Aalto University

UNIVERSITY OF HELSINKI

HELSINKI INSTITUTE FOR INFORMATION TECHNOLOGY

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

Helsinki Institute for Information Technology HIIT is a joint research institute of Aalto University and the University of Helsinki for basic and applied 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 works in a multi-disciplinary way, with scientists from computer, natural, behavioural and social sciences, as well as from humanities and design. The projects are conducted in collaboration with universities, companies and research institutions. HIIT employs around 200 researchers.

www.hiit.fi

Bingham, Lindén (eds.): HIIT Annual Report 2010

Helsinki Institute for Information Technology HIIT

Annual Report 2010

Ella Bingham, Greger Lindén (eds.)

Helsinki Institute for Information Technology HIIT

Annual Report 2010

Ella Bingham, Greger Lindén (eds.)

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Cover photo by Janne Ahvo. In the photo, Mikko Pervilä is working on the roof on the ”Running servers around zero degrees” project. More info at http://www.cs.helsinki.fi/group/greenict/
Lay-out: Anna Bergman

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1 Review of Year 2010

The statutes of HIIT were reformed and a new Director was selected, paving the way for long-term strategic planning. The daily life of many HIIT researchers was facilitated as offices in the Spektri site were moved towards Otaniemi campus – a change suggested in previous research evaluations.

HIIT has reached a mature level in volume. The base funding from each parent university has stabilized on the level of about one million euro each. The total budget of HIIT is about 12 million euro and the number of person-years is 175.

Research activities

HIIT continues to have a good presence in the EU Framework Programme for Research as well as in the Finnish ICT SHOK. HIIT is actively participating in EIT ICT Labs in which former HIIT Director, Professor Martti Mäntylä is the CSO, Professor Marko Turpeinen of HIIT is Helsinki Node Director, interim HIIT director Docent Patrik Floréen was Node Manager in 2010, and several HIIT researchers have research projects. HIIT's continuing collaboration with University of California at Berkeley and International Computer Science Institute (ICSI) in Berkeley are strong samples of HIIT's international research collaboration portfolio.

Projects supported by the Academy of Finland and Tekes are important for HIIT. The Finnish Center of Excellence in Algorithmic Data Analysis Research (Algodan) forms the majority of HIIT's Algorithmic Data Analysis (ADA) programme. ADA also contributes to another Center of Excellence, namely Adaptive Informatics Research Centre (AIRC), whose period lasts until the end of 2011. During 2010, HIIT researchers successfully submitted proposals for new Finnish Centers of Excellence – during the period 2012-2017 HIIT will contribute to 3 Centers in addition to Algodan: Finnish Centre of Excellence in Computational Inference Research (COIN), Finnish Centre of Excellence in Inverse Problems Research, and Finnish Centre of Excellence in Cancer Genetics Research.

Professor Aapo Hyvärinen, a group leader at HIIT, was listed as a Highly Cited Researcher 2010 in ISI Web of Science. Several HIIT researchers received Best Paper Awards in high-level scientific conferences, as always.

HIIT researchers organized several international conferences in 2010: 8th International Conference on Pervasive Computing (Pervasive), Logics in Artificial Intelligence – 12th European Conference (JELIA), 5th European Workshop on Probabilistic Graphical Models (PGM), IEEE International Workshop on Machine Learning for Signal Processing (MLSP), and Minisymposium on Design Theory at the SIAM Conference on Discrete Mathematics (SDM).

Doctoral studies

HIIT coordinates two national doctoral programmes: Finnish Doctoral Programme in Computational Science FICS (directed by Professor Samuel Kaski) and Future Internet Graduate School FIGS (directed by Professor Martti Mäntylä).

10 HIIT researchers got their PhD during the year. Petri Kontkanen received an honorable mention for the second best Ph.D. thesis for the international Classification Society Distinguished Dissertation Award of 2010. Pauli Miettinen received a Certificate of Recognition for ACM SIGKDD Doctoral Dissertation Award 2010.

Organizational changes

In the beginning of 2010, the institute operated at three locations: Kumpula (UH campus), Otaniemi (Aalto University campus) and in Spektri Business Park. During year 2010, Spektri site was relocated to Otaniemi campus, a change welcomed by both HIIT's personnel and collaborators.

A new long-term Director was appointed for HIIT. Professor Samuel Kaski started on August 1, 2010, for a five-year period. Docent Patrik Floréen served as Director during an interim period 15 November 2009 – 31 July 2010, following HIIT's previous Director, Professor Heikki Mannila who was elected Vice President of Aalto University in autumn 2009. During the first half of 2010, HIIT's statutes were reformed and the selection process of a new Director was carefully carried out. Similarly, a new Board was selected for the period starting on August 1, 2010.

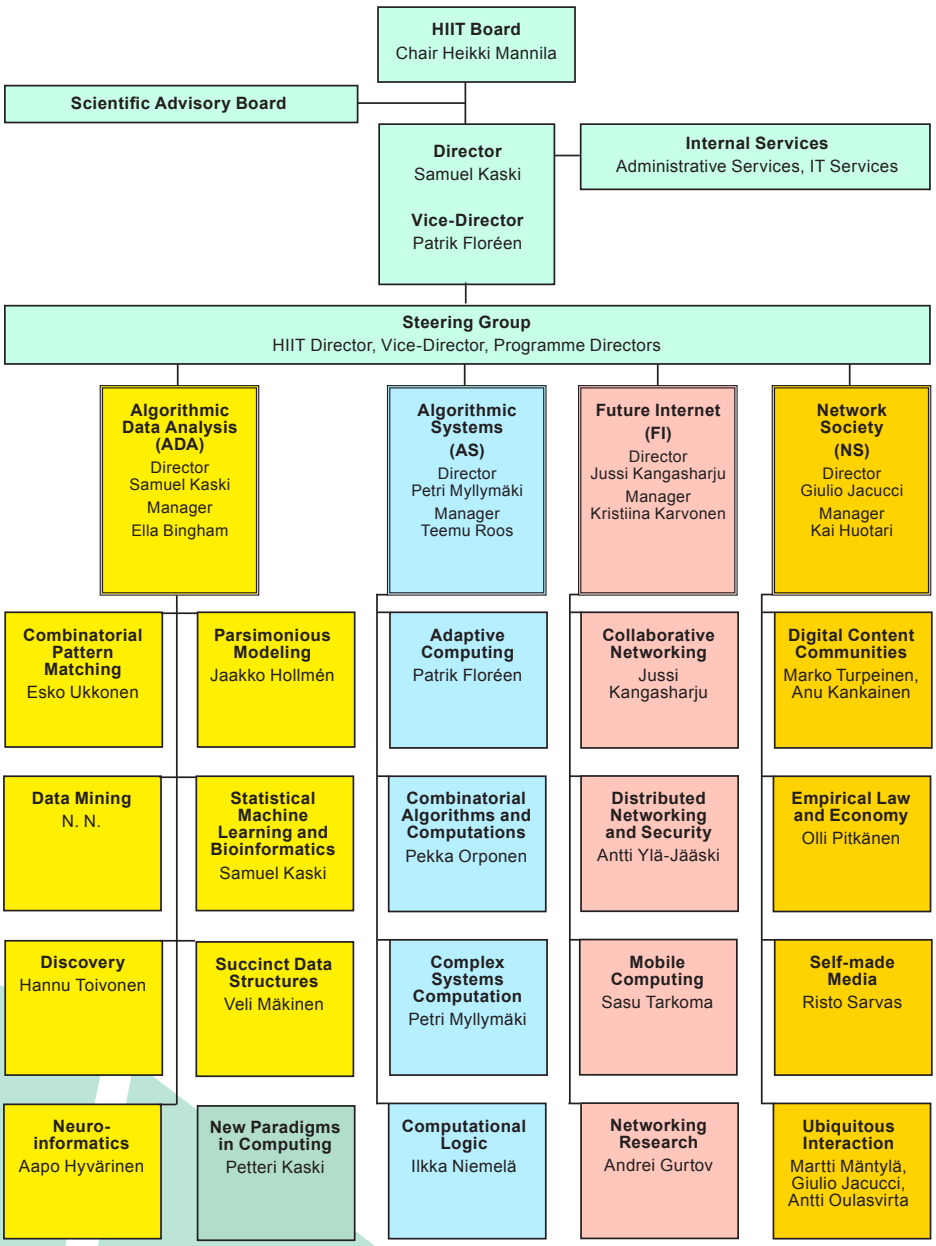
HIIT in brief

Helsinki Institute for Information Technology HIIT is a joint research institute of Aalto University and the University of Helsinki for basic and applied research in information technology. Its research ranges from fundamental methods and technologies to novel applications and their impact on people and society. HIIT is now in its eleventh year of operation with a budget of about 12 million euro, realising about 200 person-years of work. The research by HIIT has been assessed and deemed excellent by its Scientific Advisory Board in 2008 and in the Aalto University Research Assessment Exercise in 2009.

Total numbers	2008	2009	2010
Funding M€	8.6	9.0	12.1
External/competitive funding	76%	71%	83%
Person-years	165	185	175
Refereed publications	209	184	223

HIIT in Figures 2008-2010. Funding of HIIT has increased significantly, in part due to two Academy of Finland's doctoral programmes which are coordinated at HIIT, and in part due to changes in accounting procedures of the mother universities. Comparison between different years is thus difficult.

Helsinki Institute for Information Technology HIIT



2 Reseach

2.1 Algorithmic Data Analysis (ADA)

The mission of the Algorithmic Data Analysis research programme at 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.

Examples of research challenges

- 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.
- 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.
- 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.
- 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.
- Succinct Data Structures. The study of succinct data structures extends traditional data compression with the functionality preserving property: data structure functions need to be efficiently computable directly from the com-

pressed representation. Applications are sought mainly in bioinformatics, especially to the new challenges set by next-generation sequencing technologies.

Research groups

Combinatorial Pattern Matching, Professor Esko Ukkonen

Data Mining: Theory and Applications, N.N.

Discovery Group, Professor Hannu Toivonen

Neuroinformatics, Professor Aapo Hyvärinen

Parsimonious Modelling, Chief Research Scientist Jaakko Hollmén

Statistical Machine Learning and Bioinformatics, Professor Samuel Kaski

Succinct Data Structures, Professor Veli Mäkinen

Research projects

- aivoAALTO / Samuel Kaski
- MultiBio: Computational Data Fusion of Multiple Biological Information Sources and Background Data / Samuel Kaski
- ESO: European Southern Observatory Collaboration / Esko Ukkonen
- FICS: Finnish Doctoral Programme in Computational Sciences / Samuel Kaski
- ISMO MIDE: Intelligent Structural Health Monitoring System / Jaakko Hollmen
- COGSTATE: Learning User State for Cognitive User Interfaces / Samuel Kaski
- MIFSAS: Multidimensional Information Fusion and Data Mining in Situation Awareness Systems / Esko Ukkonen
- DIEM MMR: Multimodal Mixed Reality / Samuel Kaski
- PinView: Personal Information Navigator Adapting Through Viewing / Samuel Kaski
- MIDE UI-ART: Urban Contextual Information Interfaces with Multimodal Augmented Reality / Samuel Kaski

- VisMaster CA / Heikki Mannila, Kai Puolamäki
- Whole Genome Association Analysis Strategies for Multiple Phenotypes / Heikki Mannila, Mikko Koivisto

Programme management

Programme Director:
Professor Samuel Kaski

Programme Manager:
Dr Ella Bingham

Programme Management Group

N.N.
Dr Jaakko Hollmén
Professor Aapo Hyvärinen
Professor Samuel Kaski
Professor Hannu Toivonen
Professor Esko Ukkonen
Professor Veli Mäkinen

2.2 Algorithmic Systems (AS)

The Algorithmic Systems research programme aims at finding algorithmic solutions for science and society, and with this target in mind, the goal is to study the theory and practice of modelling, designing and managing complex systems. The work has a strong basic research component that intersects artificial intelligence, machine learning, theoretical computer science, information theory and mathematical statistics, and the results of this methodological work are applied to both scientific and industrial applications.

Methodological approaches

- Theoretical frameworks for probabilistic modeling. Development of computationally efficient, general-purpose methods for probabilistic modeling, focusing on issues related to model selection, parameter estimation and inference.
- Real-time optimization. Approximate but fast inference methods combining deterministic and stochastic techniques.
- Methods for data fusion. Probabilistic models for combining inputs originating from heterogeneous data sources.
- Intelligent information access. Solutions to information retrieval tasks appearing in ubiquitous environments.
- User modeling. Methods for personalization, profiling, segmentation and visualization.

Research groups

Adaptive Computing, Docent Patrik Floréen

Combinatorial Algorithms and Computation, Professor Pekka Orponen

Complex Systems Computation (CoSCo), Professor Petri Myllymäki

Computational Logic, Professor Ilkka Niemelä

Research projects

- Modest: Applications of the MDL Principle to Prediction and Model Selection and Testing / Petri Myllymäki
- STAM: Algorithmic Methods in Stemmatology / Teemu Roos
- VISCI: Virtual Intelligent Space for Collaborative Innovation / Petri Myllymäki, Patrik Floréen
- AICA: Adaptive Interfaces for Consumer Applications / Patrik Floréen, Petri Myllymäki
- LUCRE: Local and User-Created Services; as part of the Flexible Services programme of the ICT SHOK* / Patrik Floréen
- Online Optimisation and Production Planning / Pekka Orponen
- Algorithmics for Data Security / Pekka Orponen
- MCM: Methods for Constructing and Solving Large Constraint Models / Ilkka Niemelä
- StMcDes: Symbolic Testing and Model Checking of Distributed Embedded Systems / Ilkka Niemelä)
- MODSAFE: Model-Based Satefy Evaluation of Automation Systems / Ilkka Niemelä
- LIME2: Light-Weight Formal Methods for Distributed Component-Based Embedded Systems / Ilkka Niemelä
- Online Optimization in Robust Production Planning / Pekka Orponen

Programme management

Programme Director:
Professor Petri Myllymäki

Programme Manager:
Dr Teemu Roos

Programme Management Group:

Docent Patrik Floréen
Professor Petri Myllymäki
Professor Ilkka Niemelä
Professor Pekka Orponen

2.3. Future Internet (FI)

The vision of the Future Internet research programme is that the Internet will become a mission critical backbone of global information society with billions of mobile and wire line users instantly connected to information and each other, and using the Internet to communicate, conduct business, manage their everyday lives, express themselves, and enjoy entertainment.

The objective is to develop concepts, technologies, and supporting theories and methodologies needed to design and implement future 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 network architecture concepts and mechanisms, in particular information-centric network approaches and post-IP networking architectures. The solutions are applied not only in traditional wireline networks, but also in wireless and pervasive environments, addressing the specific needs of those scenarios.

Research Groups

Collaborative Networking, Professor Jussi Kangasharju

Distributed Networking and Security, Professor Antti Ylä-Jääski

Mobile Computing, Professor Sasu Tarkoma

Networking Research, Professor Andrei Gurtov

Research Projects

- CuteHIP / Andrei Gurtov
- DAAD: Security and Privacy for Mobile Users in Decentralized Collaborative Wi-Fi, Networks / Andrei Gurtov
- FICNIA: Finland-ICSI Center for Novel Internet Architectures / Jussi Kangasharju, Kristiina Karvonen
- GOODNET: Control and care in risk-aware networking / Jukka Manner
- ICT SHOK FI / Patrik Floréen, Kristiina Karvonen
- ICT SHOK FI/ Antti Ylä-Jääski
- ICT SHOK 2: Future Internet Programme / Jussi Kangasharju
- FIGS: Future Internet Graduate School / Martti Mäntylä
- IPOS: Information Processing in Overlay Systems / Sasu Tarkoma
- Hierarchical HIP / Andrei Gurtov
- NordicHIP / Andrei Gurtov, Antti Ylä-Jääski
- OtaSizzle / Antti Ylä-Jääski
- PSIRP: Publish-Subscribe Internet Routing Paradigm / Arto Karila
- Pursuit / Arto Karila
- SPEAR: Secure Peer-to-Peer Services Overlay Architecture / Andrei Gurtov
- WISEciti: Wireless Community Services for Mobile Citizens Project / Markku Kojo, Andrei Gurtov
- WiSh: Widget Sharing / Kristiina Karvonen, Patrik Floréen

Programme management

Programme Director:
Professor Jussi Kangasharju

Programme Manager:
Dr Kristiina Karvonen

Programme Management Group:

Professor Tuomas Aura
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
Professor Sasu Tarkoma
Professor Antti Ylä-Jääski

2.4 Network Society (NS)

The mission of Network Society research programme is to *empower ubiquitous users with transparent and resourceful ICT.*

Examples of Research Challenges

- Maximum User Performance in Mobile Interaction: Numerous factors limit the mobile user's ability to interact efficiently with a mobile device. We are interested in exposing these factors through controlled experimentation and developing interaction techniques and methods that improve user performance.
- Engaging and Embodied Interaction Across Modalities: Developing techniques and interactive systems utilising implicit and explicit interaction to foster co-experience, learning, physical and creative activity. This research is carried out by coupling in-depth user studies with design in the area of novel interfaces.
- Service design, Media Experience and Media Crowdsourcing: theories and methodologies for user-centered service design, understanding of critical elements of media experience (e.g. playfulness and co-experience) through user research, laboratory experiments, and explorative designs. Media crowdsourcing: co-creativity in digital content creation, optimisation of crowdsourcing tasks, creation of applications and games that utilise/produce metadata and media.
- Analysing Actors and their Agencies in ICT environments: with special focus on infrastructures, use practices, stakeholders, business models, and other agencies shaping and affecting ICT technology. The goal of this analysis is to provide for socially sustainable design spaces, taking especially issues of privacy, societal tensions, values, and user involvement into account.
- Virtual Economy and Empirical Law: to understand virtual value exchanges and to make a significant scientific and societal impact beyond virtual worlds on other services. Based on sound jurisprudential and empirical methods in co-operation with other disciplines, make a significant scientific and societal impact on legal framework of ICT.

Research Groups

Digital Content Communities, Professor Marko Turpeinen, Dr Anu Kankainen

Empirical Law and Economy, Dr Olli Pitkänen

Self-Made Media, Dr Risto Sarvas

Ubiquitous Interaction, Dr Antti Oulasvirta, Professor Giulio Jacucci, Professor Martti Mäntylä

Research Projects

- 3DGIS: Economy and technology of a global peer produced 3D geographical information systems in built environment / Martti Mäntylä, Antti Nurminen
- AICA: Adaptive Interfaces for Consumer Applications / Marko Turpeinen, Antti Oulasvirta
- AMOVEO: Work Practises and the Transition to Ubicomp / Antti Oulasvirta
- ARMS: Acquisition, Retention and Monetisation Strategies in Virtual Social Spaces / Kai Huotari
- AVEA: Advanced Virtual Economy Applications / Kai Huotari
- BeAware: Boosting Energy Awareness with Adaptive Real-Time Environments / Giulio Jacucci
- CALLAS: Conveying Affectiveness Leading-edge Living Adaptive Systems / Giulio Jacucci
- CEED: The Collective Experience of Emphathic Data Systems / Giulio Jacucci
- DCM: Digital Content Marketing / Olli Pitkänen
- Emokeitai / Kai Kuikkaniemi
- eXdesign: Extreme Design / Anu Kankainen
- Ganzheit / Antti Nurminen
- GAS: Games as Service / Marko Turpeinen, Kai Kuikkaniemi
- GNS: Global Network Society / Pekka Himanen
- HPE: Helsinki Privacy Experiment / Antti Oulasvirta

- Hydrosys: Advanced Spatial Analysis Tools for On-site Environmental Monitoring and Management / Antti Nurminen
- Innoguard: Detecting Patented Software / Perttu Virtanen
- Interruptions / Antti Oulasvirta
- IPCity / Ann Morrison
- KASI: Future Information Security Trends / Olli Pitkänen
- LUCRE: Local and User-Created Services / Antti Oulasvirta
- LUTUS: Creative Practices in Product Design / Lassi Liikkanen
- Marcus / Ann Morrison
- Mobile City Moments / Risto Sarvas
- Musiquitous / Lassi Liikkanen
- NextMedia / Marko Turpeinen, Anu Kankainen
- Non-use / Antti Salovaara
- OtaSizzle: Ubiquitous Social Media for Urban Communities / Olli Pitkänen
- P&P: Privacy/Publicity / Risto Sarvas
- POSSI: User-Driven Publicity and Privacy in Mobile Online Social Interaction / Olli Pitkänen
- Prodigy / Marko Turpeinen
- S3: Screen x Space x Social Activity / Kai Kuikkaniemi
- Social video / Anu Kankainen
- THESEUS / Antti Oulasvirta
- UDOI BOOSTER: Flexible services / Olli Pitkänen
- YLE Social Video / Marko Turpeinen, Anu Kankainen

Programme management

Programme Director:
Professor Giulio Jacucci

Programme Manager:
MSc Kai Huotari

Programme Management Group:

Professor Giulio Jacucci
Dr Anu Kankainen
Professor Martti Mäntylä
Dr Antti Oulasvirta
Dr Olli Pitkänen
Dr Risto Sarvas
Professor Marko Turpeinen

2.5 New Paradigms in Computing (NPC)

The New Paradigms in Computing research group performs basic research at the intersection of core computer science (algorithm design and analysis) and discrete mathematics, with an emphasis towards novel techniques and less studied models of computation.

The group invests substantial effort to high-risk, high-yield research problems of relatively broad theoretical interest, selected on both problem and method driven basis. However, it also aims at rapid publication of more specific, smaller observations. It particularly seeks and values solid results with mathematical elegance and simplicity.

Research challenges:

- Exploring the interplay between algebraic, combinatorial and geometric techniques in the design of exact deterministic algorithms. For example, many combinatorial problems can be cast in algebraic form, whereby a non-trivial algebraic algorithm yields a more efficient solution compared with direct combinatorial tools.
- Restricted models of computation and tradeoffs in resources and/or objectives. For example, one fundamental limitation in modern large-scale distributed systems is the infeasibility of central control. In practice, the system must be operated by a distributed algorithm in which each computational node operates based on the information available in its local neighbourhood only. Assuming this setting, is it possible to achieve globally optimal or near-optimal operation? What is the tradeoff between the available information and the degree of approximation for the optimum?
- While it is a theory group, the group occasionally engages in practical algorithm implementation. Examples include attacks on combinatorial classification problems and applications in computational geometry (e.g. air traffic management).

Research Projects:

- ADA-BRA: Algorithmics in Data Analysis: Basic Research and Applications / Mikko Koivisto
- PAHA: Local Distributed Algorithms / Jukka Suomela

Group leader:
Dr. Petteri Kaski

Group members:

Dr Petteri Kaski
Dr Mikko Koivisto
Dr Valentin Polishchuk
Dr Jukka Suomela

3 Research training and research visits

10 HIIT researchers defended their doctoral theses in 2010. In addition, 33 Master's theses were either written or instructed by HIIT researchers. A full list is given in Appendix A.

3.1 Post-graduate courses arranged by HIIT

HIIT researchers gave several under-graduate and post-graduate courses in 2010; for brevity we only list post-graduate courses here.

Spring 2010 courses:

Deterministic Distributed Algorithms (J.Suomela)

Mobile Middleware (S. Tarkoma)

Probabilistic Models (H. Yu)

Unsupervised Machine Learning (A. Hyvärinen)

Käytettävyyden arviointi (A. Oulasvirta)

PhD Student Seminar (J. Kangasharju)

Advanced Course in Computational Logic (I. Niemelä)

Graph Theory (P. Orponen)

Postgraduate Course in Theoretical Computer Science (I. Niemelä)

Research Course in Theoretical Computer Science (P. Kaski)

High-Throughput Bioinformatics (J. Salojärvi)

Machine Learning: Advanced Probabilistic Methods (J. Hollmen)

Special Course in Computer and Information Science (S. Hanhijärvi, J. Lijffijt)

Special course in Pub-Sub Internetworking (A. Karila)

Seminar on Internetworking (A. Ylä-Jääski)

Internet and Computing Forum (A. Ylä-Jääski)

Special Assignment in Datacommunications Software (A. Ylä-Jääski)

Special Assignment in Information Security (A. Ylä-Jääski, S. Tarkoma)
Internet Technologies for Mobile Computing (S. Tarkoma)
Information Security and Usability (K. Karvonen)

Fall 2010 courses:

BrowserSocket CodeCamp (S. Tarkoma)
Computational Genotype Analysis (M. Koivisto)
Distributed Systems (J. Kangasharju)
PhD Student Seminar (J. Kangasharju)
Seminar: Advanced Topics in Interactive Systems (G. Jacucci)
Algorithms for Bioinformatics (V. Mäkinen)
Design and Analysis of Algorithms (V. Polishchuk)
Elements of Bioinformatics (V. Mäkinen)
Introduction to Machine Learning (P. Hoyer)
Overlay and P2P Networks (S. Tarkoma)
Computational Complexity Theory (I. Niemelä)
Individual Studies (P. Orponen)
Advanced Course in Computational Logic (I. Niemelä)
Algorithmic Methods of Data MIning (P. Papapetrou)
Special Course in Computer and Information Science (A. Klami, J. Peltonen)
Special Assignment in Datacommunications Software (A. Ylä-Jääski)
Special Assignment in Information Security (A. Ylä-Jääski, S. Tarkoma)

3.2 Research visits

Research visits of 1 week or longer are listed here.

Visits to HIIT:

Bulling, Andreas, PhD
ETH Zurich, Switzerland,
1 week

Campi, Cristina, PhD
Postdoctoral Researcher,
1 year

Claude, Francisco
University of Waterloo,
Ontario, Canada,
2 weeks

Denecker, Marc, Professor
Katholieke Universiteit Leuven,
Belgium,
1 week

Garriga, Gemma, PhD
INRIA, France,
2 weeks

Gebser, Martin, MSc
University of Potsdam,
Germany,
1 week

Georgii, Elisabeth, PhD
Max Planck Institute for
Biological Cybernetics,
1 year

Gudes, Ehud, Professor
Ben-Gurion University, Israel,
2 weeks

Göbel, Vera, Professor
University of Oslo,
1 month

Gönen, Mehmet, PhD
Boğaziçi University,
5 months

Hirayama, Jun-ichiro, PhD
University of Kyoto, Japan,
1 year

Kahl, Gerrit
German Research Center for
Artificial Intelligence, Saarbruecken,
Germany,
2 weeks

Koetter, Tobias
University of Constance, Germany,
1 week

Laparra, Valero
Universitat de Valencia, Spain,
2 months

Li, Jiuyong, Assoc. Professor
University of South Australia,
2 months

de Luca, Alexander
Ludwig-Maximilians-Universität
München, Germany,
1 week

Orlitsky, Alon, Professor
University of California at
San Diego, CA, USA,
1 week

O'Sullivan, Joseph, Professor
Washington University at St. Louis,
MO, USA,
1 week

Petrosjan, Leon, Professor
Saint-Petersburg State University, Russia,
1 week

Plagemann, Thomas, Professor
University of Oslo,
1 month

Rissanen, Jorma,
Professor Emeritus
HIIT Fellow,
1 week

Rodriguez, Juan
University of the Basque Country, Spain,
3 months

Sasaki, Hiroaki
Riken Brain Science Institute, Tokyo, Japan,
3 months

Sgualdino, Laura (artist Puni)
Independent Italian artist,
4 months

Tompits, Hans, Professor
Vienna University of Technology, Austria,
1 week

Vergassola, Massimo, PhD
Institut Pasteur, France,
1 week

Woltran, Stefan, Dr
Vienna University of Technology, Austria,
1 week

Yamabe, Tetsuo
Waseda University, Jalan,
9 months

Yamanishi, Kenji, Professor
University of Tokyo, Japan,
1 week

Yong, Cui, Professor
University of Tsinghua,
1 month

Visits from HIIT:

Bergström-Lehtovirta, Joanna
University of Glasgow, UK,
3 months

Bhattacharya, Sourav
Aarhus University, Denmark,
2 months

Forsblom, Andreas
DFKI Saarbrucken, Germany,
2 months

Hietanen, Herkko
Massachusetts Institute of Technology (MIT), USA,
10 months;
Harvard University, USA,
10 months

Honkela, Antti
University of Manchester, UK,
7 months;
University of Glasgow, UK,
1 week

Hoyer, Patrik
Massachusetts Institute of Technology (MIT), USA,
5 months

Huotari, Kai
UC Berkeley, USA,
12 months

Hyvärinen, Aapo
Gatsby Computational Neuroscience Unit, UCL, London, UK,
2 weeks

Janhunen, Tomi
Vienna University of Technology, Austria,
1 week

Kaski, Petteri
Monash University, Melbourne, Australia,
2 weeks;
The Australian National University, Canberra, Australia,
4 weeks

Komu, Miika
Tsinghua University,
2 weeks

Kuikkaniemi, Kai
UC Berkeley, USA,
6 months

Kuptsov, Dmitriy
International Computer Science Institute, Berkeley, USA,
4 months

Lahti, Leo
European Bioinformatics Institute EBI, UK,
1 month

Lampinen, Airi
UC Berkeley, USA,
12 months

Langohr, Laura
Josef Stefan Institute, Ljubljana, Slovenia,
3 months

Lehdonvirta, Vili
University of Tokyo, Japan,
12 months

Lehtinen, Ville
HIT Lab, New Zealand,
4 months

Lemmelä, Saija-Maaria
HIT Lab, New Zealand,
3 months

Li, Ming
Tsinghua University,
1 month

Liikkanen, Lassi
Stanford University, USA,
12 months

Lindqvist, Janne
Carnegie Mellon University, USA,
10 months

Morrison, Ann
University of Queensland, Australia,
2 weeks;
University of Otago, New Zealand,
2 weeks

Nechaev, Boris
International Computer Science Institute, Berkeley, USA,
2 months

Nurmi, Petteri
National ICT Australia, Canberra, Australia,
1 month;
DFKI Saarbrucken, Germany,
1 week

Oikarinen, Emilia
Vienna University of Technology, Austria,
1 week

Oulasvirta, Antti
Florida State University, USA,
3 months

Peltonen, Jaakko
University of Sheffield,
Sheffield Institute for Translational Neuroscience,
2 months

Polishchuk, Valentin
Stony Brook University,
New York, USA,
3 weeks

Roos, Teemu
Massachusetts Institute of Technology, MIT, USA,
3 months

Sarolahti, Pasi
International Computer Science Institute, Berkeley, USA,
9 months

Suomela, Jukka
ETH Zurich, Switzerland,
2 weeks;
Carleton University, Ottawa, Canada,
3 weeks;
Braunschweig University of Technology, Germany,
3 months

Turpeinen, Marko
UC Berkeley/Stanford University, USA,
8 months

Ukkonen, Antti
Universitat Pompeu Fabra / Yahoo Research Barcelona, Spain,
12 months

Wahlström, Mikael
LACCOS Social Psycology of Communication and Cognition Laboratory, Brazil,
3 months

Xiao, Yu
Beijing University of Posts and Telecommunications,
1 week

4 Administration

4.1 Overview

HIIT is a joint research centre of Aalto University (until 31 December 2009 Helsinki University of Technology) 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.

Research programmes are led by the Programme Directors. Together with the Director and Vice-Director, they constitute the Steering Group responsible for inter-programme co-ordination and planning.

Each research programme has a Programme Management Group consisting of the leaders of the research groups in the programme. The Research Programme Manager facilitates the operation of the programme management group and co-ordinates the joint activities of the programme.

HIIT's administration team provides administrative and IT services at both Aalto University and the University of Helsinki.

4.2 Board

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

The HIIT board consists of nine members, who are appointed for four years at a time. Each university appoints four board members, two of which are university staff and two are not employed by the university. The members are appointed personal deputies. The staff of HIIT selects one board member and his or her deputy from among their colleagues.

In 2010 the old Board convened three times and the new Board two times.

Apart from dealing with the statutory tasks (i.e. approving the annual budget and activity plans, following up the work of HIIT through regular activity updates given by the Director of HIIT), the major theme for the old Board in the beginning of 2010 was to find a new Director for HIIT starting from 1 August 2010. A new Board was then elected.

Board Members until September 2010 and their personal deputies:

- Vice Rector, Professor Outi Krause, Aalto
  (Vice Rector, Professor Kalevi Ekman, Aalto)
- Vice Rector, Professor Johanna Björkroth, UH
  (Vice Rector, Professor Matti Tikkanen, UH)
- Professor Olli Simula, Aalto
  (Professor Heikki Saikkonen, Aalto)
- Dean, Professor Jukka Paakki, UH
  (Professor Jyrki Kivinen, UH)
- Dr Henry Tirri, Nokia
  (Petteri Alinikula, Nokia)
- Docent Kari-Pekka Estola
  (Director Martin Mäklin, TeliaSonera Finland Oyj)
- Director Petri Vasara, Pöyry Management Consulting Oy
  (Dr. Lars Gädda, Metsäklusteri Oy)
- MSc Kimmo Kiviluoto, Xtract
  (Research Fellow Aimo Maanavilja, Elisa Communications)
- Kai Huotari, HIIT
  (Greger Lindén, HIIT)

The Director of HIIT Patrik Floréen (15 November 2009 - 31 July 2010) was responsible for preparing and submitting propositions to the Board. In addition, Planning Officer Matti Apajalahti had the right to attend meetings. Board Secretary was Research Coordinator Greger Lindén.

Board Members from September 2010 and their personal deputies:

- Vice President, Professor Heikki Mannila, Aalto (Vice Dean, Professor Outi Krause, Aalto)
- Professor Olli Simula, Aalto (Professor Heikki Saikkonen, Aalto)
- Vice Rector, Professor Johanna Björkroth, UH (Vice Rector, Professor Jukka Kola, UH)
- Professor Hannu Toivonen, UH (Professor Jukka Paakki, UH)
- Vice President Henry Tirri, Nokia (Director Jyri Huopaniemi, Nokia)
- Docent Kari-Pekka Estola (Director Martin Mäklin, TeliaSonera Finland Oy)
- Director Petri Vasara, Pöyry Management Consulting Oy (Dr. Lars Gädda, Metsäklusteri Oy)
- MSc Kimmo Kiviluoto, Webmie Oy (Research Fellow Aimo Maanavilja, Elisa Communications)
- Dr Risto Sarvas, HIIT (Docent Ella Bingham, HIIT)

The Director of HIIT Samuel Kaski (1 August 2010 -) was responsible for preparing and submitting propositions to the Board. Board Secretary was Research Coordinator Greger Lindén.

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. The SAB did not convene in 2010.

SAB Members 2010:

- 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

4.4 Personnel

The personnel of HIIT are employed by the two parent universities, either Aalto University or University of Helsinki. In addition, some persons working at HIIT are funded directly from other sources such as personal grants from Foundations or positions from the Academy of Finland.

Many of HIIT's personnel have double or even triple affiliations. Most common is an affiliation with other Departments of 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. Thus the total number of personnel (almost 300) is much higher than the number of person-years completed by HIIT funding.

In 2010 HIIT staff completed 175 person-years on HIIT funding; this is somewhat less than in the previous year (185). The distribution of person-years per sites is shown in Table 1. The Otaniemi site comprises HIIT researchers both at Aalto University's ICS department and CSE department.

Table 1: Number of person-years paid by HIIT

Staff (person-years)	2006	2007	2008	2009	2010
Innopoli	55	60	82	83	72
Kumpula	55	57	57	60	55
Otaniemi	9	12	26	42	48
total	**119**	**129**	**165**	**185**	**175**

Another way to visualize the personnel is to look at the distribution of personnel groups per person years, again only listing the person years completed by HIIT funding. Research personnel having a Doctoral degree are listed as ”seniors or postdocs”; research personnel having a Master’s degree but not a Doctoral degree are listed as ”researchers”; and those studying for their Master’s degree are listed as ”research assistants”. When compared to year 2009, we see that the number of research assistants has decreased and the number of researchers increased, suggesting a trend towards more mature researchers. The decrease in senior researchers is artificial: a few Professors were in 2009 counted into HIIT’s person-years albeit they are funded by their departments.

Table 2: Distribution of person-years by personnel groups in 2010

Staff (person-years)	Innopoli	Kumpula	Otaniemi	total	change per 2009
seniors, postdocs	16	18	11	45	-2
researchers	30	20	29	79	9
research assistants	16	15	8	39	-16
administration	10	2	0	12	-1
total	**72**	**55**	**48**	**175**	**-10**

The number of non-Finnish staff members has increased from 2009 (then 19 per cent, now 25 per cent). Almost all non-Finns come from Europe, Russia, China, India and India's neighbouring countries. Among Europeans, the most common nationalities are German, French and Turkish. In Table 3 we list all personnel, also including those not counted in HIIT's person-years.

Table 3. Origin of staff

Staff (individuals)	total	%
Finland	224	75 %
other Europe	30	10 %
Russia	11	4 %
China	13	4 %
India & other south Asia	11	4 %
Middle East	1	0 %
other Asia	1	0 %
Australia & Oceania	2	1 %
USA & Canada	2	1 %
Central & South America	1	0 %
Africa	2	1 %
total	**298**	**100 %**

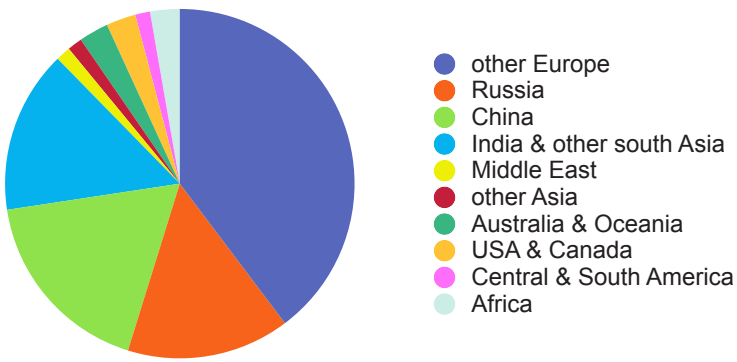


Figure 1. Nationalities of non-Finnish staff members

5 Funding

We first list the funding sources and the distribution of expenses of each site separately. One should note that comparison between different years or between universities is not always straightforward due to different procedures of accounting.

Innopoli's funding figures are shown in Table 4, on page 36. We list separately the funding of two new doctoral programmes of the Academy of Finland which HIIT now coordinates: they do not fully contribute to HIIT's person-years or publications as most doctoral students are employed by other universities, but they constitute a largish part of HIIT's budget. Similarly in the list of Expenses, the large amount of "other operational expenses" mainly consists of the expenses of these doctoral programmes.

In Table 4, in the category Other funding, we list competitive grants given by Foundations and Aalto University. In the case of Innopoli this also includes a Research Assessment Excercise bonus given by Aalto University.

Kumpula's funding figures are shown in Table 5, on page 37. Direct, "non-competitive" funding from University of Helsinki has always been 810000 Eur. In previous years, part of professors' salaries were also listed here, but not in 2010.

In Table 5, funding from Academy of Finland is very large in 2010, containing almost 0.5 MEur of Algodan Center of Excellence funding, and other large Academy projects. Item "Other funding" contains competitive grants given by foundations and University of Helsinki, and includes a research assessment bonus.

In Table 5, item "Other operational expenses" is larger than previously, mainly due to conferences organized by HIIT Kumpula.

Otaniemi's funding figures are shown in Table 6, on page 38. Otaniemi corresponds to HIIT activities at Aalto University's ICS and CSE departments. Item "Other funding" corresponds to competitive grants given by Foundations and Aalto University, of which the Aalto-funded Otasizzle project is the largest.

Table 4. Innopoli's funding

Innopoli	2007	2008	2009	2010	%
Total funding	**4 132 540**	**5 232 367**	**5 591 965**	**6 328 058**	
Aalto direct funding	436 837	773 338	1 276 792	933 701	15 %
UH direct funding	168 200	168 200	168 200	168 200	3 %
Academy of Finland	83 875	178 359	343 300	612 452	10 %
National Technology Agency Tekes	1 917 903	2 112 314	2 194 968	1 923 352	30 %
Acad.Finland doctoral programmes				1 007 319	16 %
European Union	852 437	1 051 384	910 838	848 983	13 %
Industry	510 642	306 804	183 766	190 464	3 %
Ministries and other public funding	74 821	147 052	94 820	0	0 %
Other (Foundations, competitive univ. funding)	87 825	494 917	419 281	643 587	10 %

Total expenses	**4 014 856**	**5 073 352**	**5 333 995**	**5 981 211**	
Salaries	2 538 365	3 496 797	3 616 745	3 434 744	57 %
Other operational expenses	958 624	1 068 548	957 482	1 793 403	30 %
Rents	354 006	326 854	426 773	474 044	8 %
Service charge to Aalto	163 861	181 154	332 995	279 021	5 %

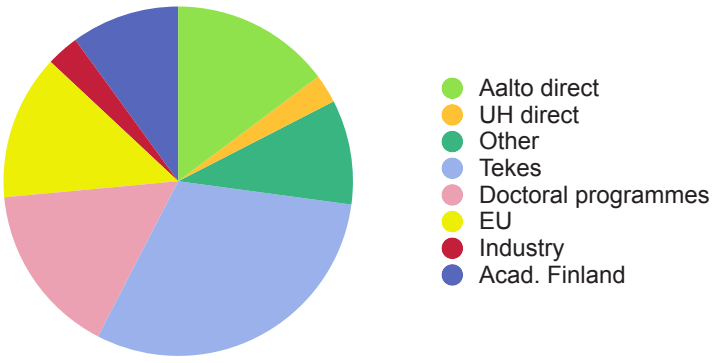


Figure 2. Innopoli's funding sources

Table 5. Kumpula's funding

Kumpula	2007	2008	2009	2010	%
Total funding	**2 737 000**	**2 038 431**	**2 272 824**	**3 110 733**	
UH direct funding	877 000	922 400	865 341	810 000	26 %
Academy of Finland	485 000	464 727	306 880	1 156 164	37 %
National Technology Agency Tekes	665 000	316 811	373 969	519 348	17 %
European Union	450 000	250 987	207 177	59 832	2 %
Industry	260 000	83 506	56 800	0	0 %
Other (Foundations, competitive univ. funding)			462 657	565 390	18 %

Total expenses	**2 446 105**	**2 170 579**	**2 450 851**	**2 915 601**	
Salaries	1 632 852	1 668 685	1 981 005	2 091 923	72 %
Other operational expenses	408 628	366 204	261 320	542 065	19 %
Service charge to UH (rents included)	404 625	135 690	208 526	281 614	10 %

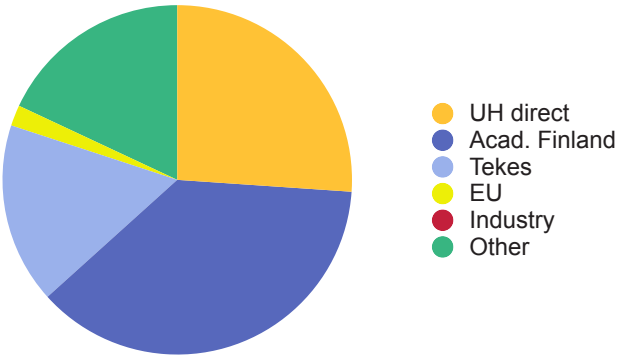


Figure 3. Kumpula's funding sources

Table 6. Otaniemi's funding

Otaniemi	2007	2008	2009	2010	%
Total funding	**663 917**	**1 348 876**	**1 164 800**	**2 611 221**	
Aalto direct funding	95 357	104 057	105 000	190 347	7 %
Centre of Excellence funding from Aalto	71 000	90 000	133 400	182 775	7 %
Academy of Finland	329 400	306 761	265 800	657 470	25 %
National Technology Agency Tekes	168 160	598 048	381 400	957 160	37 %
European Union			98 000	115 198	4 %
Industry		35 074		176 397	7 %
Other (Foundations, competitive univ. funding)		214 936	181 200	331 875	13 %

Total expenses	**581 208**	**1 328 972**	**899 300**	**2 236 649**	
Salaries	479 800	1 008 668	685 100	1 712 996	76 %
Other operational expenses	25 850	203 608	94 700	175 607	8 %
Service charge to Aalto (rents included)	75 558	116 696	119 500	348 046	16 %

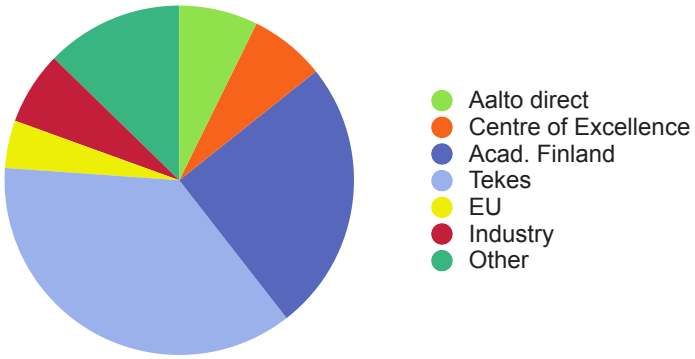


Figure 4. Otaniemi's funding sources

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Finally we list the funding sources and the distribution of expenses for the whole HIIT in the Table 7. Funding has increased significantly. In part this is due to more Academy of Finland and Tekes projects, but also in part to two Academy of Finland's doctoral programmes which are coordinated at HIIT, and to changes in accounting procedures of the mother universities. Comparison between different years is thus difficult.

Table 7. HIIT's funding

HIIT	2007	2008	2009	2010	%
Total funding	**7 533 457**	**8 619 674**	**9 029 589**	**12 050 013**	
Universities' direct funding	1 648 394	2 057 995	2 615 348	2 102 248	17 %
Academy of Finland	898 275	949 847	915 980	2 426 086	20 %
Doctoral programmes				1 007 319	8 %
National Technology Agency Tekes	2 751 063	3 027 173	2 950 337	3 399 860	28 %
European Union (EU)	1 302 437	1 302 371	1 216 015	1 024 012	8 %
Industry	770 642	425 384	240 566	366 861	3 %
Ministries and other public funding	74 821	147 052	94 820	0	0 %
Other (Foundations, competitive univ. funding)	87 825	709 853	996 523	1 723 627	14 %

Total expenses	**7 042 169**	**8 572 903**	**8 684 146**	**11 133 463**	
Salaries	4 651 017	6 174 150	6 282 850	7 239 663	65 %
Other operational expenses	1 393 102	1 638 359	1 313 502	2 511 075	23 %
Service charge to UH/TKK	644 044	433 540	635 299	788 648	7 %
Rents	354 006	326 854	452 495	594 077	5 %

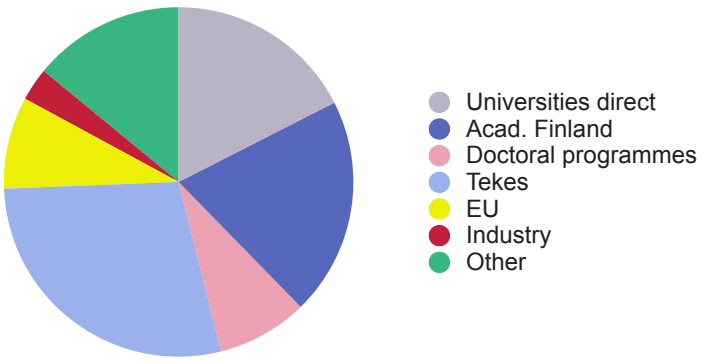

Figure 5. HIIT's funding sources in total

Appendix A. Publications

In the following Table we list the numbers of publications in different years. The numbers of the most important types of publications, namely refereed international journal and conference publications, are in 2010 the highest of all years 2005-2010.

Publications 2005 - 2010	2005	2006	2007	2008	2009	2010
Articles in international scientific journals with referee practice	29	38	50	67	51	69
Articles in international edited works and conference proceedings with referee practice	112	101	94	126	126	153
Articles in Finnish scientific journals and edited works with referee practice	4	5	6	16	7	1
Scientific monographs and edited books	8	2	6	3	6	8
Other publications	13	18	13	24	18	24
Computer programs and algorithms	3	1	1	0	1	10
Doctoral theses	3	7	9	14	13	10
Licenciate theses	1	2	0	1	1	0
Master's theses	7	10	8	76	27	33
Total	**180**	**184**	**187**	**327**	**250**	**308**

pub

1 Articles in international scientific journals with referee practice

1. Lauri Ahlroth, André Schumacher, and Harri Haanpää. On the power of lookahead in online lot-sizing. *Operations Research Letters*, 38(6):522–526, 2010.
2. Esther Arkin, Joseph Mitchell, and Valentin Polishchuk. Maximum thick paths in static and dynamic environments. *Computational Geometry*, 43(3):279–294, 2010.
3. Mikko Arvas, Niina Haiminen, Bart Smit, Jari Rautio, Marika Vitikainen, Marilyn Wiebe, Diego Martinez, Christina Chee, Joe Kunkel, Charles Sanchez, Mary Anne Nelson, Niina Pakula, Markku Saloheimo, Merja Penttilä, and Teemu Kivioja. Detecting novel genes with sparse arrays. *Gene*, 467(1-2):41–51, 2010.
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6. Robert Brummayer and Matti Järvisalo. Testing and debugging techniques for answer set solver development. *Theory and Practice of Logic Programming*, 10(4-6):741–758, 2010.
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11. Patrik Floréen, Marja Hassinen, Joel Kaasinen, Petteri Kaski, Topi Musto, and Jukka Suomela. Local approximability of max-min and min-max linear programs. *Theory of Computing Systems*, 2010.

12. Patrik Floréen, Petteri Kaski, Valentin Polishchuk, and Jukka Suomela. Almost stable matchings by truncating the Gale-Shapley algorithm. *Algorithmica*, 58(1):102–118, 2010.

13. Gemma C. Garriga, Esa Junttila, and Heikki Mannila. Banded structure in binary matrices. *Knowledge and Information Systems*, 2010 (electronic version).

14. Harri Haanpää, André Schumacher, and Pekka Orponen. Distributed algorithms for lifetime maximization in sensor networks via min-max spanning subgraphs. *Wireless Networks*, 16:875–887, 2010.

15. Niina Haiminen and Heikki Mannila. Evaluation of BIC and cross validation for model selection on sequence segmentations. *International Journal of Data Mining and Bioinformatics*, 4(6):675–700, 2010.

16. Juho Hamari and Vili Lehdonvirta. Game design as marketing: How game mechanics create demand for virtual goods. *International Journal of Business Science and Applied Management*, 5(1):14–29, 2010.

17. Timo Honkela, Aapo Hyvärinen, and Jaakko J. Väyrynen. WordICA — emergence of linguistic representations for words by independent component analysis. *Natural Language Engineering*, 16(3):277–308, 2010.

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8. Leo Lahti and Olli-Pekka Huovilainen. Dependency modeling toolkit, 2010. http://dmt.r-forge.r-project.org/.
9. Valentin Polishchuk and Arto Vihavainen. MapLab, 2010. http://www.cs.helsinki.fi/group/ compgeom/maplab/.
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7 Doctoral dissertations by a HIIT researcher

1. Dan Forsberg. Improv*ing and Distributing Key Management on Mobile Networks*. PhD thesis, Aalto University School of Science and Technology, 2010.
2. Hannes Heikinheimo. *Extending Data Mining Techniques for Frequent Pattern Discovery: Trees, Low-Entroby Sets, and Crossmining*. PhD thesis, Aalto University School of Science and Technology, 2010.
3. Jussi Kollin. Compu*tational Methods for Detecting Large-Scale Chromosome Rearrangements in SNP Data*. PhD thesis, Department of Computer Science, University of Helsinki, 2010.
4. Dmitrij Lagutin. *Securing the Internet with Digital Signatures*. PhD thesis, Aalto University School of Science and Technology, 2010.
5. Leo Lahti. *Probabilistic Analysis of the Human Transcriptome with Side Information*. PhD thesis, Aalto University School of Science and Technology, 2010.
6. Lassi A. Liikkanen. *deCO.COde - Design Cognition for Conceptual Design*. PhD thesis, Aalto University School of Science and Technology, 2010.

7. Andrey Lukyanenko. *Multi-User Resource-Sharing Problem for the Internet.* PhD thesis, Department of Computer Science, University of Helsinki, 2010.
8. Esa Pitkänen. *Computational Methods for Reconstruction and Analysis of Genome-Scale Metabolic Networks*. PhD thesis, Department of Computer Science, University of Helsinki, 2010.
9. Eerika Savia. *Mutual Dependency-Based Modeling of Relevance in Co-Occurrence Data*. PhD thesis, Aalto University School of Science and Technology, 2010.
10. André Schumacher. *Distributed Optimization Algorithms for Multihop Wireless Networks*. PhD thesis, Aalto University School of Science and Technology, 2010.

8 Master's Theses by a HIIT researcher or instructed by a HIIT researcher

1. Prem Raj Adhikari. Mixture modelling of multiresolution 0-1 data. Master's thesis, Aalto University School of Science and Technology, Department of Information and Computer Science, 2010.
2. Christian Beer. Analyse des inhaltes und der herstellerintentionen autobiografischer selbstportraits auf der web 2.0 — site www.dailymugshot.com. Master's thesis, Departement für Bildwissenschaften, Donau-University Krems, 2010.
3. Cilla Björkqvist. Kekorakenteet. Master's thesis, Department of Computer Science, University of Helsinki, 2010.
4. Sari Bombino. Computational analysis of genetic variation in putative regulatory elements. Master's thesis, Department of Computer Science, University of Helsinki, 2010.
5. Harri Hämäläinen. Nimentä tulevaisuuden arkkitehtuurissa. Master's thesis, Department of Computer Science, University of Helsinki, 2010.
6. Mika Holmström. Monte Carlo go. Master's thesis, Department of Computer Science, University of Helsinki, 2010.

7. Mohammad Hoque. Design, implementation and evaluation of traffic shaping proxies for power saving in mobile audio streaming. Master's thesis, Aalto University School of Science and Technology, Department of Computer Science and Engineering, 2010.

8. Teemu Hynönen. Mining unobvious connections between terms from unstructured text. Master's thesis, Department of Computer Science, University of Helsinki, 2010.

9. Venla Hytönen. Experiments with a clean slate internet architecture: Publish / subscribe internet routing paradigm. Master's thesis, Aalto University School of Science and Technology, Department of Computer Science and Engineering, 2010.

10. Joris Kinable. Malware detection through call graphs. Master's thesis, Aalto University School of Science and Technology, Department of Information and Computer Science, 2010.

11. Mikko Koskinen. Idea generation in user centered product development process for link design. Master's thesis, Aalto University School of Science and Technology, Department of Mechanical Engineering, 2010.

12. Yang Li. Using color histograms and SURF in locating supermarket customers. Master's thesis, Department of Computer Science, University of Helsinki, 2010.

13. Tianyan Liu. Evaluating Bayesian classifiers for mobile devices. Master's thesis, Department of Computer Science, University of Helsinki, 2010.

14. Hannu Maksimainen. Virtauttaminen vertaisverkossa. Master's thesis, Department of Computer Science, University of Helsinki, 2010.

15. Pekka Maksimainen. Finding groups in virtual communities. Master's thesis, Department of Computer Science, University of Helsinki, 2010.

16. Teppo Niinimäki. Kromosomien välisten genotyyppiassosiaatioiden etsintä. Master's thesis, Department of Computer Science, University of Helsinki, 2010.

17. Lasse Nordgren. Käyttäjien tuottama sisällön mittaus ja analyysi RSS-syötteiden avulla. Master's thesis, Department of Computer Science, University of Helsinki, 2010.

18. Matti Pihlaja. Laiteriippumattomat käyttöliittymät. Master's thesis, Department of Computer Science, University of Helsinki, 2010.

19. Suresh Kumar Ponnusamy. Interconnected home networks: An xmpp based approach. Master's thesis, Aalto University School of Science and Technology, Department of Computer Science and Engineering, 2010.

20. Teemu Pulkkinen. Semi-supervised learning of WLAN radio maps. Master's thesis, Department of Computer Science, University of Helsinki, 2010.

21. Mikko Romppainen. Scrum-prosessimallin käyttöliittymäriskien minimointi simulointipohjaisella GDD-käyttöliittymäsuunnittelumenetelmällä. Master's thesis, Department of Computer Science, University of Helsinki, 2010.

22. Janne Salo. Offloading content routing cost from routers. Master's thesis, Department of Computer Science, University of Helsinki, 2010.

23. Antti Saukko. Prosessien välivedos- ja jatkoaloitustekniikat ja niiden sovelluskohteet Linux-käyttöjärjestelmässä. Master's thesis, Department of Computer Science, University of Helsinki, 2010.

24. Yiyun Shen. On the simulation of widget sharing reputation systems. Master's thesis, Department of Computer Science, University of Helsinki, 2010.

25. Suvi Silfverberg. Profile work of online-shared music listening information. Master's thesis, Department of Social Research, University of Helsinki, 2010.

26. Pekka Silvekoski. Client-side migration of authentication session. Master's thesis, Aalto University School of Science and Technology, Department of Computer Science and Engineering, 2010.

27. Sanna Sipilä. Monilinjaus fylogeniapuun ohjaamana. Master's thesis, Department of Computer Science, University of Helsinki, 2010.

28. Sampsa Somerma. Botnet-verkot. Master's thesis, Department of Computer Science, University of Helsinki, 2010.

29. Tuomas Tanner. Detecting and preventing failure using the k-nearest neighbor method to predict student's final test performance in an online course environment. Master's thesis, Department of Computer Science, University of Helsinki, 2010.

30. Antti Virolainen. Public key infrastructure for peer-to-peer networks. Master's thesis, Aalto University School of Science and Technology, Department of Computer Science and Engineering, 2010.

31. Seppo Virtanen. Bayesian exponential family projections. Master's thesis, Aalto University School of Science and Technology, Department of Information and Computer Science, 2010.

32. Liang Wang. Large-scale experiments on cluster. Master's thesis, Department of Computer Science, University of Helsinki, 2010.

33. Yuan Zou. Structural EM methods in phylogenetics and stemmatology. Master's thesis, Department of Computer Science, University of Helsinki, 2010.

Appendix B. List of Personnel

In the list of personnel, ”Research Scientist” corresponds to a person having a Master’s degree but not a Doctoral degree, and ”Research Assistant” is one studying for his/her Master’s degree in the end of 2010.

Adhikari, Prem Raj	Research Assistant	Otaniemi
Ahlroth, Lauri	Research Scientist	Otaniemi
Ain, Mark	Research Scientist	Innopoli
Ajanki, Antti	Research Scientist	Otaniemi
Alene, Henok Adane	Research Assistant	Otaniemi
Alonso Castro, Serafin	Postdoctoral Research Scientist	Otaniemi
An, Chao	Research Assistant	Innopoli
Andersson, Markus	Research Assistant	Innopoli
Avdouevski, Ivan	Research Scientist	Innopoli
Åman, Pirkka	Research Scientist	Innopoli
Bergström-Lehtovirta, Joanna	Research Assistant	Innopoli
Bhattacharya, Sourav	Research Scientist	Kumpula
Bingham, Ella	Coordinator, Programme Manager	Innopoli
Björkskog, Christoffer	Research Scientist	Innopoli
Bombino, Sari	Research Assistant	Kumpula
Buntine, Wray	HIIT Fellow	Kumpula
Caldas, Jose	Research Scientist	Otaniemi
Campi, Cristina	Postdoctoral Research Scientist	Kumpula
Cheptegei, Laura	Research Scientist	Innopoli
Coutrix, Celine	Research Scientist	Innopoli
Dubrovin, Jori	Research Scientist	Otaniemi
Eloranta, Sirkka	Research Assistant	Otaniemi
Entner, Doris	Research Scientist	Kumpula
Eranti, Veikko	Research Assistant	Innopoli
Eronen, Jussi	Postdoctoral Research Scientist	Kumpula
Eronen, Lauri	Research Scientist	Kumpula

Faisal, Muhammad Ali	Research Scientist	Otaniemi
Floréen, Patrik	Director, Vice Director	Kumpula, Innopoli
Forsblom, Andreas	Research Assistant	Kumpula
Frits, Juho	Research Assistant	Otaniemi
Galbrun, Esther	Research Scientist	Kumpula
Gaur, Sachin	Research Scientist	Otaniemi
Georgii, Elisabeth	Postdoctoral Research Scientist	Otaniemi
Gillberg, Jussi	Research Assistant	Otaniemi
Gogolev, Alexander	Research Scientist	Innopoli
Gomés Gomés, Paula	Research Assistant	Innopoli
Gönen, Mehmet	Postdoctoral Research Scientist	Otaniemi
Gonzales, Andrea	Project Secretary	Innopoli
Göös, Mika	Research Assistant	Kumpula
Gross, Oskar	Research Assistant	Kumpula
Gurtov, Andrei	Professor	Innopoli
Gutmann, Michael	Postdoctoral Research Scientist	Kumpula
Haataja, Lari	Research Assistant	Innopoli
Hakli, Raul	Research Scientist	Kumpula
Hämäläinen, Harri	Research Assistant	Kumpula
Hamari, Juho	Research Assistant	Innopoli
Hanhijärvi, Sami	Research Scientist	Otaniemi
Hänninen, Riikka	Research Assistant	Innopoli
Hartikainen, Aleksi	Research Assistant	Kumpula
Hasu, Tero	Research Scientist	Innopoli
Hautaviita, Marjo-Anna	Research Assistant	Kumpula
Hegedus, Jozsef	Postdoctoral Research Scientist	Otaniemi
Heikkinen, Jani	Research Scientist	Otaniemi
Helin, Matti	Research Assistant	Innopoli
Hemminki, Samuli	Research Assistant	Kumpula
Hietanen, Herkko	Postdoctoral Research Scientist	Innopoli
Himanen, Pekka	Principal Research Scientist	Innopoli
Hinkka, Atte	Research Assistant	Kumpula
Hintsanen, Petteri	Research Scientist	Kumpula

staff

Hirayama, Jun-Ichiro	Senior Research Scientist	Kumpula
Hollmén, Jaakko	Chief Research Scientist	Otaniemi
Hoque, Mohammad	Research Scientist	Otaniemi
Hoyer, Patrik	Senior Research Scientist	Kumpula
Hukkinen, Janne	Research Assistant	Innopoli
Huopaniemi, Ilkka	Research Scientist	Otaniemi
Huotari, Kai	Research Scientist, Programme Manager	Innopoli
Hyttinen, Antti	Research Scientist	Kumpula
Hyvärinen, Aapo	Professor	Kumpula
Hyvärinen, Antti	Postdoctoral Research Scientist	Otaniemi
Itäpelto-Hu, Taru	Research Assistant	Kumpula
Jaakkola, Tommi	HIIT Fellow	Kumpula
Jacucci, Giulio	Professor	Kumpula, Innopoli
Janhunen, Tomi	Senior Research Scientist	Otaniemi
Jha, Vikash	Research Assistant	Kumpula
Johnson, Mikael	Research Scientist	Innopoli
Junttila, Esa	Research Scientist	Kumpula
Junttila, Tommi	Senior Research Scientist	Otaniemi
Järvenpää, Ritva	Planning Officer	Kumpula
Järvisalo, Matti	Postdoctoral Research Scientist	Kumpula
Kähkönen, Kari	Research Scientist	Otaniemi
Kallio, Aleksi	Research Scientist	Otaniemi
Kallio, Ilona	HR Coordinator	Innopoli
Kamalov, Murad	Research Assistant	Innopoli
Kandemir, Melih	Research Scientist	Otaniemi
Kangasharju, Jussi	Professor, Programme Director	Kumpula, Innopoli
Kankainen, Anu	Senior Research Scientist	Innopoli
Kantola, Vesa	Research Scientist	Innopoli
Karila, Arto	Principal Research Scientist	Innopoli
Karkulahti, Ossi	Research Scientist	Kumpula
Karlstedt, Mika	Research Scientist	Kumpula

Karvonen, Kristiina	Postdoctoral Research Scientist, Programme Manager	Innopoli
Kasari, Melissa	Research Assistant	Kumpula
Kaski, Petteri	Senior Research Scientist	Otaniemi
Kaski, Samuel	Professor, Director of HIIT	Innopoli, Kumpula, Otaniemi
Katainen, Riku	Research Assistant	Kumpula
Kaur, Puneet	Research Assistant	Innopoli
Kaustinen, Lotta	Controller	Innopoli
Kauttio, Janne	Research Assistant	Otaniemi
Kemppinen, Jukka	Professor	Innopoli
Khan, Suleiman	Research Scientist	Kumpula, Otaniemi
Khanloo, Bahman	Research Scientist	Otaniemi
Khurri, Andrey	Postdoctoral Research Scientist	Innopoli
Kiema, Ilkka	Senior Research Scientist	Innopoli
Kiirala, Niko	Research Assistant	Kumpula
Kinable, Joris	Research Assistant	Otaniemi
Kindermann, Roland	Research Scientist	Otaniemi
Klami, Arto	Postdoctoral Research Scientist	Otaniemi
Koivisto, Mikko	Postdoctoral Research Scientist	Kumpula
Kollin, Jussi	Research Scientist	Kumpula
Komu, Miika	Research Scientist	Otaniemi
Kontkanen, Petri	Postdoctoral Research Scientist	Kumpula
Korhonen, Janne	Research Scientist	Kumpula
Korpela, Johannes	Research Scientist	Kumpula
Korpela, Mikko	Research Scientist	Otaniemi
Korzun, Dmitry	Postdoctoral Research Scientist	Innopoli
Koskela, Joakim	Research Scientist	Innopoli
Kostakis, Orestis	Research Assistant	Otaniemi
Kosunen, Ilkka	Research Assistant	Innopoli
Kuikkaniemi, Kai	Research Scientist	Innopoli
Kujala, Inka	Planning Officer	Kumpula
Kujala, Jussi	Research Scientist	Otaniemi

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Kukkonen, Esa	Research Assistant	Innopoli
Kuptsov, Dmitriy	Research Scientist	Innopoli
Lagutin, Dmitrij	Postdoctoral Research Scientist	Innopoli
Lahdensuo, Tuomas	Research Assistant	Innopoli
Lahti, Leo	Research Scientist	Otaniemi
Lahtinen, Jussi	IT Specialist	Innopoli
Laine, Tuomo	Secretary	Innopoli
Laitinen, Tero	Research Scientist	Otaniemi
Laitinen, Toni	Research Assistant	Innopoli
Lam Shang Leen Gayle	Postdoctoral Research Scientist	Otaniemi
Lampinen, Airi	Research Scientist	Innopoli
Langhor, Laura	Research Scientist	Kumpula
Launiainen, Tuomas	Research Scientist	Otaniemi
Lehdonvirta, Vili	Research Scientist	Innopoli
Lehmuskallio, Asko	Research Scientist	Innopoli
Lehtinen, Ville	Research Assistant	Innopoli
Lehtinen, Vilma	Research Scientist	Innopoli
Lehto, Helen	Research Assistant	Innopoli
Lehtonen, Matti	Research Scientist	Innopoli
Leinonen, Eerika	Research Scientist	Innopoli
Lemmelä, Saija	Research Scientist	Innopoli
Lempiäinen, Tuomo	Research Assistant	Otaniemi
Leppäaho, Eemeli	Research Assistant	Otaniemi
Li, Ming	Research Scientist	Otaniemi
Lievonen, Petri	Research Assistant	Innopoli
Liikkanen, Lassi	Postdoctoral Research Scientist	Innopoli
Lijffijt, Jefrey	Research Scientist	Otaniemi
Lilja, Timo	Research Scientist	Innopoli
Lindén, Greger	Research Coordinator	Kumpula
Lindqvist, Antti	Research Assistant	Innopoli
Lindqvist, Janne	Senior Research Scientist	Innopoli
Liu, Guohua	Postdoctoral Research Scientist	Otaniemi
Louko, Antti	Senior Planning Officer	Innopoli

Lukyanenko, Andrey	Postdoctoral Research Scientist	Innopoli, Otaniemi
Mäkinen, Veli	Professor	Kumpula
Manner, Jukka	Senior Research Scientist	Kumpula
Mannila, Heikki	Professor	Innopoli, Otaniemi
Mäntylä, Teemu	Research Assistant	Innopoli
Markkula, Marja-Leena	Research Manager	Innopoli
Markus, Konrad	Research Scientist	Innopoli
Medeiros, Andre	Research Assistant	Otaniemi
Meriläinen, Arto	Research Assistant	Innopoli
Miche, Yoan	Postdoctoral Research Scientist	Otaniemi
Miettinen, Minna	Research Assistant	Kumpula
Miettinen, Pauli	Postdoctoral Research Scientist	Kumpula
Miettunen, Pirkko	Institute Secretary	Innopoli
Mikkola, Pekka	Research Assistant	Kumpula
Mohammadi, Pejman	Research Assistant	Otaniemi
Moisio, Leo	Research Assistant	Otaniemi
Morrison, Ann	Research Scientist	Innopoli
Musto, Topi	Research Assistant	Kumpula
Myllymäki, Petri	Professor, Programme Director	Kumpula, Innopoli
Narula, Prayag	Research Scientist	Innopoli
Nechaev, Boris	Research Scientist	Innopoli
Nelimarkka, Matti	Research Assistant	Innopoli
Nevala, Maija	Research Scientist	Otaniemi
Nicolas, François	Research Assistant	Otaniemi
Niemelä, Ilkka	Professor	Otaniemi
Niemimäki, Sami	IT Specialist	Innopoli
Niinimäki, Teppo	Research Assistant	Kumpula
Nordgren, Lasse	Research Assistant	Kumpula
Noronen, Visa	Communications Manager	Innopoli
Nunes, Sofia	Research Scientist	Innopoli
Nurmi, Petteri	Postdoctoral Research Scientist	Kumpula, Innopoli

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Nurminen, Antti	Postdoctoral Research Scientist	Innopoli
Nybo, Kristian	Research Scientist	Otaniemi
Nyyssönen, Tuomo	Research Assistant	Innopoli
Oikarinen, Emilia	Postdoctoral Research Scientist	Kumpula, Otaniemi
Ojala, Markus	Research Scientist	Otaniemi
Oksanen, Kenneth	Research Scientist	Innopoli
Orponen, Pekka	Professor	Otaniemi
Osmala, Maria	Research Assistant	Otaniemi
Ou, Zhonghong	Postdoctoral Research Scientist	Otaniemi
Oulasvirta, Antti	Senior Research Scientist	Innopoli
Palomäki, Jussi	Research Assistant	Innopoli
Papapetrou, Panagiotis	Postdoctoral Research Scientist	Otaniemi
Parkkinen, Juuso	Research Scientist	Otaniemi, Kumpula
Parviainen, Pekka	Research Scientist	Kumpula
Peltonen, Jaakko	Postdoctoral Research Scientist	Otaniemi
Peltonen, Peter	Research Scientist	Innopoli
Perämäki, Jussi	Research Assistant	Innopoli
Perkiö, Jukka	Research Scientist	Kumpula, Innopoli
Pervilä, Mikko	Research Scientist	Kumpula
Piirainen, Jaana	Research Assistant	Innopoli
Pihlaja, Miika	Research Scientist	Kumpula
Pitkänen, Olli	Senior Research Scientist	Innopoli
Polishchuk, Tatiana	Research Scientist	Innopoli
Polishchuk, Valentin	Postdoctoral Research Scientist	Kumpula
Ponomarev, Oleg	Research Scientist	Innopoli
Pottonen, Olli	Postdoctoral Research Scientist	Otaniemi
Prada, Miguel Angel	Research Scientist	Otaniemi
Prami, Mikko	Research Assistant	Innopoli
Pulkkinen, Teemu	Research Assistant	Kumpula
Puolamäki, Kai	Research Coordinator, Chief Research Scientist	Otaniemi
Puuronen, Jouni	Research Scientist	Kumpula

Pyykkö, Joel	Research Assistant	Kumpula
Pääkkö, Anne	Research Assistant	Kumpula
Rahman, Md. Atiqur	Research Assistant	Innopoli
Raita, Eeva	Research Scientist	Innopoli
Ray, Debarshi	Research Assistant	Kumpula
Reinvall, Jaakko	Research Assistant	Otaniemi
Rimey, Ken	Senior Research Scientist	Innopoli
Rissanen, Jorma	HIIT Fellow	Kumpula
Roos, Teemu	Postdoctoral Research Scientist, Programme Manager	Kumpula
Ropponen, Jonatan	Research Assistant	Otaniemi
Ruokolainen, Teemu	Research Scientist	Otaniemi
Ruottu, Toni	Research Assistant	Innopoli
Ruusunen, Matti	Research Scientist	Innopoli
Rybicki, Joel	Research Assistant	Kumpula
Saari, Timo	Senior Research Scientist	Innopoli
Saarikko, Petri	Research Scientist	Innopoli
Saarinen, Päivi	Planning Officer	Innopoli
Saastamoinen, Taneli	Research Assistant	Innopoli
Salmela, Leena	Postdoctoral Research Scientist	Kumpula
Salo, Marja	Research Scientist	Innopoli
Salovaara, Antti	Research Scientist	Innopoli
Sarkio, Katri	Research Scientist	Innopoli
Sarolahti, Pasi	Postdoctoral Research Scientist	Innopoli
Sarvas, Risto	Postdoctoral Research Scientist	Innopoli
Schoenauer, Stefan	Postdoctoral Research Scientist	Kumpula
Schumacher, Andre	Postdoctoral Research Scientist	Otaniemi
Segerståhl, Katarina	Research Scientist	Innopoli
Seppälä, Lassi	Research Assistant	Innopoli
Shen, Yiyun	Research Assistant	Kumpula
Shibasaki, Sanna	Research Scientist	Innopoli
Siekkinen, Matti	Postdoctoral Research Scientist	Otaniemi
Silander, Tomi	Postdoctoral Research Scientist	Kumpula
Silfverberg, Suvi	Research Scientist	Innopoli

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Sipilä, Sanna-Kaisa	Research Assistant	Kumpula
Sirén, Jouni	Research Scientist	Kumpula
Slivinskiy, Maxim	Research Assistant	Innopoli
Solajov, Dmitrih	Research Assistant	Innopoli
Sorjamaa, Antti	Postdoctoral Research Scientist	Otaniemi
Sri Kalyanaraman, Ramya	Research Scientist	Innopoli
Su, Hongyu	Research Assistant	Kumpula
Sulkava, Mika	Postdoctoral Research Scientist	Otaniemi
Sun, Tao	Research Assistant	Otaniemi
Suomalainen, Tiia	Research Assistant	Innopoli
Suomela, Jukka	Postdoctoral Research Scientist	Kumpula
Suvitaival, Tommi	Research Scientist	Otaniemi
Sysikaski, Mikko	Research Assistant	Kumpula
Tarkoma, Sasu	Professor	Kumpula
Toivola, Janne	Research Scientist	Otaniemi
Toivonen, Hannu	Professor	Kumpula
Toivonen, Jarkko	Research Scientist	Kumpula
Tolvanen, Juha	Research Assistant	Innopoli
Tonteri, Pekka	IT Manager	Innopoli, Kumpula
Torvinen, Petteri	Research Scientist	Innopoli
Tuominen, Antti	Research Assistant	Kumpula
Turpeinen, Marko	Professor	Innopoli
Turunen, Jani	Research Scientist, Technical Specialist	Innopoli
Uitto, Jara	Research Assistant	Kumpula
Ukkonen, Esko	Professor	Kumpula
Urbonas, Aetuzas	Research Assistant	Innopoli
Urtela, Mika	Research Assistant	Kumpula
Uutela, Juho	Research Assistant	Kumpula
Varjonen, Samu	Research Scientist	Innopoli, Kumpula
Vihavainen, Sami	Research Scientist	Innopoli
Viinikanoja, Jaakko	Research Scientist	Otaniemi

Vilkki, Max	Research Assistant	Innopoli
Virtanen, Perttu	Postdoctoral Research Scientist	Innopoli
Virtanen, Seppo	Research Scientist	Otaniemi
Visala, Kari	Research Scientist	Innopoli
Vuokko, Niko	Research Scientist	Otaniemi
Vähäkangas, Taneli	Research Scientist	Kumpula
Vähäkangas, Teemu	Research Assistant	Innopoli
Väisänen, Jussi	Research Assistant	Kumpula
Välimäki, Niko	Research Scientist	Kumpula
Wahlström, Mikael	Research Scientist	Innopoli
Wang, Liang	Research Assistant	Kumpula
Wessman, Jaana	Research Scientist	Kumpula
Xiao, Yu	Research Scientist	Otaniemi
Yu, Huizhen	Postdoctoral Research Scientist	Kumpula
Zhang, He	Research Scientist	Otaniemi
Zhou, Fang	Research Scientist	Kumpula
Zou, Yuan	Research Assistant	Kumpula

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