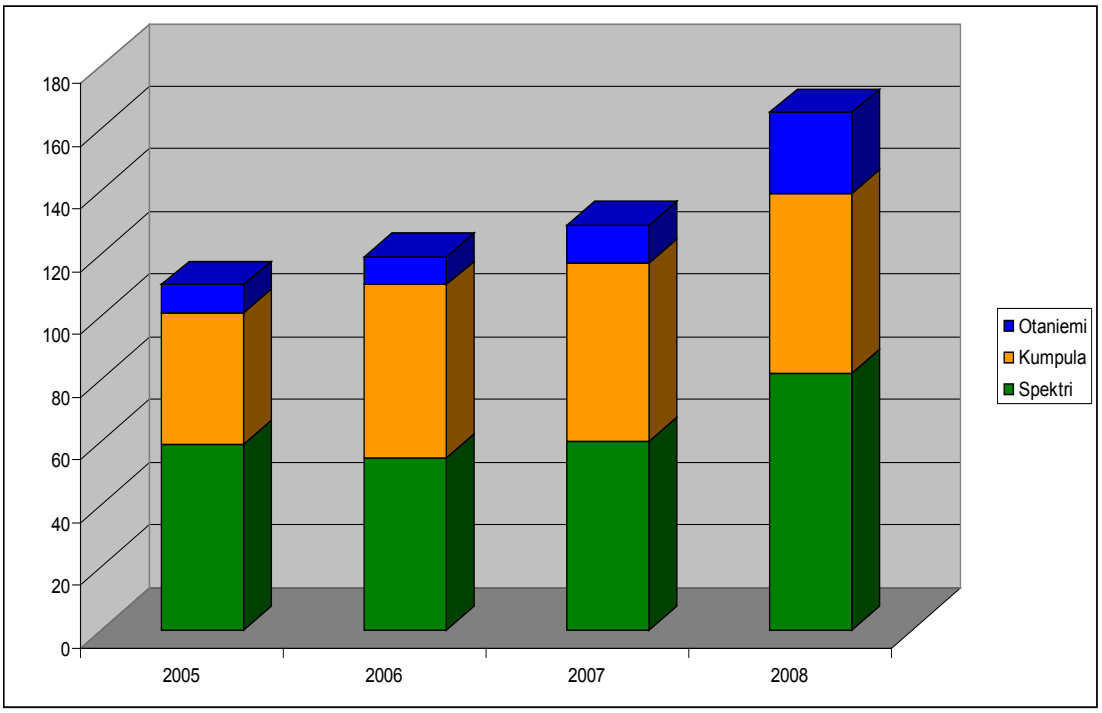
The SAB gave immediate feedback on the research of HIIT during the meeting and later submitted a nine-page report (see https://www.hiit.fi/sab/).

4.4 Personnel

The personnel directly employed by HIIT are formally employed by the two parent universities; the Spektri and Otaniemi personnel are employed by TKK and the Kumpula personnel by UH. In addition, there are a number of persons working in HIIT with some other form of funding, such as post-graduate students with funding from Helsinki Graduate School of Computer Science and Engineering (HeCSE) and researchers with academic positions. Many of HIIT's personnel have double or even triple affiliations. Most common is an affiliation with one or both of the parent universities, but there are also some who share their time between HIIT and some other organisation. The diversity of affiliations is characteristic of HIIT personnel.

Number of person-years and distribution by sites in 2005-2008

Staff (person-years)	2005	2006	2007	2008
Spektri	59	55	60	82
Kumpula	42	55	57	57
Otaniemi	9	9	12	26
Total	**110**	**119**	**129**	**165**

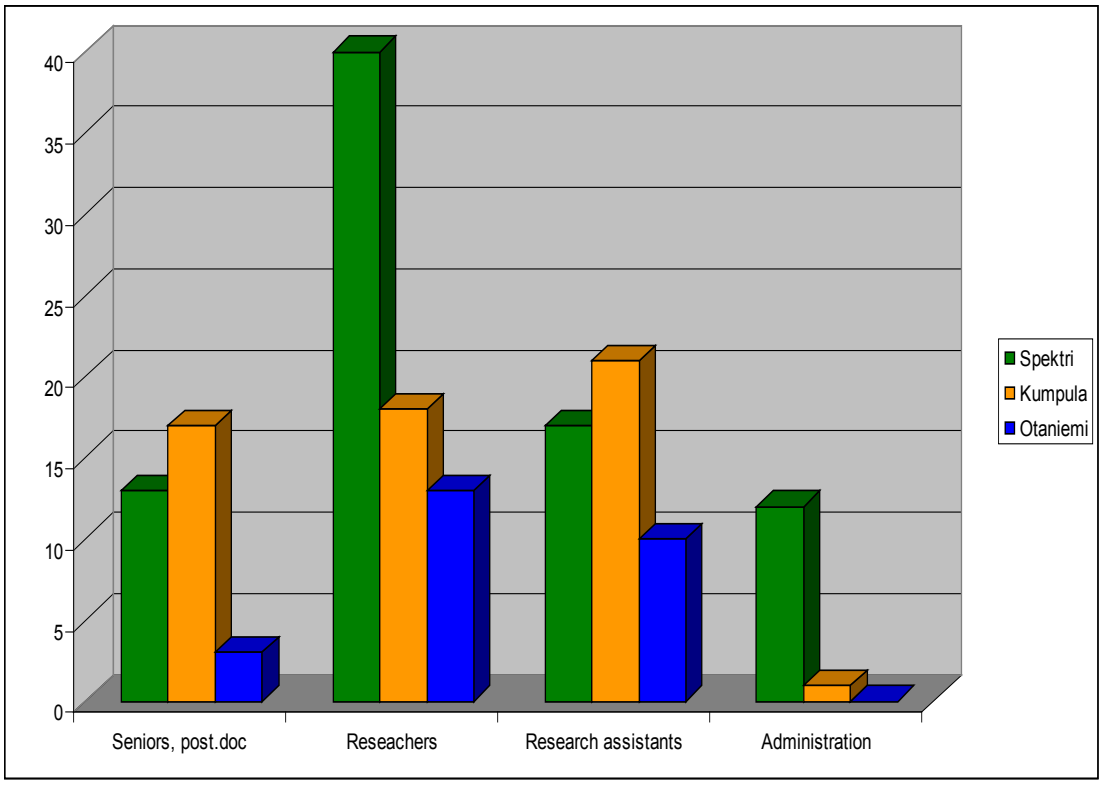


In 2008 the total number of employees was 298; HIIT staff completed 165 person-years, over 30 more than the previous year.

Almost 25 % of the personnel were non-Finns. Out of all non-Finnish citizens 1/4 were EU citizens, 1/4 Chinese, 1/4 Russians and 1/4 other nationalities.

Number of person-years and distribution by personnel groups in 2008

Staff (person-years)	Spektri	Kumpula	Otaniemi	Total	Change from 2007
Seniors, post.doc	13	17	3	33	+ 1
Reseachers	40	18	13	71	+ 10
Research assistants	17	21	10	48	+ 21
Administration	12	1	0	13	+ 4
Total	**82**	**57**	**26**	**165**	**+ 36**



5 Funding and costs

Spektri unit finances

SPEKTRI (RUOHOLAHTI)	2006	2007	2008
Total funding	**3 958 172**	**4 132 540**	**5 232 367**
TKK funding	263 272	436 837	773 338
UH funding	168 200	168 200	168 200
Academy of Finland	140 698	83 875	178 359
Tekes, National Technology Agency	1 953 297	1 917 903	2 112 314
European Union (EU)	658 028	852 437	1 051 384
Industry	559 943	510 642	306 804
Ministries and other public funding	99 727	74 821	147 052
Other domestic funding	115 007	87 825	494 917
Total expences	**3 809 977**	**4 014 856**	**5 073 352**
Salaries	2 511 946	2 538 365	3 496 797
Other operational expences	725 940	958 624	1 068 548
Rents	407 331	354 006	326 854
Service charge to TKK	164 760	163 861	181 154

University funding, of total funding	**11 %**	**15 %**	**18 %**
External funding, of total funding	**89 %**	**85 %**	**82 %**
Academy funding, of total funding	4 %	2 %	3 %
Tekes funding, of total funding	49 %	46 %	40 %
Industry funding, of total funding	14 %	12 %	6 %
EU funding, of total funding	17 %	21 %	20 %
Other public funding, of total funding	5 %	4 %	12 %

Salaries, of total expences	66 %	63 %	69 %
Other expences, of total expences	23 %	28 %	25 %
Rents, of total expences	11 %	9 %	6 %

Kumpula unit finances

KUMPULA	2006	2007	2008
Total funding	**2 179 499**	**2 737 000**	**2 038 431**
UH funding	891 744	877 000	922 400
Academy of Finland	490 570	485 000	464 727
Tekes, National Technology Agency	418 612	665 000	316 811
European Union (EU)	274 818	450 000	250 987
Industry	103 756	260 000	83 506
Total expences	**1 965 993**	**2 446 105**	**2 170 579**
Salaries	1 483 555	1 632 852	1 668 685
Other operational expences	242 647	408 628	366 204
Service charge to UH (rents included)	239 790	404 625	135 690

University funding, of total funding	**41 %**	**32 %**	**45 %**
External funding, of total funding	**59 %**	**68 %**	**55 %**
Academy funding, of total funding	22,5 %	18 %	23 %
Tekes funding, of total funding	19 %	24 %	16 %
Industry funding, of total funding	5 %	9 %	12 %
EU funding, of total funding	12,5 %	16 %	4 %

Salaries, of total expences	78 %	75 %	77 %
Other expences, of total expences	14 %	12 %	17 %
Rents, of total expences	9 %	12 %	6 %

Otaniemi unit finances

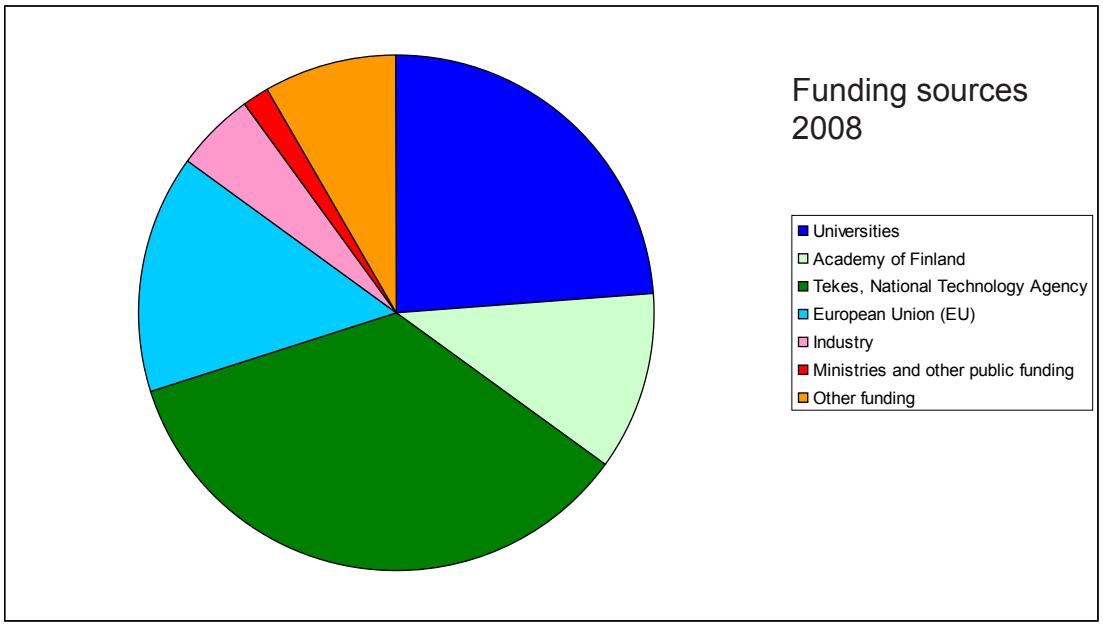
OTANIEMI	2006	2007	2008
Total funding	**436 790**	**663 917**	**1 348 876**
TKK funding	106 386	95 357	104 057
Center of Excellence funding from TKK	71 280	71 000	90 000
Academy of Finland	218 226	329 400	306 761
Tekes, National Technology Agency	40 898	168 160	598 048
Industry	0	0	35 074
Other funding	0	0	214 936
Total expences	**395 107**	**581 208**	**1 328 972**
Salaries	344 875	479 800	1 008 668
Other operational expences	21 064	25 850	203 608
Service charge to TKK/UH (rents included)	29 168	75 558	116 696

University funding, of total funding	**24 %**	**25 %**	**14 %**
External funding, of total funding	**76 %**	**75 %**	**86 %**
Academy funding, of total funding	50 %	50 %	23 %
Tekes funding, of total funding	9 %	25 %	44 %
Industry funding, of total funding	0 %	0 %	3 %
EU funding, of total funding	0 %	0 %	0 %
Other funding, of total funding	16 %	11 %	14 %

Salaries, of total expences	87 %	83 %	76 %
Other expences, of total expences	5 %	4 %	15 %
Rents, of total expences	7 %	13 %	9 %

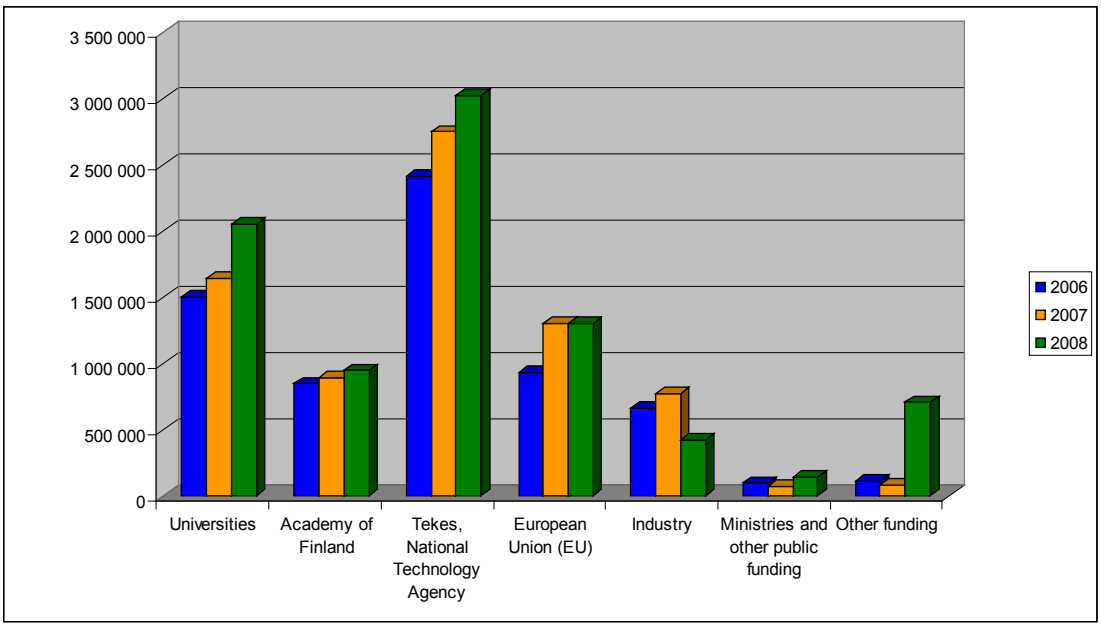
HIIT finances summary

HIIT	2006	2007	2008
Total funding	**6 574 462**	**7 533 457**	**8 619 674**
Universities	1 500 882	1 648 394	2 057 995
Academy of Finland	849 494	898 275	949 847
Tekes, National Technology Agency	2 412 807	2 751 063	3 027 173
European Union (EU)	932 846	1 302 437	1 302 371
Industry	663 699	770 642	425 384
Ministries and other public funding	99 727	74 821	147 052
Other funding	115 007	87 825	709 853
Total expences	**6 171 076**	**7 042 169**	**8 572 903**
Salaries	4 340 376	4 651 017	6 174 150
Other operational expences	989 651	1 393 102	1 638 359
Rents	407 331	354 006	326 854
Service charge to TKK/UH	433 718	644 044	433 540



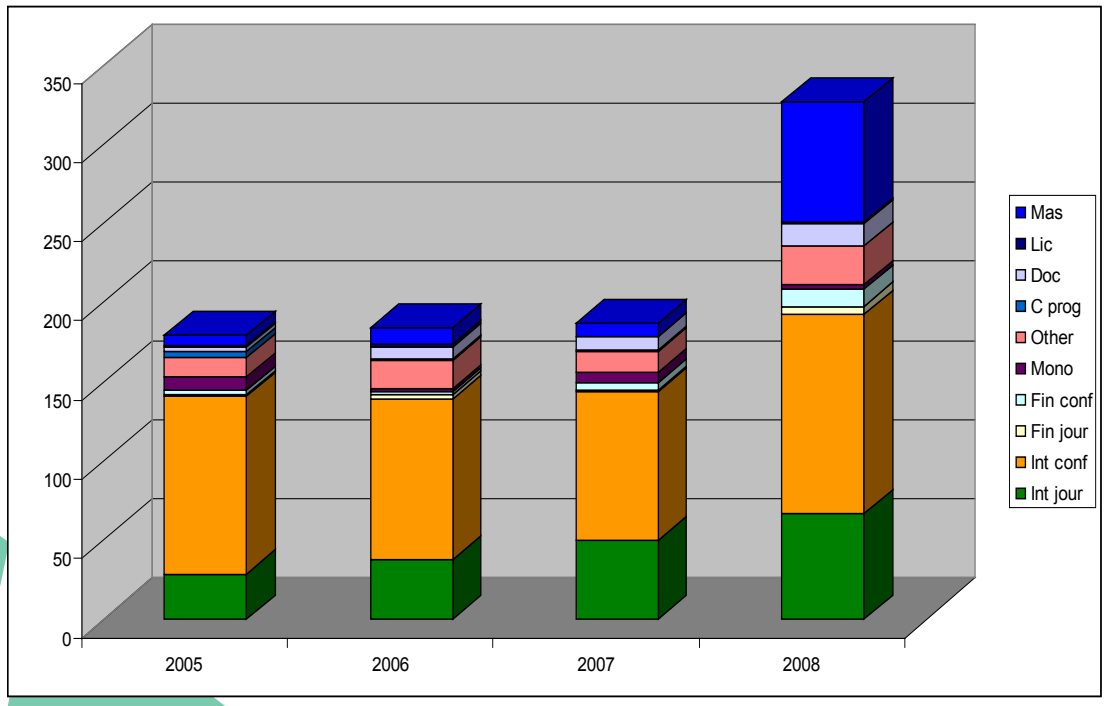
University funding, of total funding	**23 %**	**22 %**	**24 %**
External funding, of total funding	**77 %**	**78 %**	**76 %**
Academy funding, of total funding	13 %	12 %	11 %
Tekes funding, of total funding	37 %	37 %	35 %
Industry funding, of total funding	10 %	10 %	5 %
EU funding, of total funding	14 %	17 %	15 %
Other funding, of total funding	3 %	2 %	10 %

Salaries, of total expences	70 %	66 %	72 %
Other expences, of total expences	23 %	29 %	24 %
Rents, of total expences	7 %	5 %	4 %



Appendices
A - Publications

Publications 2004 - 2007	2005	2006	2007	2008
Articles in international scientific journals with referee practice	29	38	50	67
Articles in international edited works and conference proceedings with referee practice	112	101	94	126
Articles in Finnish scientific journals with referee practice	1	3	1	5
Articles in Finnish edited works and conference proceedings with referee practice	3	2	5	11
Scientific monographs	8	2	6	3
Other publications	13	18	13	24
Computer programmes (and algorithms)	3	1	1	0
Degrees				
- PhD and DSc thesis	3	7	9	14
- Licenciate thesis	1	2	0	1
- Master's thesis	7	10	8	76
Total	**180**	**184**	**187**	**327**



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B - List of Personnel

Ain, Mark	Researcher	Spektri
Ajanki, Antti	Researcher	Otaniemi
Ala-Härkönen, Väinö	Assistant Researcher	Kumpula
Andersson, Mikael	Assistant Researcher	Kumpula
Antikainen, Markku	Research Assistant	Spektri
Bhattacharya, Sourangshu	Researcher	Spektri
Bingham, Ella	Postdoctoral Researcher	Kumpula
Bishaj, Blerta	Research Assistant	Spektri
Björkskog, Christoffer	Researcher	Spektri
Boström, Fredrik	Assistant Researcher	Kumpula
Boyvat, Baris	Research Assistant	Spektri
Buntine, Wray	Senior Researcher	Kumpula
Caldas, José	Researcher	Otaniemi
Casas Garriga, Gemma	Postdoctoral Researcher	Otaniemi
Chalambalakis, Alessandro	Research Assistant	Spektri
Chowdhury, Rafiqul	Researcher	Otaniemi
Du, Wei	Researcher	Spektri
Entner, Doris	Doctoral Student	Kumpula
Ermolov, Andrey	Researcher	Otaniemi
Eronen, Lauri	Researcher	Kumpula
Etter von, Peter	Assistant Researcher	Kumpula
Evans, John	Researcher	Spektri
Faisal, Muhammad	Researcher	Otaniemi
Finez Moral, Teresa	Research Assistant	Spektri
Floréen, Patrik	Senior Researcher	Kumpula
Forsblom, Andreas	Assistant Researcher	Kumpula
Garriga, Gemma	Postdoctoral Researcher	Spektri
Gillberg, Leo	Assistant Researcher	Otaniemi
Gonzales Urquieta, Andrea	Project Secretary	Spektri
Gurtov, Andrei	Principal Scientist	Spektri
Gutmann, Michael	Postdoctoral Researcher	Kumpula
Haiminen, Niina	Researcher	Kumpula
Hamari, Juho	Research Assistant	Spektri
Hanhijärvi, Sami	Researcher	Otaniemi
Hankalahti, Aleksi	Assistant Researcher	Kumpula
Hara, Henriika	Research Assistant	Spektri
Hassinen, Marja	Assistant Researcher	Kumpula
Hasu, Tero	Researcher	Spektri

staff

Heikinheimo, Hannes	Researcher	Otaniemi
Heikkilä, Juho	Researcher	Spektri
Heikkinen, Jani	Researcher	Otaniemi
Helin, Matti	Research Assistant	Spektri
Hietanen, Herkko	Researcher	Spektri
Himanen, Pekka	Principal Scientist	Spektri
Hintsanen, Petteri	Researcher	Kumpula
Hollmén, Jaakko	Senior Researcher	Otaniemi
Hoyer, Patrik	Postdoctoral Researcher	Kumpula
Hu, Weiwei	Research Assistant	Otaniemi
Hukkinen, Janne	Research Assistant	Spektri
Hummen, Rene	Research Assistant	Spektri
Huopaniemi, Ilkka	Researcher	Otaniemi
Huotari, Kai	Research Programme Manager	Spektri
Huvio, Eero	Researcher	Spektri
Hyttinen, Antti	Researcher	Kumpula
Hytönen, Venla	Research Assistant	Spektri
Hyvärinen, Aapo	Senior Researcher	Kumpula
Hämäläinen, Harri	Research Assistant	Spektri
Ikola, Mikko	Research Assistant	Otaniemi
Ilmonen, Tommi	Researcher	Spektri
Inki, Mika	Postdoctoral Researcher	Kumpula
Jaakkola, Tommi	Visiting Researcher	Kumpula
Jacucci, Giulio	Researcher	Spektri
Johnson, Fredrik	Researcher	Spektri
Jokipii, Matti	Assistant Researcher	Kumpula
Junttila, Esa	Researcher	Kumpula
Jylhäkoski, Juha	Researcher	Spektri
Järvenpää, Ritva	Planning Officer	Kumpula
Kaartinen, Heidi	Research Assistant	Spektri
Kaasinen, Joel	Assistant Researcher	Kumpula
Kainiemi, Laura	Project Coordinator	Spektri
Kaipiainen, Pertti	Research Assistant	Spektri
Kajastila, Raine	Researcher	Spektri
Kallio, Aleksi	Doctoral Student	Kumpula
Kandehir, Melih	Researcher	Otaniemi
Kangasharju, Jaakko	Postdoctoral Researcher	Otaniemi
Kangasharju, Jussi	Professor	Kumpula

Kantola, Vesa	Researcher	Spektri
Kari, Jussi	Research Assistant	Spektri
Karila, Arto	Principal Scientist	Spektri
Karila, Artturi	Research Assistant	Spektri
Karlstedt, Mika	Researcher	Kumpula
Karvonen, Kristiina	Research Programme Manager	Spektri
Kaski, Petteri	Postdoctoral Researcher	Kumpula
Kaski, Samuel	Professor	Otaniemi
Katainen, Riku	Assistant Researcher	Kumpula
Kemppinen, Jukka	Principal Scientist	Spektri
Kervinen, Kati	Administrative Assistant	Kumpula
Khan, Umair Azfar	Researcher	Spektri
Khurri, Andrey	Researcher	Spektri
Kilinkaridis, Theofanis	Research Assistant	Spektri
Kim, Sojin	Researcher	Spektri
Klami, Arto	Postdoctoral Researcher	Otaniemi
Kleimola, Jari	Researcher	Spektri
Koivisto, Mikko	Postdoctoral Researcher	Kumpula
Kollin, Jussi	Doctoral Student	Kumpula
Komu, Miika	Researcher	Spektri
Kontkanen, Petri	Doctoral Student	Kumpula
Konttinen, Marko	Project Researcher	Kumpula
Koponen, Teemu	Researcher	Spektri
Korhonen, Janne	Assistant Researcher	Kumpula
Korpela, Mikko	Researcher	Otaniemi
Korzun, Dmitry	Researcher	Spektri
Koskela, Arvid	Researcher	Spektri
Kosunen, Ilkka	Research Assistant	Spektri
Kozma, László	Assistant Researcher	Otaniemi
Kuikkaniemi, Kai	Researcher	Spektri
Kujala, Inka	Administrative Assistant	Kumpula
Kujala, Teija	Administrative Assistant	Kumpula
Kukkonen, Joonas	Assistant Researcher	Kumpula
Kulovesi, Kimmo	Assistant Researcher	Kumpula
Kuptsov, Dmitriy	Researcher	Spektri
Kurki, Ilmari	Researcher	Kumpula
Kurvinen, Esko	Researcher	Spektri
Kääriäinen, Matti	Postdoctoral Researcher	Kumpula
Köster, Urs	Researcher	Kumpula

Laasonen, Kari	Researcher	Kumpula
Lagerspetz, Eemil	Assistant Researcher	Kumpula
Lagutin, Dmitrij	Researcher	Spektri
Lahdenmäki, Miro	Research Assistant	Otaniemi
Lahti, Leo	Researcher	Otaniemi
Lahtinen, Jussi	Assistant Researcher	Kumpula
Laine, Tei	University Researcher	Kumpula
Laine, Tuomo	Secretary	Spektri
Laitinen, Toni	Research Assistant	Spektri
Lampinen, Airi	Researcher	Spektri
Lappalainen, Sampsa	Assistant Researcher	Kumpula
Lee, Na Ri	Researcher	Spektri
Leen, Gayle	Postdoctoral Researcher	Otaniemi
Lehdonvirta, Vili	Researcher	Spektri
Lehmuskallio, Asko	Researcher	Spektri
Lehtinen, Ville	Research Assistant	Spektri
Lehtinen, Vilma	Researcher	Spektri
Lehtiniemi, Tuukka	Researcher	Spektri
Lehtonen, Matti	Researcher	Spektri
Leino, Antti	Researcher	Kumpula
Li, Jia	Research Assistant	Spektri
Liikkanen, Lassi	Researcher	Spektri
Lilja, Timo	Researcher	Spektri
Lindell, Lasse	Research Assistant	Otaniemi
Lindén, Greger	Senior Researcher	Kumpula
Lindgren, Jussi	Researcher	Kumpula
Lindholm, Carl	Researcher	Spektri
Lindqvist, Antti	Research Assistant	Spektri
Lindqvist, Janne	Researcher	Otaniemi
Liu, Tianyan	Assistant Researcher	Kumpula
Liu, Xian	Research Assistant	Otaniemi
Llorca, Jordi Gil	Research Assistant	Otaniemi
Lorentin, Bruno	Research Assistant	Spektri
Louko, Antti	Senior Planning Officer	Spektri
Lu,Yang	Research Assistant	Otaniemi
Lukyanenko, Andrey	Researcher	Spektri
Luosto, Panu	Doctoral Student	Kumpula
Luusua, Vesa	Research Assistant	Spektri
Ma, Lingyi	Researcher	Spektri

Maheswaree, Pardeep	Research Assistant	Otaniemi
Makkonen, Juha	Doctoral Student	Kumpula
Mannila, Heikki	Professor	Kumpula
Markkola, Anu	Research Assistant	Otaniemi
Markkula, Marja-Leena	Research Manager	Spektri
Markus, Konrad	Technical Expert	Spektri
Martikainen, Petri	Research Manager	Spektri
Mattila, Juhana	IT Specialist	Spektri
Miettinen, Pauli	Researcher	Kumpula
Miettunen, Pirkko	Institute Secretary	Spektri
Mohammadi, Pejman	Assistant Researcher	Otaniemi
Mononen, Tommi	Researcher	Kumpula
Morrison, Ann	Researcher	Spektri
Mukhametzhanova, Assel	Project Coordinator	Spektri
Musto, Topi	Assistant Researcher	Kumpula
Myllymäki, Petri	Senior Researcher	Kumpula
Myllyniemi, Annu	Research Assistant	Otaniemi
Mäki, Jani	Research Assistant	Otaniemi
Mäntylä, Martti	Research Director	Spektri
Mäntylä, Teemu	Research Assistant	Spektri
Mäntysaari, Ville	Research Assistant	Spektri
Natau, Robert	Assistant Researcher	Kumpula
Nechaev, Boris	Researcher	Spektri
Neuvonen, Tiina	Research Assistant	Spektri
Nevala, Maija	Assistant Researcher	Otaniemi
Nicolas, Francois	Doctoral Student	Kumpula
Niemimäki, Sami	IT Specialist	Spektri
Niinimäki, Teppo	Assistant Researcher	Kumpula
Niinivaara, Olli	Researcher	Kumpula
Niissalo, Aija	Assistant Researcher	Kumpula
Nordgren, Lasse	Assistant Researcher	Kumpula
Noronen, Visa	Communications Manager	Spektri
Nurmi, Petteri	Doctoral Student	Kumpula
Nurminen, Antti	Laboratory Engineer	Spektri
Nuuros, Esa	Research Assistant	Spektri

staff

Nybo, Kristian	Assistant Researcher	Otaniemi
Nyyssönen, Tuomo	Research Assistant	Spektri
Näsänen, Jaana	Researcher	Spektri
Ocaña, David	Research Assistant	Spektri
Ogul, Hasan	Postdoctoral Researcher	Otaniemi
Ojala, Markus	Researcher	Otaniemi
Oksanen, Kenneth	Projektipäällikkö	Spektri
Oulasvirta, Antti	Researcher	Spektri
Parkkinen, Juuso	Assistant Researcher	Otaniemi
Partala, Timo	Tutkijatohtori	Spektri
Parviainen, Pekka	Doctoral Student	Kumpula
Patil, Prabhu	Researcher	Otaniemi
Peltonen, Jaakko	Postdoctoral Researcher	Otaniemi
Peltonen, Peter	Researcher	Spektri
Perkiö, Jukka	Researcher	Kumpula
Pitkänen, Olli	Researcher	Spektri
Polishchuk, Tatiana	Researcher	Spektri
Polishchuk, Valentin	Postdoctoral Researcher	Kumpula
Ponomarev, Oleg	Researcher	Spektri
Poroshin, Vladimir	Assistant Researcher	Kumpula
Przybilski, Michael	Researcher	Kumpula
Puhakka, Mikko	Researcher	Otaniemi
Puolamäki, Kai	Senior Researcher	Otaniemi
Päkkilä, Timo	Research Assistant	Otaniemi
Pääkkö, Anne	Assistant Researcher	Kumpula
Raatikainen, Kimmo	Principal Scientist	Spektri
Rantala, Tommi	Project Researcher	Kumpula
Rantanen, Ari	University Researcher	Kumpula
Rantanen, Matti	Researcher	Spektri
Reti, Tommo	Researcher	Spektri
Reunanen, Samuli	Assistant Researcher	Kumpula
Rimey, Kenneth	Principal Scientist	Spektri
Roos, Teemu	Postdoctoral Researcher	Kumpula
Ruosaari, Salla	Researcher	Otaniemi
Ruottu, Toni	Research Assistant	Spektri
Räsänen, Pekka	Principal Scientist	Spektri
Saari, Timo	Principal Scientist	Spektri
Saarikko, Petri	Researcher	Spektri

Saarinen, Päivi	Planning Officer	Spektri
Salmenkivi, Marko	Postdoctoral Researcher	Kumpula
Salojärvi, Jarkko	Postdoctoral Researcher	Otaniemi
Salovaara, Antti	Researcher	Spektri
Samperio Sepulveda, Rodolfo	Research Assistant	Spektri
Sarkio, Katri	Researcher	Spektri
Sarvas, Risto	Researcher	Spektri
Savia, Eerika	Researcher	Otaniemi
Schoenauer, Stefan	Postdoctoral Researcher	Kumpula
Seppälä, Lassi	Research Assistant	Spektri
Sevon, Petteri	Postdoctoral Researcher	Kumpula
Shen, Yiyun	Research Assistant	Kumpula
Silander, Tomi	Doctoral Student	Kumpula
Silvennoinen, Lauri	Research Assistant	Spektri
Sipilä, Sanna-Kaisa	Assistant Researcher	Kumpula
Soisalon-Soininen, Eljas	Principal Scientist	Spektri
Solin, Otto	Doctoral Student	Kumpula
Soni, Amit	Research Assistant	Spektri
Sri Kalyanaraman, Ramya	Researcher	Spektri
Suhonen, Emmi	Research Assistant	Otaniemi
Sulander, Anu	Assistant Researcher	Kumpula
Sulkava, Mika	Postdoctoral Researcher	Otaniemi
Suomalainen, Päivi	Assistant Researcher	Kumpula
Suomela, Jukka	Researcher	Kumpula
Suoranta,Sanna	Researcher	Otaniemi
Suvitaival, Tommi	Assistant Researcher	Otaniemi
Tapio, Juha-Matti	Research Assistant	Spektri
Tatti, Nikolaj	Researcher	Otaniemi
Tikka, Jarkko	Researcher	Otaniemi
Toivola, Janne	Assistant Researcher	Otaniemi
Toivonen, Aleksi	Research Assistant	Otaniemi
Toivonen, Hannu	Senior Researcher	Kumpula
Toivonen, Jarkko	Doctoral Student	Kumpula
Tonteri, Pekka	IT Specialist	Spektri
Tripathi, Abhishek	Researcher	Kumpula
Tuominen, Antti	Assistant Researcher	Kumpula
Turpeinen, Marko	Principal Scientist	Spektri
Turunen, Jani	Technical Expert	Spektri
Tuulos, Ville	Researcher	Kumpula
Törmä, Seppo	Postdoctoral Researcher	Otaniemi
Ukkonen, Antti	Researcher	Otaniemi
Ukkonen, Esko	Research Director	Kumpula

staff

Urtela, Mika	Assistant Researcher	Kumpula
Wahlström, Mikael	Researcher	Spektri
Vainio, Niklas	Researcher	Spektri
Vaismaa, Elina	Coordinator	Spektri
Wan,Tao	Research Assistant	Otaniemi
Varjonen, Samu	Researcher	Spektri
Wessman, Jaana	Doctoral Student	Kumpula
Wettig, Johannes	Doctoral Student	Kumpula
Vihavainen, Sami	Researcher	Spektri
Vikman, Juho	Assistant Researcher	Kumpula
Vikman, Veli-Matti	Research Assistant	Spektri
Virolainen, Antti	Research Assistant	Otaniemi
Virtanen, Esa	Research Assistant	Otaniemi
Virtanen, Perttu	Coordinator	Spektri
Virtanen, Seppo	Assistant Researcher	Otaniemi
Visala, Kari	Researcher	Spektri
Vorobyeva, Ekaterina	Researcher	Spektri
Vuokko, Niko	Researcher	Otaniemi
Vähäkangas, Taneli	Researcher	Kumpula
Xiao, Xi	Research Assistant	Spektri
Xiao, Yu	Research Assistant	Spektri
Xie, Xiaolei	Research Assistant	Otaniemi
Ylä-Jääski, Antti	Professor	Otaniemi
Yrjänäinen, Sampo	Assistant Researcher	Kumpula
Yu, Huizhen	Researcher	Kumpula
Zhang, Kun	Postdoctoral Researcher	Kumpula
Zhang, Ruishan	Postdoctoral Researcher	Spektri
Zou, Yuan	Assistant Researcher	Kumpula
Åkerlund, Arto	Assistant Researcher	Kumpula

C - HIIT Review by the SAB

Helsinki Institute of Information Technology HIIT Review 26-28 May 2008

***Randy Katz**, University of California Berkeley (Editor)*
***Alberto Apostolico**, University of Padua*
***Christos Faloutsos**, Carnegie Mellon University*
***Bengt Jonsson**, Uppsala University*
***Martin Kersten**, CWI Amsterdam*
***Kari-Jouko Räihä**, Tampere University of Technology*
***Mart Saarma**, University of Helsinki Institute of Biotechnology*
***Angela Sasse**, University College London*
***Martin Vingron**, Max Planck Institute for Molecular Genetics Berlin*

Executive Summary

The Scientific Advisory Board (SAB) finds that the Helsinki Institute of Information Technology HIIT has emerged as a proven and effective center-based model for scientific innovation in computer science and its applications within the modern university. We were impressed with the Institute's cross-disciplinary research activities of computer science at the interface of the scientific and societal domains. In our view, the return on the Universities' investment justifies their joint funding and the complex institutional challenges that have been necessary to make the Institution a success.

Our key summary recommendations are:

1. The Institute should develop a strategic plan for the next ten years of its existence.
2. External communications and public relations should become a high priority in the near-term.
3. The existing management structure is working, but a new organization and leadership structure will likely be needed to take the Institute to its next level of development and achievement.

1. Introduction and Review Process

The Helsinki Institute of Technology HIIT, a joint research institute in computer science founded by the Helsinki Technical University (TKK) and the University of Helsinki (UH) in 1999, held its third Scientific Advisory Board meeting 26-28 May 2008. The SAB was constituted from international experts in the underlying technical areas of research expertise within the Institute, and its membership was expanded to address some shortcomings in its expertise encountered in the prior reviews of 2003 and 2004. The SAB reviewed the Institute's progress in terms of its organization, funding, and research achievements. Areas of review were based on four unifying programmatic themes: Probablistic Adaptive Systems (PAS), Algorithmic Data Analysis (ADA), Network Society (NS), and Future Internet (FI). The individual program leaders covered each program in an overview presentation, with supplementary short presentations highlighting group activities, and a poster session of individual researcher projects. The SAB met for three hours to draft its observations, findings, and recommendations, which were reported to the Vice Rectors of the sponsoring universities on the morning of the third day. The SAB report was briefed in an open session to interested members of the Institute for feedback, clarifications, and corrections.

2. Institute Assessment

Our summary assessment is that HIIT is a strong and rapidly growing research institute, with internationally recognized researchers. It enjoys an excellent level of funding, and is highly productive in its research output. The Institute's activities can be broadly grouped into two nicely balanced categories: (1) analytical techniques applied to a variety of scientific domains and (2) technology-developments coupled to empirical "in vivo" evaluations to assess the societal context. The high degree of cross-disciplinary research in many areas is impressive.

The level and integration of research activities since the last review is impressive. Clearly the Institute has left its adolescence, and is now developing into adulthood. The Institute's activities have reached a critical mass, and its cross-fertilization across disciplines yields increased visibility and attracts technical talent.

The amount and quality of the Institute's activities are comparable to those of the key information technology institutes throughout Europe, such as those that are the founding members of the European Consortium for Informatics and

Mathematics (ERCIM). In reality, HIIT is a more appropriate partner for ERCIM than VTT. This as a positive development, and indicates that HIIT stands among the first rank of such institutes within Europe.

HIIT offers a successful model for inter-university joint ventures in Finland and represents an effective organizational collaboration between TKK and UH. The Institute offers an intriguing model for how UH can collaborate with the newly forming Innovation University that will incorporate TKK in the near future.

3. Institute-wide Observations

3.1. Strategic Planning

We believe that the Institute must undertake a strategic planning exercise, to address the challenges and new opportunities it will face as it moves to its next stage of development. HIIT's success implies that it is likely to persist for many years to come, and now is the time to consider how it should develop from its current solid foundation. In formulating this plan, the Institute should identify its process for how to evolve its current portfolio of research projects, striking an appropriate balance between opportunistic research driven by funding consideration and new longer-term strategic directions driven by a clear scientific agenda.

A positive attribute of the Institute that has contributed to its success is its strong technical leaders for its programs. However, this makes the organization dangerously dependent on a small number of individuals. We are concerned about a lack of succession planning for senior program leaders. It is unclear how young researchers are being groomed to become leaders in their own right, leaving the organization fragile to the loss of key individuals. Succession planning is part of the process of become a maturing research enterprise, planning for a long term future.

While our sense is that Institute's age distribution is appropriately biased towards early career researchers, it is important that the Institute should track the age distribution of its technical staff as part of its assessment of the health of the Institute, and to identify candidates for future leadership.

We observe a surprising lack of women among those who presented to the SAB, suggesting that there are few women among the Institute's senior technical leadership. This is especially surprising given Scandinavia's justifiably

renowned record of gender equity in professional fields. The Institute should assess whether there is any inherent gender bias in the way it operates. Furthermore, providing enhanced technical opportunities for women should become a priority for the Institute.

As part of its planning exercise, the Institute leadership should consider the limiting factors in its size and organization. Is the Institute size and composition limited by management span of control? Or is research funding the limiting factor? What about space, or the ability to attract further technical talent to the Institute? Further, the process by which Programs, Groups, and individual Projects are assessed, old activities ended and new ones launched to evolve the Institute's research portfolio is unclear. While less pressing for a new Institute, this becomes a major issue for a mature and established research organization. It is particularly difficult to end activities that are no longer at the edge of the research frontier. Similarly, to foster new research directions, the Institute should have a process for determining new expertise and how to acquire it.

As a thought process, suppose that the Institute's strategic planning process identified parallel computing as important expertise to add to its portfolio of competences. How would this be acquired? Would it be developed from within the Institute's current staff? Or would it be attracted from activities at one of the sponsoring universities? Or perhaps a collaboration could be forged with other scientific activities within Finland, e.g., the national supercomputer center? Any strategic plan should also consider how new areas of research are to be funded. We can imagine two approaches:

1. by investing internal opportunity funds to start work in the new area, or
2. seeking external funding, and once secured, attract new researchers to work in that area.

3.2. Institute Visibility and Communications

The SAB notes that while HIIT's individual researchers are well known internationally, the Institute is not as internationally visible as it deserves to be. HIIT should consider how to craft a "corporate identity," and undertake a campaign to make HIIT better known internationally. This could take the form of an external communications program, generating press releases describing the Institute's research successes and placing general interest articles describing the Institute's projects in venues spanning from IEEE Spectrum or Communications of the ACM, to international newspapers like the Financial Times or The Economist. The Institute can join with any efforts by the Finnish government to publicize high technology in Finland to an international audience, to insure that the Institute is mentioned in any such campaign.

We understand that the Institute has recently hired a media communications professional. We strongly support the Institute's investment in this kind of professional expertise that can help raise the international recognition of the Institute.

Just as important is a program of internal communications, to enhance a sense among the staff of belonging to a world-class Institute. Institute management should carefully consider how all aspects of the Institute's activities can present a consistent image, even down to such subtle ideas of having a common poster and presentation format that prominently displays the HIIT logo.

The concept of the program appears to provide a useful tool for structuring the Institute's activities and communicating them to the outside world. The group level view is too complicated and fragmented for this purpose. However, in presenting the programmatic structure of the Institute, we continue to see the need for a clear, non-generic mission statement for the Institute and its constituent programs.

The Institute should put the posters of its individual investigator and small group research projects on line as part of its web site. It is a good idea to make these available before a review, and use events like external reviews to force posters to be updated. Putting this material on-line is an excellent way to make visible the broad and deep range of the Institute's research activities.

3.3. Assessing Impact

Research has "impact" if it is so important that others depend on it as the foundation to build on for their own success. This definition applies equally to conceptual and theoretical work as it does to engineering developments. While the Institute is justly proud of its record of high quality publications in selective venues, it should also report on its significant technical contributions in other forms.

For example, contributions to technical standards are an important kind of high impact activity for a technology-oriented institute. The development of useful software codes and tools, especially when these gain wide-acceptance outside of the Institute, is also important. Modern web technology makes it easy to track the number of downloads and their geographic spread. These should be tracked and reported to assess the influence of the Institute's software artifacts.

Since a major activity of the Institute is the training of young researchers, their careers should be tracked as well, with a particular focus on graduate stu-

dents, postdoctoral researchers, and junior researchers. Leaving the Institute and moving to other positions in Finland and internationally should be seen as marks of success. Similarly, as the Institute attracts increasing numbers of international students, postdoctoral researchers, and research visitors, this will be a sign of its growing international reputation.

3.4. A Better Accounting

To insure an adequate in depth assessment of the Institute, it is important that clear and precise information be provided to the SAB. Since we consider the training of students to be an important metric of the Institute's success, it is particularly important to distinguish between research staff and actual graduate students working in the Institute towards their advanced degrees. We understand that this is not a simple request—a high percentage of the Institute's staff believes they are working towards an advanced degree. However, it is important to distinguish among them those making true progress towards their degree goals, and to report these numbers.

The increasing numbers of Ph.D.s granted to students affiliated with the Institute since the last review is a positive development. Nevertheless, given the facilities and concentration of excellent researchers within the Institute, we expect even higher levels of production of advanced degree holders, and will expect evidence of this in future reviews.

The introduction of a program-oriented structure providing greater internal visibility to budget issues is also a positive development. Nevertheless, we understand that most of the Institute's funding is associated with specific projects and is allocated to groups. It would have been useful for the SAB to see how the University's funding—presumably the most flexible—is being allocated as opportunity funds to support new activities.

3.5. Comments on the Review Process

The organization of the review of the Institute's research programs could be improved. During this review, the focus on the high-level programmatic view, juxtaposed with the detailed individual researcher poster prospective, misses the important group and projectoriented view. The latter level of review is particularly important, because research groups are were the detailed technical work is performed.

We understand that it is difficult to review all of the Institute's research in a relatively small amount of time. One alternative is to reserve the first day of the

review for overview and highlight talks, and to split up the committee to permit parallel detailed reviews at the group-level on the second day. Alternatively, a review schedule can be developed so that programs are evaluated, down to the group level, once every other year. This would allow, for example, two programs to be reviewed in detail every other year.

3.6. Comments on the Poster Sessions

We were impressed with the enthusiasm of the poster presenters, their ability to describe their technical work, and their diversity, particularly in terms of the number of women and foreign researchers associated with the Institute. The marked increase in the number of foreign graduate students compared with the 2004 review reflects the growing international reputation of the Institute and its senior researchers. The project demonstrations were also very impressive.

3.7. Institute Funding Profile

The increase in and diversity of the Institute's funding sources is an excellent development. The Institute is doing well in competitive research programs, and its core expertise makes it a highly sought partner for proposals in response to funding opportunities. This success in winning external funding is another healthy sign of the rising reputation of the Institute and its senior researchers.

The diversity of funding sources—University, Finnish Academy, Tekes, Industrial, and European Union—makes the Institute reasonably resilient to shifts in funding. Less clear is the implications of this funding profile for the mix of basic versus directed research conducted within the Institute. We suspect this is not uniform over all programs and groups within the Institute. A focus on too many short term funding opportunities could compromise the longer term scientific vision of the Institute. In particular, more information should be provided on how University funding used to seed new opportunities.

4. Program Observations

4.1. Probabilistic Adaptive Systems

In this program, we assess the Institute's activities as excellent. The groups have a strong publication record, and its researchers have assumed important leadership and organizational positions within their technical fields. The Neuroinformatics Group is very strong, with an established track record in Independent Component Analysis (ICA). Its new direction of using ICA for causality

is very promising. The Statistical Machine Learning and Bioinformatics group provides an excellent linkage between the PAS and ADA programs.
Despite this obvious excellence, we are motivated to ask the question, “What is the Helsinki school of PAS?” This is to encourage the Institute to articulate its particular strengths and unique approaches to research in this area. The mission statement for this program is too generic, and needs better focus. There are a large number of groups working under this program, and the overarching research themes and how they interrelate was not adequately clarified.

In our own view, the Institute’s strength is in its approaches to modeling sources. The use and extension of MDL is a critical underlying thread being leveraged by the research groups. MDL is a critical enabler and is particularly appropriate as a distinguisher, as it solves many of the general problems faced by machine learning efforts.

Given the strength of the program, we were surprised that it has produced so few Ph.D.s over the last six years. However, we were pleased to learn that there are several students likely to emerge from the Ph.D. pipeline in the near future. We are concerned about the detachment of Henry Tirri and the departure of Wray Buntine, who were formerly leading figures in this program. What new technical leaders are emerging? How are the topic areas evolving under their leadership? For example, we see the winding down of the information retrieval activities is clear and appropriate, with the build up of other activities. The strategic direction of this program was left unclear.

4.2. Algorithmic Data Analysis

This program has one of the clearer mission statements: “Useful data analysis methods for other sciences and industry.” Nevertheless, we ask the question “What is the Helsinki school of ADA?” in an effort to understand how the Institute perceives its unique strengths and intellectual approach. In our view, the program’s key focus is its work in algorithmic pattern extraction and combinatorial matching. The program’s methodological approach is to formulate computational concepts in strong collaboration with domain experts. This is an excellent example of deeply mathematically-based yet “use-inspired” research.

This world-class program is under the leadership of a widely recognized scientific leader. It is successful in attracting large number of postdocs, which helps it scale the research effort. Its diverse sources of external funding indicate the quality of its scientific activities. The collaboration with domain experts is impressive, and provides further evidence of the impact and usefulness of the algorithms being developed.

We applaud this outward focus, seeking inspiration from application domains to derive and study important computational primitives. This is all too uncommon in the computing field. Nevertheless, we feel that there are some potential opportunities in computer science that are being overlooked. One research direction is to develop a methodology for evaluating whether algorithms are the "best possible" for the job, perhaps identifying unifying underlying principles that could drive new algorithm development. Another research opportunity is to investigate how the algorithms can be parallelized to address the issues of scaling to much larger data sets.

4.3. Network Society

We find that the work in this area has improved. It is distinguished by a considerably more disciplined approach than that which we encountered in our 2004 review. This program has a good mission statement, and its focus on "end-to-end research" is appropriate. It has developed a solid track record of success. The number and quality of publications is excellent, and its work is appearing in the best venues for user interface and computer-human interaction research. The collaboration with industry and its sponsorship is excellent, and indicates the strong attraction of the research program. The involvement of legal and economic expertise in the program's projects is a positive development.

We were impressed by the demonstrations, but the presenters were generally unable to clarify how their efforts contributed to the larger scientific vision of the program. New researchers, who were not intimately familiar with the work they were presenting, presented several of the demonstrations. Sometimes they were unaware of the related literature. We suspect that this is a program undergoing a transition, with some turnover of the research staff. Furthermore, the demonstration-driven nature of the work gives the appearance of being driven either by the sponsor who provides funding or by the desire to develop and apply a new technology. Research of this kind should also make use of a user-centered design methodology.

4.4. Future Internet

The Future Internet program has a strong and well-established reputation in network transport, host mobility, and security based on host identity. It contributes strongly to the international reputation of the Institute.

The presentation of research within the program by lines (or themes) was not particularly effective. Specific projects are associated with funding, and groups

are collections of researchers under the direction of a technical leader. Lines are essentially functional crosscuts; in the case of the Future Internet program, these are described as transport, mobility, energy, and security/privacy. To us, it was unclear how lines are mapped onto the groups that will do the actual research work. A great strength of the Institute is its ability to deploy testbeds for experimentation. A missed opportunity is to exploit the "living laboratories" of the Network Society Program for testbeds in which to pursue Future Internet research. This is an essential way for the Institute to distinguish itself from other Future Internet efforts.

The criterion for clustering groups into programs was never clearly articulated. We could well imagine that the security work presented under Future Internet could be comfortably performed within the context of the Networked Society program. Many of the security/privacy issues faced by current and future networks are more a question of usability and user-centered design, rather than focused on new technology development. The Future Internet program strikes us as one that is in transition, with a reorganization that is still in progress, and for which new research directions are yet to be determined.

We are concerned that the proposed future directions have the appearance of being evolutionary rather than revolutionary. Since "Future Internet" is such an internationally competitive activity, it is critical for the Institute that a unique and important direction be identified for the program. A large management group—perhaps too large—is trying to chart these next steps. We suggest that a smaller, more focused group might be more prudent.

5. Responsiveness to Last Review

The Summary Recommendation from the 2004 Review was as follows: "Move the Institute's governance model towards a truly joint venture with joint vision and mission statement that spans the independent units of the Institute. Establish transparent funding and accountability procedures under the leadership of a single director with an institute-wide budget that s/he can use to successfully direct the research in order to achieve the goals of the joint vision."

In May 2008, we find that this Institute is more integrated and communication that integration much better than in the 2004 review. The mission statements have improved, but some tuning is still needed. The dual-directorship structure appears to be working effectively. Furthermore, the steering/management group structure does enhance budgetary transparency, but we would have liked to understand in more detail how opportunity funds are being directed within the Institute.

6. Summary and Conclusions

The Helsinki Institute of Information Technology has emerged as a proven and effective model for organizing a center for scientific innovation within the modern university. The Institute exhibits impressive cross-disciplinary research of computer science with the other scientific as well as societal domains. In our opinion, the return on the Universities' investments—in terms of world-class research, impact, and success in external funding— justifies the joint funding and the institutional challenges that were necessary to make the
Institute a success.

Our Key Summary Recommendations are the following:

1. **Develop a strategic research plan for the next ten years of Institute's existence.**
2. **Improve external communications and public relations to raise the visibility and awareness of the Institute in the near-term.**
3. **Carefully consider changes to the existing Institute management structure, as generally it appears to be working well.**

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