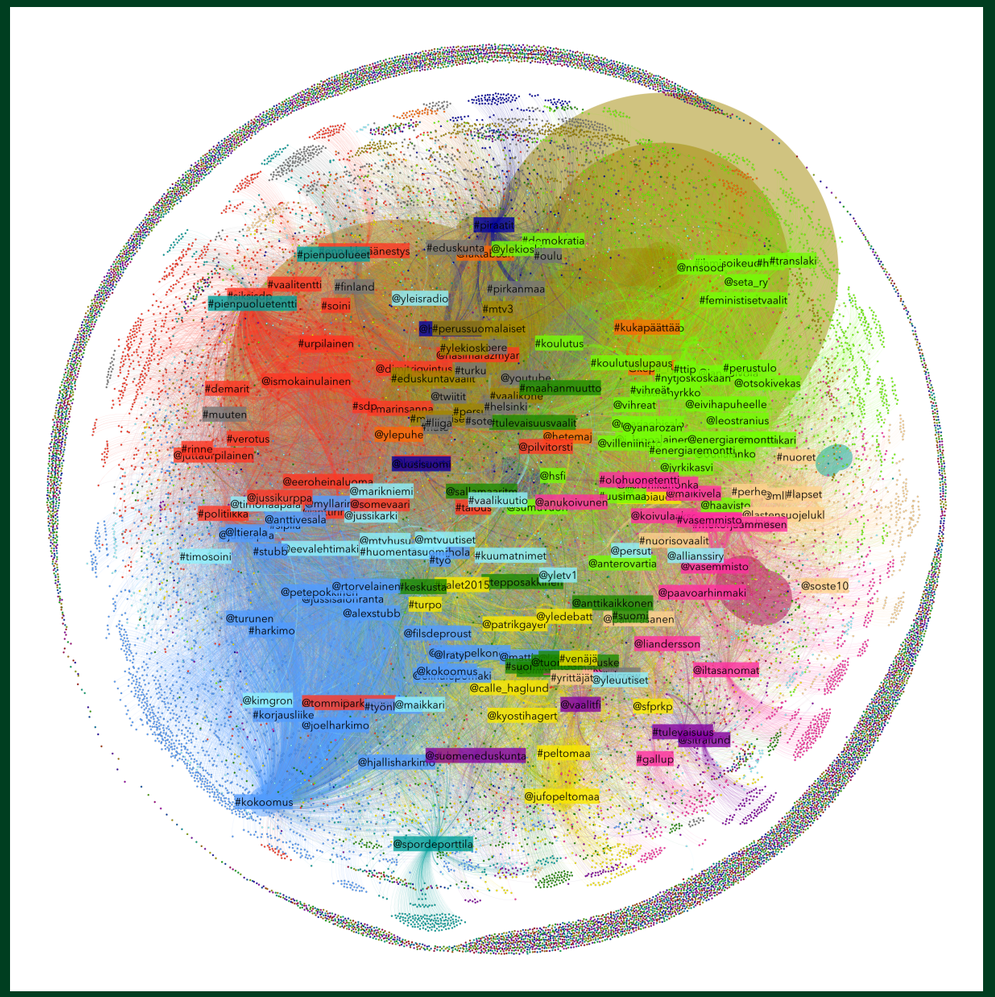
Aalto University

UNIVERSITY OF HELSINKI

HELSINKI INSTITUTE FOR INFORMATION TECHNOLOGY

Helsinki Institute for Information Technology HIIT

Annual Report 2015



Helsinki Institute for Information Technology HIIT
Tietotekniikan tutkimuslaitos HIIT
Forskningsinstitutet för Informationsteknologi HIIT

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. HIIT's mission is to conduct top-level research, seamlessly moving between fundamental methods and technologies to novel applications and their impact on people and society. HIIT is a strategic partnership of the two universities to take Helsinki IT to the world class and keep it there. HIIT's research is interdisciplinary, operating across departments and with industry. The current foci of research are computational modelling and data analysis, and ubiquitous ICT in the modern networked world.

HIIT groups belong to several national Centers of Excellence and co-operate with the information industry and with sciences applying information technology. HIIT works in a multidisciplinary way, with scientists from computer, natural, behavioural and social sciences, as well as from humanities and design. HIIT partners with several international and Finnish companies as well as with universities and research institutions in Europe, North America and Asia.

HIIT was founded in 1999 and now has a budget of 9 million euros, realising in total about 140 person-years of work by about 300 researchers. HIIT is located in two different sites in the Helsinki Metropolitan area: at Aalto University's Otaniemi campus and University of Helsinki's Kumpula campus. HIIT's operating principle is that it adds to other departments' activities, instead of competing with them. The institute was led by Professor Samuel Kaski until July 2015 and by Professor Petri Myllymäki from August 2015 onwards. HIIT's research is funded by Aalto University, the University of Helsinki, Tekes, the Academy of Finland, the European Union, private companies, and foundations financing Finnish hi-tech research. The research by HIIT has been assessed and deemed excellent by its Scientific Advisory Board in 2008 and 2012; in the Aalto University Research Assessment Exercise in 2009; and in the Evaluation of Research and Doctoral Training at the University of Helsinki in 2011.

www.hiit.fi

Ella Bingham, Noora Suominen de Rios (eds.)

Helsinki Institute for Information Technology HIIT

Annual Report 2015

Ella Bingham and Noora Suominen de Rios (eds.)

Contact Information

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

hiit-info@hiit.fi
www.hiit.fi

Otaniemi Site

Postal address at Open Innovation House (OIH):
Helsinki Institute for Information Technology HIIT
PO Box 15600, FI-00076 Aalto, Finland

Street address:
Aalto University, Open Innovation House (OIH), Otaniementie 19-21, Espoo
Telephone: +358 9 47001

Postal address at Computer Science Building:
Helsinki Institute for Information Technology HIIT
PO Box 15400, FI-00076 Aalto, Finland

Street address:
Computer Science Building, Konemiehentie 2, Espoo
Telephone: +358 9 47001

Kumpula Site

Postal address:
Helsinki Institute for Information Technology HIIT
PO Box 68, FI-00014 University of Helsinki, Finland

Street address:
University of Helsinki, Department of Computer Science, Exactum
Gustaf Hällströmin katu 2b, Helsinki
Telephone: +358 9 1911
Fax: +358 9 191 51120

Unigrafia, Espoo 2016

Cover image by Digivaalit 2015 project
Lay-out: Anna Bergman, Noora Suominen de Rios

Table of Contents

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 on information technology. HIIT's mission is to conduct top-level research, seamlessly moving between fundamental methods and technologies to novel applications and their impact on people and society. HIIT is a strategic partnership of the two universities to take Helsinki IT to the world class and keep it there. HIIT's research is interdisciplinary, operating across departments and with industry. The current foci of research are computational modelling and data analysis, and ubiquitous ICT in the modern networked world.

HIIT groups belong to several national Centers of Excellence and co-operate with the information industry and with sciences applying information technology. HIIT works in a multidisciplinary way, with scientists from computer, natural, behavioural and social sciences, as well as from humanities and design. HIIT partners with several international and Finnish companies as well as with universities and research institutions in Europe, North America and Asia.

HIIT was founded in 1999 and now has a budget of 9 million euros, realising in total about 140 person-years of work by about 300 researchers. HIIT is located in two different sites in the Helsinki Metropolitan area: at Aalto University's Otaniemi campus and University of Helsinki's Kumpula campus. HIIT's operating principle is that it adds to other departments' activities, instead of competing with them. The institute was led by Professor Samuel Kaski until July 2015 and by Professor Petri Myllymäki from August 2015 onwards. HIIT's research is funded by Aalto University, the University of Helsinki, Tekes, the Academy of Finland, the European Union, private companies, and foundations financing Finnish hi-tech research. The research by HIIT has been assessed and deemed excellent by its Scientific Advisory Board in 2008 and 2012; in the Aalto University Research Assessment Exercise in 2009; and in the Evaluation of Research and Doctoral Training at the University of Helsinki in 2011.

Total numbers	2010	2011	2012	2013	2014	2015
Funding M€	12,1	10,5	11,5	10,0	10,5	9,1
External/competitive funding	83 %	78 %	83 %	79 %	82 %	80 %
Person-years	175	135	144	154	134	138
Refereed publications	222	213	209	238	274	257

Aalto-yliopisto

HELSINGIN YLIOPISTO
HELSINGFORS UNIVERSITET
UNIVERSITY OF HELSINKI

Review of Year 2015

Augmented research, health and knowledge work, and other IT

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. HIIT is a strategic partnership of the two universities to *take Helsinki IT to the world class and keep it there*.

Professor Petri Myllymäki, a HIIT group leader and programme director, started as a new Director of HIIT in August 2015. Professor Samuel Kaski's 5-year term ended in July 2015.

Two main goals of HIIT are to (1) conduct high level strategic research bridging the two universities, and (2) coordinate big common ICT issues across departments to form a common "Helsinki ICT". Year 2015 again witnessed success along both lines.

In 2015 HIIT contributed to three Centres of Excellence of the Academy of Finland: Computational Inference (COIN, overlapping with HIIT's CI programme), Inverse Problems, and Cancer Genetics.

Tekes's strategic research openings are visionary and challenging projects aiming to make serious breakthroughs that will lay the foundation for entirely new areas of business in the future. The first strategic openings were chosen in 2013 when Re:Know, Revolution of Knowledge Work, was one of the two. Re:Know is coordinated by HIIT and the partners are University of Helsinki, Aalto University and Institute for Occupational Health. In 2014, Tekes funded three new strategic openings, two of which HIIT's researchers participate in: Digital Health Revolution and Living Factories. The vision of the Digital Health Revolution initiative is that future healthcare will allow citizens to control and make use of their personal data. The goal of Living Factories is to realise the full potential of Synthetic Biology in Finland. Synthetic Biology is based on the design and engineering of new-to-nature biological systems.

Re:Know

DIGITAL HEALTH REVOLUTION

Professor Hiroshi Mamitsuka from the Institute for Chemical Research, Kyoto University, Japan, started as a FiDiPro Professor funded by Tekes in the beginning of 2015.

.

COIN Finnish Centre of Excellence in Computational Inference Research

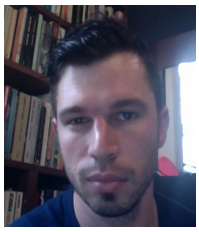
Finnish Centre of Excellence in Inverse Problems Research

The Finnish Center of Excellence in Cancer Genetics Research

Nominations

Professor Samuel Kaski, Director of HIIT until July 2015, was nominated as an Academy Professor. He develops computational methods for interactive multi-source data analysis and machine learning. The aim of the Academy of Finland's funding for an Academy Professor is to facilitate full-time scientific research for internationally leading-edge researchers. Academy Professors are expected to greatly contribute to the progress of research in their fields and develop a creative research environment.

Dr Pekka Marttinen got Academy of Finland's 5-year Academy Research Fellow funding for his research on "Enhanced learning of hierarchical structured models with biomedical applications". Similarly, Dr Simon Puglisi's 5-year Academy Research Fellow funding is for "Fast and Efficient Indexes for Highly Repetitive Data". Dr Jukka-Pekka Kauppi got Academy of Finland's 3-year Postdoctoral Research funding for his research on "Neuroscientifically motivated novel decoding methods for multichannel electromyographic and magnetoencephalographic signals" and Dr Niko Välimäki was awarded a similar position for "Variation Calling on Population Genotypes: From Data Structures to Applications".



Professor Jukka Corander was selected as a Visiting Fellow at University of Cambridge. His research during the visit will concentrate on infectious disease epidemiology and genomics. Professor Corander was also awarded the Cozzarelli Prize in biomedical sciences by PNAS, for a revolutionary discovery concerning evolutionary mechanisms in bacterial populations.

Augmented research

Augmented search, research, and knowledge work are the main themes of the HIIT-wide research initiative that is a strategic research focus of HIIT. It is a big multidisciplinary project spanning several research groups of HIIT at Aalto University and University of Helsinki. Several research groups ranging from Human-Computer Interaction to Machine Learning and Complex Systems Computation collaborates to produce cutting edge research and demonstrations that go beyond individual research papers. The initiative is described in more detail on page 31.

Collaboration

HIIT collaborates actively both within Helsinki area and internationally, and acts as a link between researchers, companies and public administration.

Collaboration in Helsinki IT

HIIT collaborates actively both within Helsinki area and internationally, and acts as a link between researchers, companies and public administration. In Helsinki area, HIIT coordinates common activities of computer science research in several ways: education, recruitments, and joint initiatives.

In doctoral education, HIIT coordinates **the Helsinki Doctoral Education Network in Information and Communications Technology (HICT)**. HICT is hosted jointly by Aalto University and the University of Helsinki, the two leading universities within this area in Finland. The network serves as a collaboration platform for doctoral education combining all the relevant subfields of computer science and information technology at Aalto University and the University of Helsinki. It involves at present 65 professors and almost 300 doctoral students, and the participating units produce altogether more than 40 new doctors each year.

HIIT also collaborates with **Institute for Molecular Medicine Finland FIMM** in recruiting PhD students to rotate between research groups at FIMM and HIIT. The collaboration is part of the Nordic EMBL Partnership for Molecular Medicine and the call is able to attract a large number of excellent doctoral candidates from all over the world.

Data Science is a big research focus for the whole HIIT, spanning over several application areas. Its objective is to provide the underlying theory and the necessary tools to cope with the current data revolution. The education in this area has been boosted by several education programmes such as the Master's Programme in Machine learning and Data mining (Madacamia) at Aalto and Data Science study profile at University of Helsinki. For interdisciplinary studies, Analytics and Data Science is a minor topic available for all MSc students at Aalto, jointly coordinated by professor Aristides Gionis from HIIT and professor Pekka Malo at Aalto BIZ. The goal of the minor is to educate students on how to become proficient in making sense of such big data, and how to apply data analysis skills on their own domain of expertise.

Recruitment is an important means of collaboration. HIIT arranges joint Helsinki IT **postdoc and senior researcher calls** together with several departments in the field of computer science at Aalto University and University of Helsinki. These joint calls leverage on and further enhance the brand of Helsinki as a hub of computer science, and attract a wide range of high-level applicants.

Aalto Digi Platform

Digi Platform is Aalto University's collaborative initiative in the field of ICT and digitalization. It is chartered to innovate, initiate and increase digitalization related cooperation broadly inside Aalto and with its industrial and academic partners. The Digi Platform facilitates and brings together Aalto's competences in this multidisciplinary area, in a bottom up manner, and increases Aalto's visibility. Expertise across Aalto is brought together to maximize the potential of IT to boost other sciences, technologies and society. The Digi Platform provides seed funding, arranges matchmaking events, acts as a collaboration platform within Aalto, and provides a "front desk" for external contacts. HIIT coordinates the Digi Platform, and University of Helsinki participates in the platform via HIIT.

International collaboration

All HIIT's activities are inherently international, mostly in a bottom-up manner. Cooperation with key international research institutes and univarrersities is active: Berkeley (ICSI and UC Berkeley), MIT, Centre for Computational Statistics and Machine Learning (CSML) at UCL, European Bioinformatics Institute EBI, Human Technology Lab (HTLab) at University of Padova, and Waseda University, to name a few.

Center for Science of Information
NSF Science and Technology Center

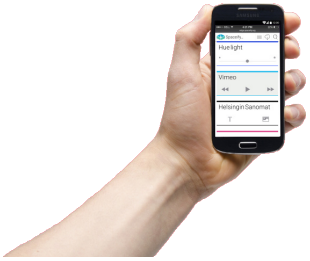
National Science Foundation

HIIT coordinates Aalto University's and University of Helsinki's strategic partnership with NSF Science and Technology Center for Science of Information (SoI). The member universities of the SoI center are Purdue (leader), Bryn Mawr, Howard, MIT, Princeton, Stanford, Texas A&M, UC Berkeley, UCSD and Urbana-Champaign. Other strategic partners in Europe are ETH (Zürich, Switzerland) and the LINCS network (Paris, France).

eit Digital

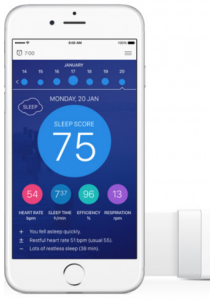
EIT Digital is an European initiative intended to turn Europe into a global leader in ICT innovation. It aims to fulfill this mission by establishing a new type of partnership between leading companies, research centres, and universities in Europe. One of the 5 nodes is Helsinki. Several HIIT researchers have research projects with EIT Digital.

HIIT's researcers are active in organizing high-profile international conferences and workshops: the most recent ones are International Conference on Computational Creativity ICCC 2015 and 4th International Workshop on Symbiotic Interaction.



Societal impact

HIIT aims to boost the competitiveness of the Finnish information industry and information society in the long run by linking scientific research with the long-term high-risk research and development of the information industry, and by contributing to the development of the information society. HIIT both anticipates developments of the information society and influences them. New technologies developed at HIIT are taken into use at the ICT sector or other fields in the commercial and public sector.



HIIT's researchers and alumni establish approximately one startup company per year. The newest one is Spaceify, a startup to webify spaces. The aim of Spaceify is to commercialise solutions that provide immediate interaction with smart spaces through web technologies. The core of the solution is a client-edge-server ecosystem that seamlessly integrates physical spaces with the web. Spaceify can give web apps controlled access to resources such as big screens, sensors and lighting in the space. The founding of Spaceify Oy is an example of long-term strategic research resulting in an impact beyond academic results.

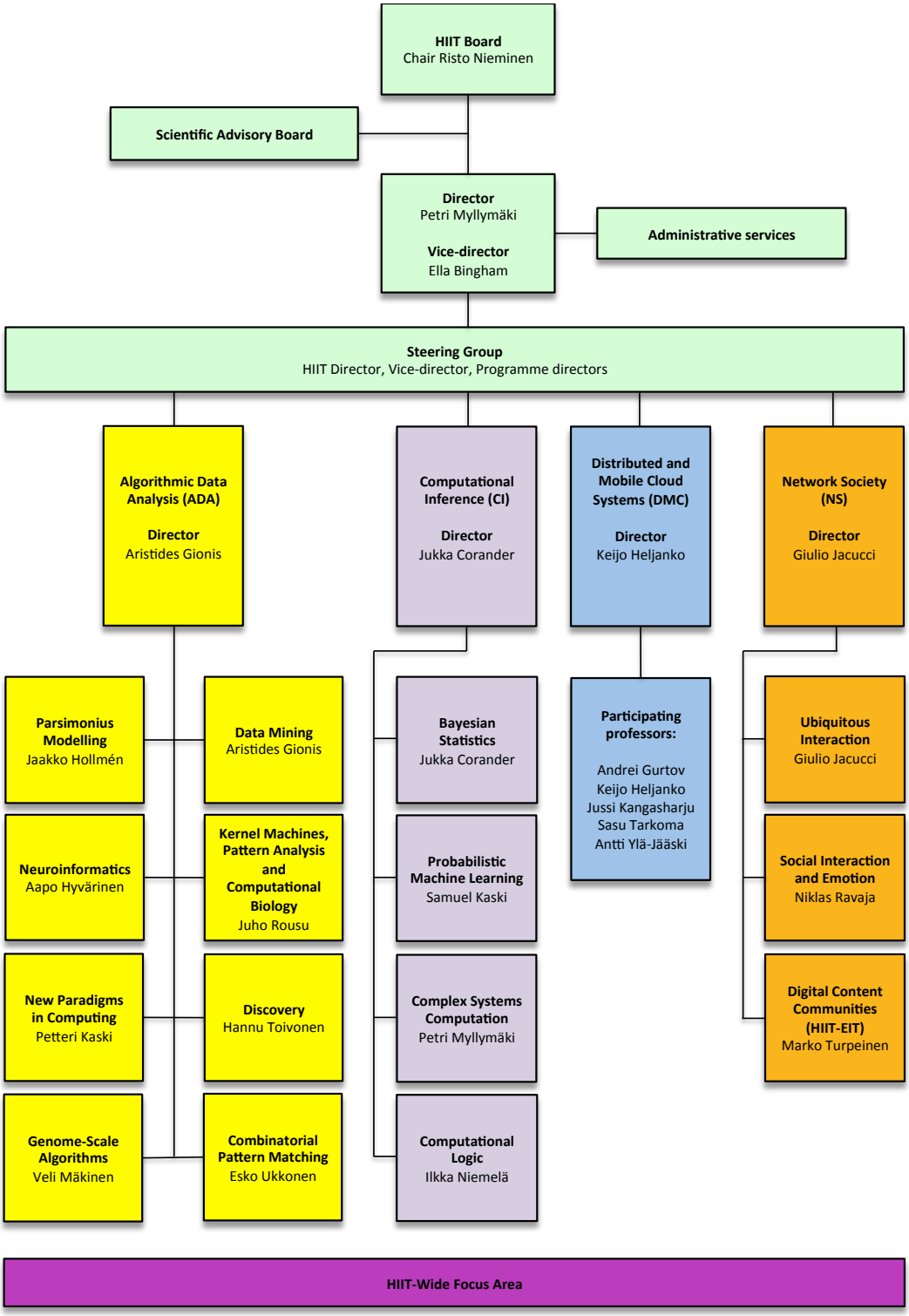
The sleep monitor firm Beddit uses a sleep analysis software developed in the PhD work of Joonas Paalasmaa of HIIT.

HIIT researchers have been active in issues related to public policy having the profile of a vocal and visible participant in the public debate related to various important themes of information society, especially the discussion on emerging social forms of media use, immaterial rights, privacy and trust in the network society. MyData is a human-centric approach to the managing and processing of personal information. It is based on the right of individuals to access the data collected about them. The core idea is that individuals should be in control of their own data. The MyData approach aims at strengthening digital human rights while opening new opportunities for businesses to develop innovative personal data based services built on mutual trust. HIIT researchers Kai Kuikkaniemi and Antti Poikola are key figures behind MyData in Finland.

Views for 2016

The research programmes of HIIT will be renewed in 2016. The new programmes will be challenge-oriented, scientifically top-level, potentially high-impact with respect to HIIT's mission, interdisciplinary, and fixed term. Administratively all HIIT's activities at Aalto University merge with the Computer Science department of the School of Science at Aalto University as of 1 January 2016. This will not restrict HIIT's scientific activities, and HIIT researchers can also be affiliated with other departments at Aalto University.

Helsinki Institute for Information Technology

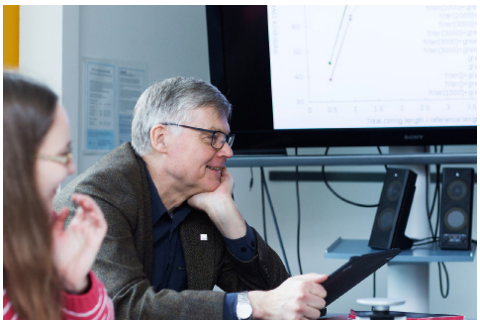


Research

Algorithmic Data Analysis (ADA) Programme

The mission of the Algorithmic Data Analysis (ADA) 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. The research focuses on the algorithmic and modeling problems of combinatorial pattern matching, data mining, and machine learning. The work is strongly interdisciplinary. Developing new concepts and algorithms is an iterative process consisting of interacting extensively with the application experts, formulating computational concepts, analyzing the properties of the concepts, designing algorithms and analyzing their performance, implementing and experimenting with the algorithms, and applying the results in practice. The main application areas of ADA are in biology, medicine, environmental studies, creativity, social networks, and neuroscience.

Combinatorial Pattern Matching, Professor Esko Ukkonen



The combinatorial pattern-matching group develops combinatorial algorithms and probabilistic modeling techniques for pattern search and synthesis problems in sequential and higher-dimensional data. The team is interested in the basic research of the theoretical aspects of the area as well as in various applications such as genome structure, gene regulation, and information retrieval.

Key publications:

- Jouni Kvist, Anniina L. K. Mattila, Panu Somervuo, Virpi Ahola, Patrik Koskinen, Lars Paulin, Leena Salmela, Toby Fountain, Pasi Rastas, Annukka Ruokolainen, Minna Taipale, Liisa Holm, Petri Auvinen, Rainer Lehtonen, Mikko J. Frilander, and Ilkka Hanski. Flight-induced changes in gene expression in the Glanville fritillary butterfly. Molecular Ecology, 24(19):4886–4900, 10 2015.
- Leena Salmela, Kristoffer Sahlin, Veli Mäkinen, and Alexandru I. Tomescu. Gap filling as exact path length problem. In Teresa M. Przytycka, editor, Research in Computational Molecular Biology: 19th Annual International Conference, RECOMB 2015, Warsaw, Poland, April 12-15, 2015, Proceedings, volume 9029 of Lecture Notes in Bioinformatics, pages 281–292, 2015.

Data Mining,
Professor Aristides Gionis

The data-mining group focuses on developing novel methods to extract knowledge from data, designing algorithms to summarize large volumes of data efficiently and effectively, and exploring new ways of using the extracted information. Specific areas of interest include: pattern discovery, clustering and outlier detection, graph mining, social-network analysis, analysis of information networks and social-network dynamics, and analysis of smart-city sensor data.

Key publications:

- Francesco Bonchi, Aristides Gionis, Francesco Gullo, Charalampos E. Tsourakakis, and Antti Ukkonen. Chromatic correlation clustering. ACM Transactions on Knowledge Discovery from Data, 9(4):000034/1–24, 2015.
- Ehsan Amid, Aristides Gionis, and Antti Ukkonen. A kernel-learning approach to semi-supervised clustering with relative distance comparisons. Machine Learning and Knowledge Discovery in Databases: European Conference, ECML PKDD 2015, Porto, Portugal, September 7-11, 2015, Proceedings, Part I. Springer, 2015.
- Kiran Garimella, Gianmarco De Francisci Morales, Aristides Gionis, and Mauro Sozio. Scalable facility location for massive graphs on Pregel-like systems. In 24th ACM International Conference on Information and Knowledge Management (CIKM 2015), pages 273–282, October 2015.
- Aristides Gionis, Michael Mathioudakis, and Antti Ukkonen. Bump hunting in the dark: Local discrepancy maximization on graphs. In 31st IEEE International Conference on Data engineering (ICDE), 2015.
- Orestis Kostakis and Aristides Gionis. Subsequence search in event-interval sequences. In 38th International ACM SIGIR Conference on Research and Development in Information Retrieval, pages 851–854, New York, NY, USA, August 2015.
- Rohit Kumar, Toon Calders, Aristides Gionis, and Nikolaj Tatti. Maintaining sliding-window neighborhood profiles in interaction networks. Machine Learning and Knowledge Discovery in Databases: European Conference, ECML PKDD 2015, Porto, Portugal, September 7-11, 2015, Proceedings, Part II, pages 719-735, Springer, 2015.
- Eric Malmi, Arno Solin, and Aristides Gionis. The blind leading the blind: Network-based location estimation under uncertainty. Machine Learning and Knowledge Discovery in Databases: European Conference, ECML PKDD 2015, Porto, Portugal, September 7-11, 2015, Proceedings, Part II, pages 406–421. Springer, 2015.
- Charalampos Mavroforakis, Michael Mathioudakis, and Aristides Gionis. Absorbing random-walk centrality: Theory and algorithms. In IEEE International Conference on Data Mining (ICDM), 2015.
- Nikolaj Tatti and Aristides Gionis. Density-friendly graph decomposition. In Proceedings of the 24th International Conference on World Wide Web (WWW 2015), page 1099, 2015.

Discovery Group: Data Mining and Computational Creativity, Professor Hannu Toivonen

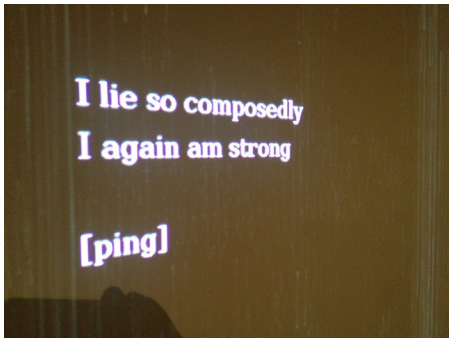
The Discovery research group develops novel methods and tools for data mining and computational creativity. Our focus is on algorithmic methods for discovering links and patterns in data and on their use in creative systems.

In data mining and graph mining we focus on analysis and exploration methods for text documents and weighted graphs. We identify relevant computational problems, develop new concepts and algorithms, and apply them.

A more recent focus area is computational creativity, interesting on its own right but also as an application area for data mining methods. We work on verbal creativity, i.e., computational poetry and humour, and also on automatic composition of music. We are developing novel methods that minimize the need for manually coded or language-specific knowledge.

Key publications:

- Joonas Paalasmaa, Hannu Toivonen, and Markku Partinen. Adaptive heartbeat modeling for beat-to-beat heart rate measurement in ballistocardiograms. IEEE Journal of Biomedical and Health Informatics, 19(6):1945–1952, 11 2015.
- Hannu Toivonen and Oskar Gross. Data mining and machine learning in computational creativity. Wiley Interdisciplinary Reviews. Data Mining and Knowledge Discovery, 5(6):265–275, 2015.
- Anna Kantosalo, Jukka Toivanen, and Hannu Toivonen. Interaction evaluation for human-computer co-creativity: A case study. In Hannu Toivonen, Simon Colton, Michael Cook, and Dan Ventura, editors, Sixth International Conference on Computational Creativity (ICCC 2015), pages 276–283, 2015.
- Ping Xiao and Simo Matias Linkola. Vismantic: Meaning-making with images. In Hannu Toivonen, Simon Colton, Michael Cook, and Dan Ventura, editors, Sixth International Conference on Computational Creativity (ICCC 2015), pages 158–165, 6 2015.



Neuroinformatics, Professor Aapo Hyvärinen

Neuroinformatics is widely defined as the cross-fertilization of information-processing and mathematical sciences on the one hand, and neural and cognitive sciences on the other.

Our group works on different aspects of neuroinformatics related to machine learning. We model the visual system in the brain by analyzing the statistical structure of the natural input images. We apply machine learning models on neuroimaging data, in particular MEG. We also develop the relevant theory of statistical machine learning, typically unsupervised.

Key publications:

- Aleksandra Herbec, Jukka-Pekka Kauppi, Corinne Jola, Jussi Tohka, and Frank E. Pollick. Differences in fMRI intersubject correlation while viewing unedited and edited videos of dance performance. Cortex, 71:341–348, 10 2015.
- Haruo Hosoya and Aapo Hyvärinen. A hierarchical statistical model of natural images explains tuning properties in V2. Journal of Neuroscience, 35(29):10412–10428, 2015.
- Jukka-Pekka Kauppi, Janne Hahne, Klaus-Robert Müller, and Aapo Hyvärinen. Three-way analysis of spectrospatial electromyography data: Classification and interpretation. PLoS One, 10(6), 6 2015.
- Aapo Hyvärinen. A unified probabilistic model for independent and principal component analysis. In Ella Bingham, Samuel Kaski, Jorma Laaksonen, and Jouko Lampinen, editors, Advances in Independent Component Analysis and Learning Machines, pages 75–82. Elsevier, 2015.

Parsimonious Modeling, Dr. Jaakko Hollmén

The research group Parsimonious Modelling develops novel computational data analysis methods and applies these methods on two application fields: cancer genomics and environmental informatics. Parsimonious modeling aims at simple, compact, or sparse models as a result of learning from data in the presence of very little or no a priori information about the modeled problem. Simplicity of the models facilitates understanding of the problem domain by humans.

Both application fields present similar challenges to the data analysis problems: the high dimensionality of observed data and the presence of moderate or large noise levels are both factors that bear fundamental problems for any data analysis. Seeking new areas of application and interfacing the newest application domains with lots of novel types of generated data helps in finding new, unsolved settings of problems.

Key publications:

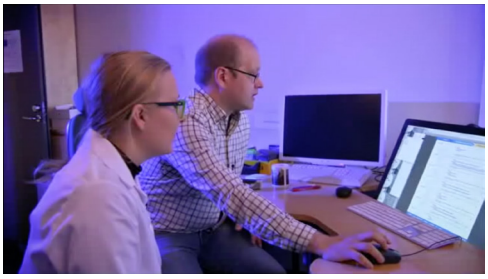
- Prem Raj Adhikari and Jaakko Hollmen. Fast progressive training of mixture models for model selection. Journal of Intelligent Information Systems, 44(2):223–241, 2015.
- Luca Martino, Jesse Read, and David Luengo. Independent doubly adaptive rejection metropolis sampling within Gibbs sampling. IEEE Transactions on Signal Processing, 63(12):3123–3138, 2015.
- Indre Zliobaite, Albert Bifet, Jesse Read, Bernhard Pfahringer, and Geoff Holmes. Evaluation methods and decision theory for classification of streaming data with temporal dependence. Machine Learning, 98(3):455–482, 2015.
- Indre Zliobaite and Jaakko Hollmen. Optimizing regression models for data streams with missing values. Machine Learning, 99(1):47–73, 2015.
- Albert Bifet, Gianmarco De Francisci Morales, Jesse Read, Bernhard Pfahringer, and Geoff Holmes. Efficient online evaluation of big data stream classifiers. In 21st ACM SIGKDD Conference on Knowledge Discovery and Data Mining (KDD-2015), pages 59–68. AAAI Press, August 2015.
- Jesse Read, Albert Bifet, and Fernando Perez-Cruz. Deep learning in partially-labeled data streams. In 30th ACM Symposium on Applied Computing (SAC 2015), April 2015.
- Olli-Pekka Rinta-Koski, Jaakko Hollmén, Markus Leskinen, and Sture Andersson. Variation in oxygen saturation measurements in very low birth weight infants. In Fillia Makedon, editor, Proceedings of the 8th ACM International Conference on PErvasive Technologies Related to Assistive Environments, New York, NY, USA, July 2015. ACM.

Kernel Machines, Pattern Analysis and Computational Biology, Professor Juho Rousu

The group develops machine learning methods, models and tools for data science, in particular computational metabolomics. The methodological backbone of the group is formed by kernel methods and regularized learning. The group focusses in learning with multiple and structured targets, multiple views and ensembles. Machine learning applications of interest include metabolite identification, metabolic network reconstruction and pathway analysis, chemogenomics as well as biomarker discovery.

Key publications:

- Anna Cichonska, Juho Rousu, and Tero Aittokallio. Identification of drug candidates and repurposing opportunities through compound-target interaction networks. Expert Opinion on Drug Discovery, 10(12):1333–1345, 2015.
- Kai Dührkop, Huibin Shen, Marvin Meusel, Juho Rousu, and Sebastian Böcker. Searching molecular structure databases with tandem mass spectra using CSI:FingerID. Proceedings of the National Academy of Sciences. 112(41):12580–12585, 2015.
- Hongyu Su. Multilabel Classification through Structured Output Learning - Methods and Applications. PhD thesis, Aalto University, 2015.
- Hongyu Su and Juho Rousu. Multilabel classification through random graph ensembles. Machine Learning, 99(2):231–256, 2015.
- Viivi Uurtio, Malin Bomberg, Kristian Nybo, Merja Itävaara, and Juho Rousu. Canonical correlation methods for exploring microbe-environment interactions in deep subsurface. In Discovery Science. 18th International Conference, DS 2015, Banff, AB, Canada, October 4-6, 2015. Proceedings, LNCS 9356, pages 299–307. Springer International Publishing, October 2015.



Genome-Scale Algorithms, Professor Veli Mäkinen

We develop algorithms and data structures for the analysis of genome-scale data. Such data is abundant due to modern molecular biology measurement techniques like high-throughput sequencing. We are especially interested in applications of compressed data structures, that make it possible to analyse the often highly redundant data within the space of their information content. We also study other scalability aspects like distributed computation/storage around genome-scale data.

Key publications:

- Diego Arroyuelo, Francisco Claude, Sebastian Maneth, Veli Mäkinen, Gonzalo Navarro, Kim Nguyen, Jouni Sirén, and Niko Välimäki. Fast in-memory XPath search using compressed indexes. Software: Practice & Experience, 45(3):399–434, 3 2015.
- Djamal Belazzougui. Improved space-time tradeoffs for approximate full-text indexing with one edit error. Algorithmica, 72(3):791–817, 7 2015.
- Djamal Belazzougui and Gonzalo Navarro. Optimal lower and upper bounds for representing sequences. ACM Transactions on Algorithms, 11(4), 2015.
- Travis Gagie, Pawel Gawrychowski, and Simon J. Puglisi. Approximate pattern matching in LZ77-compressed texts. Journal of Discrete Algorithms, 32:64–68, 2015.
- Alexandru I. Tomescu, Travis Gagie, Alexandru Popa, Romeo Rizzi, Anna Kuosmanen, and Veli Mäkinen. Explaining a weighted DAG with few paths for solving genome-guided multi-assembly. IEEE/ACM Transactions on Computational Biology and Bioinformatics, 12(6):1345–1354, 12 2015.
- Karen E. van Rens, Veli Mäkinen, and Alexandru I. Tomescu. SNV-PPILP: refined SNV calling for tumor data using perfect phylogenies and ILP. Bioinformatics, 31(7):1133– 1135, 4 2015.
- Roland Wittler, Tobias Marschall, Alexander Schönhuth, and Veli Mäkinen. Repeat- and error-aware comparison of deletions. Bioinformatics, 31(18):2947–2954, 9 2015.
- Djamal Belazzougui, Veli Mäkinen, and Daniel Valenzuela. Compressed suffix array. In Ming-Yang Kao, editor, Encyclopedia of Algorithms. Springer, 2015.
- Travis Gagie. Rank and select operations on sequences. In Ming-Yang Kao , editor, Encyclopedia of Algorithms. Springer, 2015.
- Veli Mäkinen, Djamal Belazzougui, Fabio Cunial, and Alexandru Ioan Tomescu. Genome-Scale Algorithm Design: Biological Sequence Analysis in the Era of High-Throughput Sequencing. Cambrigde University Press, United Kingdom, 5 2015.

New Paradigms in Computing, Professor Petteri Kaski

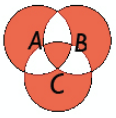
The group performs basic research at the intersection of core computer science (algorithm design and analysis) and discrete mathematics, with an emphasis towards novel techniques and less studied models of computation. We invest substantial effort to high-risk, high-yield research problems of relatively broad theoretical interest, selected on both problem and method driven basis. The current research themes of the group are threefold. (1) 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 nontrivial algebraic algorithm yields a more efficient solution compared with direct combinatorial tools. (2) Restricted models of computation and tradeoffs in resources and/or objectives. (3) While we are a theory group, we occasionally engage in practical algorithm implementation. Examples include attacks on combinatorial classification problems and applications in computational geometry.

Key publications:

- Michael A. Bender, Sándor P. Fekete, Alexander Kröller, Vincenzo Liberatore, Joseph S. B. Mitchell, Valentin Polishchuk, and Jukka Suomela. The minimum backlog problem. Theoretical Computer Science, (605):51–61, 2015.
- Andreas Björklund, Thore Husfeldt, Petteri Kaski, Mikko Koivisto, Jesper Nederlof, and Pekka Parviainen. Fast Zeta transforms for lattices with few irreducibles. ACM Transactions on Algorithms, 12(1):4, 2015.
- Ho-Lin Chen, David Doty, and Shinnosuke Seki. Program size and temperature in self-assembly. Algorithmica, 72(3):884–899, 2015.
- Alon Efrat, Sándor P. Fekete, Joseph S. B. Mitchell, Valentin Polishchuk, and Jukka Suomela. Improved approximation algorithms for relay placement. ACM Transactions on Algorithms, 12(2):28 p., 2015.
- Serge Gaspers, Mikko Koivisto, Mathieu Liedloff, Sebastian Ordyniak, and Stefan Szeider. On finding optimal polytrees. Theoretical Computer Science, 592(C):49–58, 2015.
- Lauri Hella, Matti Järvisalo, Antti Kuusisto, Juhana Laurinharju, Tuomo Lempiäinen, Kerkko Luosto, Jukka Suomela, and Jonni Virtema. Weak models of distributed computing, with connections to modal logic. Distributed computing, 28(1):31–53, 2015.
- Petteri Kaski, Patric R.J. Östergård, and Alexandru Popa. Enumeration of Steiner triple systems with subsystems. Mathematics of Computation, 84(-):3051–3067, 2015.
- Keren Censor-Hillel, Petteri Kaski, Janne H. Korhonen, Christoph Lenzen, Ami Paz, and Jukka Suomela. Algebraic methods in the congested clique. In Proc. ACM PODC, pages 143–152, 2015.
- Juho-Kustaa Kangas, Teppo Niinimäki, and Mikko Koivisto. Averaging of decomposable graphs by dynamic programming and sampling. In Proc. UAI, pages 415–424, 2015.
- Christoph Lenzen, Joel Rybicki, and Jukka Suomela. Towards optimal synchronous counting. In Proc. ACM PODC, pages 441–450, July 2015.

$$\Delta(f,g,h) = \sum_{\substack{A,B,C\in\binom{[n]}{k/3} \\ A\cap B=\emptyset \\ A\cap C=\emptyset \\ B\cap C=\emptyset}} f(A)g(B)h(C) = x_k$$

$$x_j = \sum_{\substack{A,B,C\in\binom{[n]}{k/3} \\ |A\oplus B\oplus C|=j}} f(A)g(B)h(C)$$



$j = 0, 1, \ldots, k$

$X \oplus Y = (X \setminus Y) \cup (Y \setminus X)$

$j \equiv k \pmod 2$

Computational Inference (CI) Programme

The four groups of the CI programme are all members of the Finnish Centre of Excellence in Computational Inference Research (COIN), and the objectives of the programme are closely intertwined with those of COIN.

The main objective of CI is to develop methods for transforming the data produced by the current data revolution into useful information. The key methodology for achieving this goal is statistical and computational inference based on the data. The emphasis is on large data collections and computationally demanding modelling and inference algorithms. Our mission is to push the boundary towards both more complex problems, requiring more structured data models, and towards extremely rapid inference. We address a set of carefully chosen interdisciplinary “grand challenge” -level problems with high societal impact where solving the data intensive problems requires novel methodologies that can only result from combining the expertise of separate subfields

Our mission brings up four partially overlapping methodological focus areas: Learning of massive data-driven models; Learning from multiple sources; Statistical inference in highly structured stochastic models; and Extreme inference engine.

In applied research our work is also motivated by the big data and ubiquitous computing vision, where adaptivity, context-awareness and personalisation are key enablers. We see that our four methodological research areas support strongly each other, and they all address from a different perspective the key technological problems we face in our future “big data” information society. In our applied research we link our strong basic research work in machine learning and constraint reasoning to well-motivated applied research activities involving prototype applications and real-world deployments

Probabilistic Machine Learning, Professor Samuel Kaski

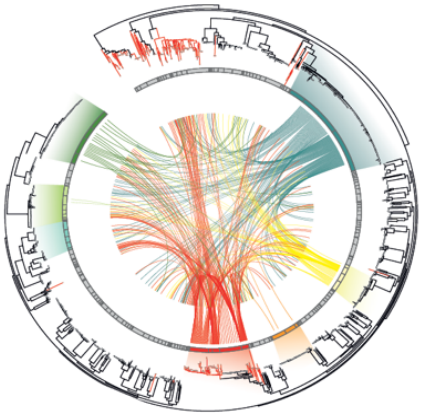
We develop new methods for probabilistic modeling, Bayesian inference and machine learning. Our current focuses are in particular learning from multiple data sources, Bayesian model assessment and selection, approximate inference and information visualization. Our primary application areas are digital health and biology, neuroscience and user interaction.

Key publications:

- James Hensman, Panagiotis Papastamoulis, Peter Glaus, Antti Honkela, and Magnus Rattray. Fast and accurate approximate inference of transcript expression from RNA-seq data. Bioinformatics, 31(24):3881–3889, 12 2015.
- Antti Honkela, Jaakko Peltonen, Hande Topa, Iryna Charapitsa, Filomena Matarese, Korbinian Grote, Hendrik G. Stunnenberg, George Reid, Neil D. Lawrence, and Magnus Rattray. Genome-wide modeling of transcription kinetics reveals patterns of RNA production delays. PNAS, 112(42):13115–13120, 10 2015.
- Jukka-Pekka Kauppi, Melih Kandemir, Veli-Matti Saarinen, Lotta Hirvenkari, Lauri Parkkonen, Arto Klami, Riitta Hari, and Samuel Kaski. Towards brain-activity-controlled information retrieval: Decoding image relevance from MEG signals. NeuroImage, 112(1):288–298, 2015.
- Arto Klami, Seppo Virtanen, Eemeli Leppäaho, and Samuel Kaski. Group factor analysis. IEEE Transactions on Neural Networks and Learning Systems, 26(9):2136– 2147, 2015.
- Tuukka Ruotsalo, Giulio Jacucci, Petri Myllymäki, and Samuel Kaski. Interactive intent modeling: Information discovery beyond search. Communications of the ACM, 58(1):86–92, 2015.
- Hande Topa, Àgnes Jònàs, Robert Kofler, Carolin Kosiol, and Antti Honkela. Gaussian process test for high-throughput sequencing time series: application to experimental evolution. Bioinformatics, 31(11):1762–1770, 2015.
- Zhirong Yang, Jaakko Peltonen, and Samuel Kaski. Majorization-minimization for manifold embedding. In The 18th International Conference on Artificial Intelligence and Statistics (AISTATS'15), pages 1088–1097, USA, May 2015.
- Dario Gasbarra , Elja Arjas, Aki Vehtari, Rémy Slama, and Niels Keiding. The current duration design for estimating the time to pregnancy distribution: a nonparametric Bayesian perspective. In Lifetime Data Analysis, volume 21, Issue 4, pp 594-625, 2015.

Bayesian Statistics, Professor Jukka Corander

We do research on theoretical and applied machine learning, biometry, bioinformatics and forensic statistics. Some specific areas of interest are clustering and statistical inference in highly structured stochastic models. Our main application area is computational biology, in particular models for evolution and transmission of bacteria and viruses. These findings have been enabled by our better scalable Bayesian inference methods for the analysis of bacterial whole-genome data that are several orders of magnitude faster than recent other methods based on standard Bayesian computation.



Key publications:

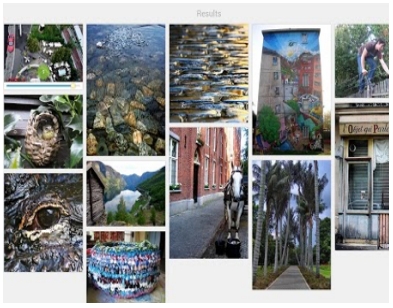
- Johan Pensar, Henrik Nyman, Jarno Lintusaari, Jukka Corander. The role of local partial independence in learning of Bayesian networks. International Journal of Approximate Reasoning, doi:10.1016/j.ijar.2015.11.008, 2015.
- Paul Blomstedt, Jing Tang, Jie Xiong, Christian Granlund, and Jukka Corander. A Bayesian predictive model for clustering data of mixed discrete and continuous type. IEEE Transactions on Pattern Analysis and Machine Intelligence, 37(3):489–498, 2015.
- Lucy Weinert, Roy Chaudhuri, Jinhong Wang, Sarah Peters, Jukka Corander, Thibaut Jombart, Abiyad Baig, Kate Howell, Minna Vehkala, Niko Välimäki, David Harris, Bich Chieu Tran Thi, Chau Nguyen Van Vinh, James Campbell, Constance Schultsz, Julian Parkhill, Stephen Bentley, Paul Langford, Andrew Rycroft, Brendan Wren, Jeremy Farrar, Stephen Baker, Ngo Hoa, Matthew Holden, Alexander Tucker, and Duncan Maskell. Genomic signatures of human and animal disease in the zoonotic pathogen Streptococcus suis. Nature Communications, doi:10.1038/ncomms7740, 2015.
- Luca Martino, Jesse Read, and David Luengo. Independent doubly adaptive rejection metropolis sampling within Gibbs sampling. IEEE Transactions on Signal Processing, 63(12):3123–3138, 2015.
- Luca Martino, Víctor Elvira, David Luengo, and Jukka Corander. An Adaptive Population Importance Sampler: Learning from Uncertainty. IEEE Transactions on Signal Processing, doi: 10.1109/TSP.2015.2440215, 2015.
- Pekka Marttinen, Nicholas J. Croucher, Michael U. Gutmann, Jukka Corander, and William P. Hanage. Recombination produces coherent bacterial species clusters in both core and accessory genomes. Microbial Genomics, (1):5, 2015.
- Tomi Janhunen, Martin Gebser, Jussi Rintanen, Henrik Nyman, Johan Pensar, Jukka Corander. Learning Discrete Decomposable Graphical Models via Constraint Optimization. Statistics and Computing, DOI: 10.1007/s11222-015-9611-4, 2015.

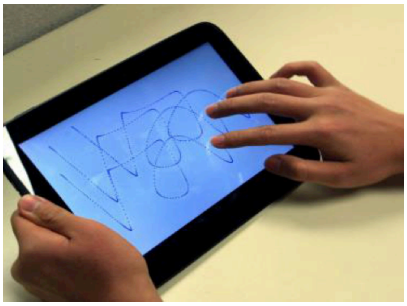
Complex Systems Computation (CoSCo), Professor Petri Myllymäki

The CoSCo research group investigates computational problems related to complex systems, focusing on prediction and modeling tasks. The basic research areas addressed include machine learning, probabilistic modeling and data analysis, information theoretical approaches to inference and constraint reasoning and optimization. Central themes in the applied research include methods for analyzing and visualizing multidimensional and multimodal Big Data, intelligent information retrieval and context-awareness for ubiquitous computing.

Key publications:

- Kazuho Watanabe and Teemu Roos. Achievability of asymptotic minimax regret by horizon-dependent and horizon-independent strategies. Journal of Machine Learning Research, 16:2357 2375, 11 2015.
- Ralf Eggeling, Teemu Roos, Petri Myllymäki, and Ivo Grosse. Inferring intra-motif dependencies of DNA binding sites from ChIP-seq data. BMC Bioinformatics, 16, 11 2015.
- Arto Klami, Seppo Virtanen, Eemeli Leppäaho, and Samuel Kaski. Group factor analysis. IEEE Transactions on Neural Networks and Learning Systems, 26(9):2136– 2147, 2015.
- Arto Klami, Abhishek Tripathi, Jalmar Sirola, Lauri Väre, and Frederic Roulland. Latent feature regression for multivariate count data. In Proceedings of AISTATS 2015, pages 462–470, 2015.
- Brandon Malone, Matti Järvisalo, and Petri Myllymäki. Impact of learning strategies on the quality of Bayesian networks: An empirical evaluation. In Proceedings of UAI 2015, pages 562–571, 2015.
- Antti Hyttinen, Frederick Eberhardt, and Matti Järvisalo. Do-calculus when the true graph is unknown. In Proceedings of UAI 2015, pages 395–404, 2015.
- Dag Sonntag, Matti Järvisalo, Jose Pena, and Antti Hyttinen. Learning optimal chain graphs with answer set programming. In Proceedings of UAI, pages 822–831, 2015.
- Adrian Balint, Anton Belov, Matti Järvisalo, and Carsten Sinz. Overview and analysis of the SAT challenge 2012 solver competition. Artificial Intelligence, 223:120–155, 2015.
- Marijn Heule, Matti Järvisalo, Florian Lonsing, Martina Seidl, and Armin Biere. Clause elimination for SAT and QSAT. Journal of Artificial Intelligence Research, 53:127–168, 2015.



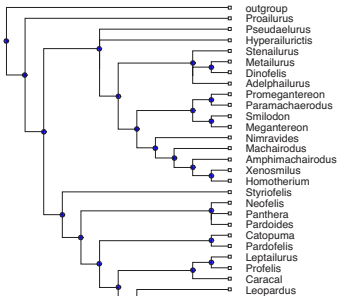


Computational Logic, Professor Ilkka Niemelä

The group develops automated reasoning techniques for solving challenging computational problems in engineering and science. The current focus is on efficient computational methods for solving large constraint satisfaction problems formally represented as Boolean satisfiability (SAT) problems or their generalizations, or expressed in terms of rule-based constraints used in answer-set programming (ASP). The group has a strong track record in research on verification and testing of automation systems and software, as well as applying formal methods in the analysis of distributed systems.

In 2015, our research on ASP concentrated on various aspects of the paradigm. As regards aggregate functions used in ASP, we developed a polynomial, faithful, and modular translation into monotonic aggregates that lend themselves for efficient implementation with contemporary solver technology. In addition, the input language of the state-of-the-art ASP grounder Gringo was formally extended by a number of constructs such as intervals, pooling, and aggregates. We also developed new techniques for ASP solving in dynamic settings where new domain elements are gradually incorporated into a problem description. A variety of application problems were studied, including the inference of phylogenetic supertrees from partial, mutually conflicting phylogenies. A real-world dataset concerning the family of cats (Felidae) was used for benchmarking.

In the area of constraint-based planning and scheduling, we investigated the use of SAT modulo theories (SMT) framework in timed systems planning. The research has developed new modeling languages, discretization methods, and encodings of timed planning systems in SMT, leading to dramatic performance improvements over earlier SMT-based methods, and to far better plan quality than is possible with leading methods that do not take into account time information during the search phase, but handle action scheduling and selection separately.



Key publications:

- Mario Alviano, Wolfgang Faber, and Martin Gebser. Rewriting Recursive Aggregates in Answer Set Programming: Back to Monotonicity. Theory and Practice of Logic Programming, 15 (4-5), 559-573, 2015.
- Martin Gebser, Amelia Harrison, Roland Kaminski, Vladimir Lifschitz, and Torsten Schaub. Abstract Gringo. Theory and Practice of Logic Programming, 15 (4-5), 449-463, 2015.
- Martin Gebser, Tomi Janhunen, Holger Jost, Roland Kaminski, and Torsten Schaub: ASP Solving for Expanding Universes. International Conference on Logic Programming and Nonmonotonic Reasoning (LPNMR), 354-367, 2015.
- Laura Koponen, Emilia Oikarinen, Tomi Janhunen, and Laura Säilä. Optimizing Phylogenetic Supertrees Using Answer Set Programming. Theory and Practice of Logic Programming, 15 (4-5), 604-619, 2015.
- Jussi Rintanen: Discretization of Temporal Models with Application to Planning with SMT. AAAI Conference on Artificial Intelligence, 3349-3355, 2015.
- Jussi Rintanen: Models of Action Concurrency in Temporal Planning. International Joint Conference on Artificial Intelligence (IJCAI), 1659-1665, 2015.

Distributed and Mobile Cloud Systems (DMC)

The focus of the programme is to bridge the gap between mobile devices and the cloud based server backend systems into a single seamless distributed and mobile computing platform. The main motivation behind this is that mobile devices are by their very nature very resource constrained in available battery power, CPU, memory, network, as well as storage capacity compared to the server hardware available in the cloud backend systems. Thus mobile devices need to be tightly integrated to the cloud backend systems in order to do computational tasks that are too heavy for them. However, this basic setup is not yet sufficient for highly interactive applications. The wide area network (WAN) communication latencies between the mobile device and the possibly quite physically remote cloud backend can often be too large for interactive mobile applications, e.g., for interactive augmented reality applications such as Google Glass, as well as computationally intensive mobile intelligent information access applications. Therefore, sometimes an additional layer of computing called cloudlets is called for, that is a collection of local cloud servers that acts as local computing service for mobile devices in its own network neighborhood area. This idea is also known as cyber foraging in the literature.

The research programme operates via close collaboration of the groups of Professors Andrei Gurtov, Keijo Heljanko, Jussi Kangasharju, Sasu Tarkoma and Antti Ylä-Jääski.





Key publications of the DMC programme:

- Ijaz Ahmad, Suneth Namal, Mika Ylianttila, and Andrei Gurtov. Security in software defined networks: A survey. IEEE Communications Surveys and Tutorials, 17(4):2317–2346, 2015.
- Suzan Bayhan, Esa Hyytiä, Jussi Kangasharju, and Jörg Ott. Analysis of hop limit in opportunistic networks by static and time-aggregated graphs. In 2015 IEEE International Conference on Communications (ICC), pages 3288–3292, 6 2015.
- Sourav Bhattacharya, Henrik Blunck, Mikkel Baun Kjaergaard, and Petteri Nurmi. Robust and energy-efficient trajectory tracking for mobile devices. IEEE Transactions on Mobile Computing, 14(2):430–443, 2 2015.
- Huber Flores, Pan Hui, Sasu Tarkoma, Yong Li, Satish Srirama, and Rajkumar Buyya. Mobile code offloading: From concept to practice and beyond. IEEE Communications Magazine, 53(3):80– 88, 2015.
- Mohammad A. Hoque, Matti Siekkinen, Jukka K. Nurminen, Mika Aalto, and Sasu Tarkoma. Mobile multimedia streaming techniques: QoE and energy saving perspective. Pervasive and Mobile Computing, 16(Part A):96 114, 2015.
- Mohammad A. Hoque, Matti Siekkinen, Kashif Khan, Yu Xiao, and Sasu Tarkoma. Modeling, profiling, and debugging the energy consumption of mobile devices. ACM Computing Surveys, 48(3), 2015.
- Jussi Lahtinen, Tuomas Kuismin, and Keijo Heljanko. Verifying large modular systems using iterative abstraction refinement. Reliability Engineering & System Safety, 139(-):120–130, 2015.
- Youming Lin, Teemu Kämäräinen, Mario Di Francesco, and Antti Ylä-Jääski. Performance evaluation of remote display access for mobile cloud computing. Computer Communications, 72(-):17–25, 2015.
- Madhusanka Liyanage, Ahmed Abro, Mika Ylianttila, and Andrei Gurtov. Opportunities and challenges of software-defined mobile networks in network security perspective. IEEE Security and Privacy Magazine, 2015.
- Hanna Mäenpää, Arto Vihavainen, Samu Varjonen, and Sasu Tarkoma. Blending problem- and project-based learning in internet of things education: Case Exact Greenhouse. Internet of Things, 2015(1):49–52, 2015.
- Weixiong Rao, Roman Vitenberg, Lei Chen, and Sasu Tarkoma. MTAF: An adaptive design for keyword-based content dissemination on DHT networks. IEEE Transactions on Parallel and Distributed Systems, 26(4):1071–1084, 4 2015.
- Antti Siirtola and Keijo Heljanko. Parametrised modal interface automata. ACM Transactions on Embedded Computing Systems, 14(4):1–15, 2015.

Network Society (NS) Programme

The mission of the Network Society research programme is to empower ubiquitous users with transparent and resourceful ICT with the following example 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, optimization of crowdsourcing tasks, creation of applications and games that utilise/ produce metadata and media.

Emotional-Social Interaction: To understand emotional and cognitive processess during ICT-mediated social interaction. This research is carried out by using neurophysiological recordings, for example.

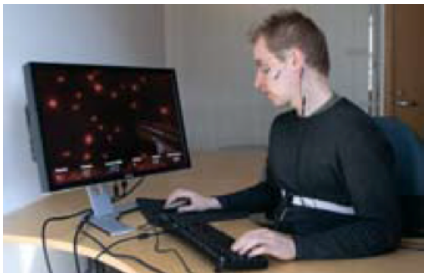
Digital Content Communities, Professor Marko Turpeinen

Our research focuses on social computing, i.e., information systems that enable and support social creativity, participatory media and distributed problem solving. However, to develop successful new technologies, and bear responsibility of design decisions, we as developers should understand and anticipate the dynamics of technology-society interaction. This requires multi disciplinary end-to-end research from technological platforms to various viewpoints to their impact on the use environment.

The goal of our research is to enable and encourage people to belong to communities of content creators, to develop service design methodology and business model development for social media, to study how people interact with each other using digital content, and to understand what new business opportunities and social structures emerge around community-generated content and technology. One of our strong focus areas is the rapidly expanding social forms of gaming and how to apply the findings from online games to other non-gaming domains. This includes virtual economies and virtual consumerism, and applying economics and business studies in virtual worlds.

Digital Content Communities is a joint research group of both HIIT and EIT Digital Helsinki node.

Key publications:



- Sampsa Hyysalo, Pia Helminen, Samuli Mäkinen, Mikael Johnson, Jouni K. Juntunen, and Stephanie Freeman. Intermediate search elements and method combination in lead-user searches. International Journal of Innovation Management, 19(1), 2015.
- Matti Nelimarkka, Vilma Lehtinen, Antti Ukkonen, Kai Kuikkaniemi, and Giulio Jacucci. Threading and conversation in co-located chats. Computers in Human Behavior, (53):324–331, 2015.
- Ehsan Amid, Aristides Gionis, and Antti Ukkonen. A kernel-learning approach to semi-supervised clustering with relative distance comparisons. In European Conference on Machine Learning and Principles and Practice of Knowledge Discovery in Databases (ECML/PKDD) 2015, page 234, Porto, Portugal, September 2015. Springer International Publishing.
- Airi Lampinen, Kai Huotari, and Coye Cheshire. Access to participation in the sharing economy: The case of local online exchange in a single parents' network. In Erika et al. Pearson, editor, IR15: Boundaries and Intersections. Association of Internet Researchers, United States, 2015.
- Matthijs van Leeuwen and Antti Ukkonen. Same bang, fewer bucks: Efficient discovery of the cost-influence skyline. In 2015 SIAM International Conference on Data Mining, May 2015.
- Jouni Vepsäläinen, Antonella Di Rienzo, Matti Nelimarkka, Jouni A. Ojala, Petri Savolainen, Kai Kuikkaniemi, Sasu Tarkoma, and Giulio Jacucci. Personal device as a controller for interactive surfaces. In Proceedings of the 2015 International Conference on Interactive Tabletops & Surfaces - ITS '15, pages 201–2014, 2015.

Social Interaction and Emotion (SIE), Professor Niklas Ravaja

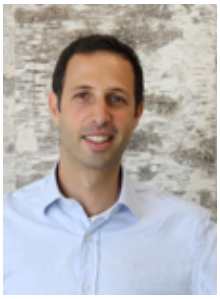
The mission of SIE is to increase our understanding of ICT-mediated social interaction. Our studies focus on: (a) emotional and cognitive processes during mediated social interaction, including mediated touch, interaction with virtual humans, and knowledge work, (b) the neuroscience of social ICT, (c) socially-mediated behavioral phenomena in SNSs, (d) the use of gamification to support the adoption of healthier lifestyles, and (e) user experience of ICT.

We use a wide methodological approach, from surveys and qualitative methods to neurophysiological recordings (e.g., EEG), to study users in the laboratory as well as in real-life contexts. By providing both fundamental and applied insight into social interaction, we help to create ICT and services that take the human social and emotional processes into account.

Key publications:

- Anssi Peräkylä, Pentti Henttonen, Liisa Voutilainen, Mikko Kahri, Tuire Stevanovic, Mikko Sams, and Niklas Ravaja. Sharing the emotional load: Recipient affiliation calms down the storyteller. Social Psychology Quarterly, 78(4):301–323, 2015.
- Deborah Serrien and Michiel Sovijärvi-Spapé. Hemispheric asymmetries and the control of motor sequences. Behavioural Brain Research, 283:30–36, 2015.
- Michiel M. Spapé, Imtiaj Ahmed, Giulio Jacucci, and Niklas Ravaja. The self in conflict: Actors and agency in the mediated sequential Simon task. Frontiers in Psychology, 6, 3 2015.
- Michiel M. Spapé, Eve E. Hoggan, Giulio Jacucci, and Niklas Ravaja. The meaning of the virtual Midas touch: An ERP study in economic decision making. Psychophysiology, 52(3):378–387, 3 2015.
- Minna Stenius, Nelli Hankonen, Ari Haukkala, and Niklas Ravaja. Understanding knowledge sharing in the work context by applying a belief elicitation study. Journal of Knowledge Management, 19(3):497–513, 2015.
- Stephan Verschoor, Marcus Paulus, Michiel Sovijärvi-Spapé, Szilvia Biro, and Bernhard Hommel. The developing cognitive substrate of sequential action control in 9-to 12-month-olds: Evidence for concurrent activation models. Cognition, 138(-):64–78, 2015.

Ubiquitous Interaction (UiX), Professor Giulio Jacucci



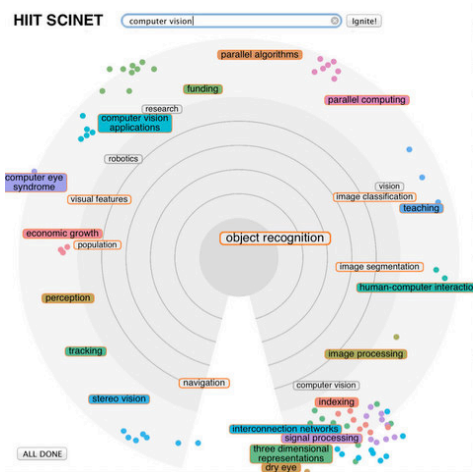
Ubiquitous Interaction contributes to research in human-computer interaction, in adaptive and affective interfaces, in multimodal interaction an in exploratory search and social computing. Application areas range from sustainability and environmental awareness, home computing, walk-up-and-use display, information exploration, and persuasive computing to scientific and knowledge work.

Key publications:

- Khalil Klouche, Tuukka Ruotsalo, Diogo Cabral, Salvatore Andolina, Andrea Bellucci, and Giulio Jacucci. Designing for exploratory search on touch devices. In Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems, pp. 4189-4198, 2015.
- Tuukka Ruotsalo, Giulio Jacucci, Petri Myllymaki, and Samuel Kaski. Interactive intent modeling: Information discovery beyond search. Communications of the ACM, 58(1):86–92, 2015.
- Giulio Jacucci, Stephen Fairclough, and Erin T. Solovey. Physiological computing. Computer : a publication of the IEEE Computer Society, 48(10):12–16, 10 2015.
- Michiel M. Spapé, Eve E. Hoggan, Giulio Jacucci, and Niklas Ravaja. The meaning of the virtual Midas touch: An ERP study in economic decision making. Psychophysiology, 52(3):378–387, 3 2015.
- Blankertz, Benjamin, Giulio Jacucci, Luciano Gamberini, Anna Spagnolli, and Jonathan Freeman. Symbiotic Interaction. 4th International Workshop, Symbiotic 2015, Berlin, Germany, October 7-8, 2015, Proceedings, Vol. 9359. Springer, 2015.
- Oswald Barral, Manuel J.A. Eugster, Tuukka Ruotsalo, Michiel M. Spapé, Ilkka Kosunen, Niklas Ravaja, Samuel Kaski, and Giulio Jacucci. Exploring peripheral physiology as a predictor of perceived relevance in information retrieval. In Proceedings of the 20th International Conference on Intelligent User Interfaces (pp. 389-399), ACM 2015.

HIIT-Wide Focus Area: Augmented Science

Augmented search, research, and knowledge work are the main themes of the multidisciplinary HIIT-wide research initiative that is a strategic research focus of HIIT. Several research groups ranging from Human-Computer Interaction to Machine Learning and Complex Systems Computation collaborate to produce cutting edge research and demonstrations that go beyond individual research papers. The project investigates how Human-Computer Interaction and Probabilistic Machine Learning can be combined to a loop that will increase, by order of magnitude, the effectiveness of search and knowledge work. We are applying our research to scientific data and work environments as well as industrial settings. The methods and tools will be able to better utilize the massive explosion of raw data, documents, distributed information and link structures between these, and sensory information recorded from the users. The methods and pilot applications are expected to revolutionize our work practices in data-driven fields such as modern biology, business intelligence, and others. In particular improving the general problem solving method of science, research, and development, in collaboration with the other fields, is the best way for our research community to contribute to solving the grand challenges of humanity.



Key publications:

- Tuukka Ruotsalo, Giulio Jacucci, Petri Myllymäki, and Samuel Kaski. Interactive intent modeling: information discovery beyond search. Commun. ACM 58, 1, 86-92. January 2015.
- Kumaripaba Ahukorala, Alan Medlar, Kalle Ilves, and Dorota Głowacka. Balancing Exploration and Exploitation: Empirical Parameterization of Exploratory Search Systems. In Proceedings of the 24th ACM International on Conference on Information and Knowledge Management (CIKM '15). ACM, New York, NY, USA, 1703-1706. October 2015.
- Salvatore Andolina, Khalil Klouche, Diogo Cabral, Tuukka Ruotsalo, and Giulio Jacucci. InspirationWall: Supporting Idea Generation Through Automatic Information Exploration. In Proceedings of the 2015 ACM SIGCHI Conference on Creativity and Cognition (C&C '15), 103-106. June 2015.
- Antti Kangasrääsiö, Dorota Głowacka, and Samuel Kaski. Improving Controllability and Predictability of Interactive Recommendation Interfaces for Exploratory Search. In Proceedings of the 20th International Conference on Intelligent User Interfaces (IUI '15), 247-251. March-April 2015.
- Salvatore Andolina, Khalil Klouche, Jaakko Peltonen, Mohammad Hoque, Tuukka Ruotsalo, Diogo Cabral, Arto Klami, Dorota Głowacka, Patrik Floréen, and Giulio Jacucci. IntentStreams: Smart Parallel Search Streams for Branching Exploratory Search. In Proceedings of the 20th International Conference on Intelligent User Interfaces (IUI '15), 300-305. March-April 2015.
- Oswald Barral, Manuel J.A. Eugster, Tuukka Ruotsalo, Michiel M. Spapé, Ilkka Kosunen, Niklas Ravaja, Samuel Kaski, and Giulio Jacucci. Exploring Peripheral Physiology as a Predictor of Perceived Relevance in Information Retrieval. In Proceedings of the 20th International Conference on Intelligent User Interfaces (IUI '15), 389-399. March-April 2015.

Administration

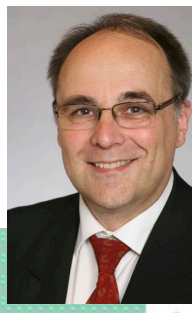
HIIT is a joint research institute of Aalto University and the University of Helsinki. The contract between the two universities was renewed in 2015, again emphasizing that the two universities will fund HIIT with equal shares and ensure the necessary basic funding. The Statutes of HIIT were renewed as well, with minor amendments.

Personnel and funding

At Aalto University, HIIT researchers currently work in the Department of Computer Science, School of Science. An administrative merge was made in the beginning of 2016 to provide HIIT's services via the Computer Science department. This does not restrict researchers from other departments in joining HIIT's activities. At University of Helsinki, our operations are at the Department of Computer Science, Department of Mathematics and Statistics, and Department of Social Sciences. The personnel of HIIT are employed by the two parent universities. Many of HIIT's personnel have double affiliations. The 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. Thus the total number of HIIT affiliated personnel is much higher than the number of person-years, 138.

The total funding of HIIT in 2015 was 9 MEur, of which 80 per cent was competitive. The main funding sources were Academy of Finland, Tekes, EU and the mother universities. More details will be given in the Facts and Figures document found via http://www.hiit.fi/abouthiit






Board

The highest decision-making body of HIIT is the Board. It decides on HIIT's overall research strategy and research programmes. The statutory tasks of the Board are to approve the annual budget and activity plans, and follow up and comment on the work of HIIT through regular activity updates given by the Director of HIIT. In 2015 the Board convened four times.

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, and personal deputies to each of them. The staff of HIIT selects one board member and his or her deputy from among their colleagues. In 2015, the Board consisted of the following members (personal deputies in parentheses):

- Chairman: Dean, Professor Risto Nieminen, Aalto (Professor Jouko Lampinen, Aalto)
- Vice chairman: Dean, Professor Jouko Väänänen, UH (Vice Dean, Professor Esko Ukkonen, UH)
- Professor Pekka Orponen, Aalto (Professor Lauri Savioja, Aalto)
- Professor Sasu Tarkoma, UH (Professor Valtteri Niemi, UH)

- Vice President Hannu Kauppinen, Nokia Oyj (Director Jyri Huopaniemi, Nokia Oyj)
- Docent Kari-Pekka Estola (Director Ville Peltola, The Federation of Finnish Technology Industries)
- Director Mervi Karikorpi, The Federation of Finnish Technology Industries (Director Petri Vasara, Pöyry Management Consulting Oy)
- CEO Harri Valpola, Curious AI (CEO Kimmo Kiviluoto, Enreach Solutions)
- Personnel representative: Docent Antti Honkela, HIIT (Dr. Antti Jylhä, HIIT

The Director of HIIT, Professor Petri Myllymäki, is responsible for preparing and submitting propositions to the Board. Board Secretary is Vice Director, Docent Ella Bingham.




Scientific Advisory Board (SAB)

The SAB consists of internationally prominent scholars who are invited by the HIIT Board. The SAB convened in 2012 and its recommendations were actively taken into account afterwards. The next SAB meeting is planned for autumn 2016. The members of the SAB are:

- Professor John Shawe-Taylor, University College London, UK; Chairman of the SAB
- Professor Elisabeth André, University of Augsburg, Germany
- Professor Richard Durbin, Wellcome Trust Sanger Institute, UK
- Professor Jodi Forlizzi, Carnegie Mellon University, USA
- Professor Seif Haridi, Swedish Institute of Computer Science, Sweden
- Professor Michael Mahoney, University of California Berkeley, USA
- Professor Kari-Jouko Räihä, University of Tampere, Finland
- Professor Wojciech Szpankowski, Purdue University, USA










Helsinki Institute for Information Technology HIIT

Facts and Figures 2015

Appendix to the Annual Report

Ella Bingham and Noora Suominen de Rios (eds.)

www.hiit.fi

HELSINKI
INSTITUTE FOR
INFORMATION
TECHNOLOGY

Contact Information

Helsinki Institute for Information Technology HIIT
Tietotekniikan tutkimuslaitos HIIT
Forskningsinstitutet för Informationsteknologi HIIT

hiit-info@hiit.fi
www.hiit.fi

Otaniemi Site

Postal address at Open Innovation House (OIH):
Helsinki Institute for Information Technology HIIT
PO Box 15600, FI-00076 Aalto, Finland

Street address:
Aalto University, Open Innovation House OIH, Otaniementie 19-21, Espoo
Telephone: +358 9 47001

Postal address at Computer Science Building:
Helsinki Institute for Information Technology HIIT
PO Box 15400, FI-00076 Aalto, Finland

Street address:
Computer Science Building, Konemiehentie 2, Espoo
Telephone: +358 9 47001

Kumpula Site

Postal address:
Helsinki Institute for Information Technology HIIT
PO Box 68, FI-00014 University of Helsinki, Finland

Street address:
University of Helsinki, Department of Computer Science, Exactum
Gustaf Hällströmin katu 2b, Helsinki
Telephone: +358 294 1911
Fax: +358 2941 51120

Lay-out: Anna Bergman, Noora Suominen de Rios

Table of Contents

A. Teaching

Courses given by HIIT researchers at participating departments at Aalto University and University of Helsinki

Spring Term 2015

- Advanced Course in Algorithms, Petteri Kaski, Aalto
- Advanced Course in Computational Logic, Tomi Janhunen, Aalto
- Algorithms in Molecular Biology, Veli Mäkinen, UH
- Approximation Algorithms, Mikko Koivisto, UH
- Artificial intelligence, Jussi Rintanen, Aalto
- Bayesilainen mallintaminen, Aki Vehtari, Aalto
- Bayesian theory with applications, Jukka Corander, UH
- Big Data Frameworks, Sasu Tarkoma, Mohammad Hoque, Ella Peltonen UH
- Biological Sequence Analysis (guided self study), Veli Mäkinen, UH
- Data Compression Techniques, Simon Puglisi, UH
- Data Mining (guided self study), Hannu Toivonen, UH
- Data Mining Project (guided self study), Hannu Toivonen, UH
- Discrete Models and Search, Emilia Oikarinen, Aalto
- Distributed Systems Project, Jussi Kangasharju, UH
- Energy-efficient Mobile Computing, Yu Xiao, Aalto
- Information Retrieval, Tuukka Ruotsalo, Aalto
- Information visualization, Pekka Marttinen, Luana Micallef, Aalto
- Interactive Systems, Salvatore Andolina, UH
- Internet and Computing Forum, Antti Ylä-Jääski, Aalto
- Johdatus ohjelmointiin yhteiskuntatieteissä, Matti Nelimarkka, UH
- Johdatus tietoliikenteeseen ja multimediatekniikkaan, Antti Ylä-jääski, Aalto
- Laboratory Works in Networking and Security, Andrey Lukyanenko, Aalto
- Machine Learning: Advanced Probabilistic Methods, Pekka Marttinen, Aalto
- Methodology for Research on Information and Communication Technology and Social Interaction, Niklas Ravaja, UH
- Mobile Sensing, Petteri Nurmi, UH
- Ohjelmistotekniikan erikoistyö, Keijo Heljanko, Aalto
- Ohjelmointi 2, Petteri Kaski, Aalto
- Overlay and P2P Networks, Sasu Tarkoma, UH
- PhD Student Seminar, Petri Myllymäki, UH
- Programming Parallel Computers, Jukka Suomela, Aalto
- Project in Algorithms in Molecular Biology, Leena Salmela, UH
- Project in Biological Sequence Analysis, Daniel Valenzuela, UH
- Project in Data Compression, Simon Puglisi, UH
- Project in Probabilistic Models, Petri Myllymäki, UH
- Satisfiability, Boolean Modeling and Computation, Matti Järvisalo, UH
- Seminar: Hot Topics in IETF, Jussi Kangasharju, UH
- Seminar on Analysis and Assembly of Big Bioinformatics Data, Esko Ukkonen, UH
- Seminar on Computational Creativity, Hannu Toivonen, Ping Xiao, Anna Kantosalo, UH
- Seminar on Educational Data Mining and Learning Analytics, Hannu Toivonen, UH
- Soveltavan matematiikan pääaine, Jukka Corander, UH
- Special Assignment in Networking and Security, Keijo Heljanko, Aalto
- Special Course in Bioinformatics II, Juho Rousu, Aalto

- Special Course in Computer and Information Science II, Aristides Gionis, Aalto
- Special Course in Computer and Information Science III, Jaakko Hollmén, Aalto
- Special Course in Computer and Information Science VI, Manuel Eugster, Aalto
- Special Course in Computer and Information Science with Varying Content, Paul Blomstedt, Aalto
- Special Course in Computer and Information Science with Varying Content, Mrinal Das, Aalto
- Special Course in Computer and Information Science with Varying Content, Aristides Gionis, Aalto
- Statistical Natural Language Processing, Juho Rousu, Aalto
- Tietojenkäsittelyteoria, Tommi Junttila, Aalto
- Tietokoneverkot, Matti Siekkinen, Aalto
- Tietoliikenneohjelmistojen erikoiskurssi, Andrei Gurtov, Aalto
- Tietorakenteet ja algoritmit, Patrik Floréen, UH
- Tilastotieteen pääaine, Jukka Corander, UH
- Unsupervised Machine Learning, Aapo Hyvärinen, UH
- Warehouse-Scale Computing, Jussi Kangasharju, UH
- Work Course on Bayesian Analysis, Aki Vehtari, Aalto
- xBayesian Statistics and Decision Analysis (EuroBayes), Jukka Corander, UH

Summer Term 2015

- Johdatus ohjelmointiin yhteiskuntatieteissä, Matti Nelimarkka, UH

Autumn Term 2015

- Algorithmic methods of data mining, Aristide Gionis, Aalto
- Answer Set Programming, Tomi Janhunen, Aalto
- Applications and Services in Internet, Zhonghong Ou, Aalto
- Attitudes and prejudice, Alessio Falco, UH
- Bayesian Data Analysis, Aki Vehtari, Aalto
- Bayesilaisen mallintamisen erikoiskurssi 3, Aki Vehtari, Aalto
- Computational Creativity Project, Hannu Toivonen, UH
- Computational Genomics, Elena Czeizler, Aalto
- Computer Networks II - Advanced Features, Matti Siekkinen, Aalto
- Concurrent Programming, Keijo Heljanko, Aalto
- Datasta tietoon, Jaakko Hollmén, Aalto
- Design and Analysis of Algorithms, Veli Mäkinen, Alexandru Tomescu, UH
- Distributed Algorithms, Jukka Suomela, Aalto
- Distributed Systems, Jussi Kangasharju, Ossi Karkulahti, UH
- Fragments of Structural and Algoritmic Graph Theory, Alexandru Tomescu, UH
- High-Throughput Bioinformatics, Elena Czeizler, Aalto
- Human-Computer Interaction, Kumaripaba Athukorala, Yi-Ta Hsieh, UH
- Indoor Localization, Petteri Nurmi, UH
- Introduction to Analytics and Data Science, Aristides Gionis, Aalto
- Introduction to Computational Creativity, Hannu Toivonen, UH
- Introduction to programming in Social Science, Matti Nelimarkka, UH
- Kernel Methods in Machine Learning, Juho Rousu, Aalto
- Kilpaohjelmointi, Topi Talvitie, Tuukka Korhonen, UH
- Laskennallisen tekniikan erikoistyö, Aki Vehtari, Aalto
- Learning Markov Random Fields and Models of Statistical Physics from Data, Onur Dikmen, Michael Gutmann, UH
- Linux Fundamentals, Julien Mineraud, Samu Varjonen, UH
- Machine Learning: Basic Principles, Ritabrata Dutta, Aalto
- Machine Learning: Basic Principles, Pekka Marttinen, Aalto
- Markovian modelling and Bayesian learning, Jukka Corander, UH
- Mobile Cloud Computing, Yu Xiao, Aalto

- Modelling and Analysis in Bioinformatics, Veli Mäkinen, Leena Salmela, Antti Honkela, UH
- Nonlinear dimensionality reduction, Yang Zhirong, UH
- PhD Student Seminar, Sasu Tarkoma, UH
- Research Project in Computer and Information Science, Aristides Gionis, Aalto
- Robottiohjelmoinnin harjoitustyö, Joel Pyykkö, UH
- Scalable Cloud Computing, Keijo Heljanko, Aalto
- Scientific Writing for MSc in Computer Science, Julien Mineraud, Ashwin Rao, UH
- Seminar: Information-Centric Networks, Jussi Kangasharju, UH
- Seminar: Machine Learning in Computer Vision, Markus Koskela, UH
- Seminar on Combinatorial Pattern Matching, Simon Puglisi, UH
- Seminar on Computational Creativity, Hannu Toivonen, UH
- Seminar on Fairness-aware machine learning, Indre Zliobaite, Aalto
- Seminar on Tractability, Johannes Wallner, Matti Järvisalo, UH
- Seminar: Software-Defined Networking (SDN) and Network Functions Virtualization (NFV), Ashwin Rao, UH
- Software Factory Project (period I), Fabian Fagerholm, UH
- Software Factory Project (period II), Fabian Fagerholm, UH
- Special Course in Computer and Information Science I, Aristides Gionis, Aalto
- Special Course in Computer and Information Science IV, Kerstin Bunte, Aalto
- Tieto- ja viestintäteknologian sosiaalipsykologiaa, Niklas Ravaja, UH
- Tietorakenteet ja algoritmit (ohjattu itseopiskelu), Patrik Floréen, UH
- TVT-ajokortin näyttökoe, Matematiikan ja tilastotieteen pääaineopiskelijat, Minna Vehkala, UH

B. 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. In 2015, HIIT operated administratively at University of Helsinki's Kumpula campus (Department of Computer Science and Department of Mathematics and Statistics) and Aalto University's Otaniemi campus (HIIT's own “department” at Open Innovation House, OIH, and Department of Computer Science, CS). In 2016, activities at OIH will be merged with CS at Aalto University.

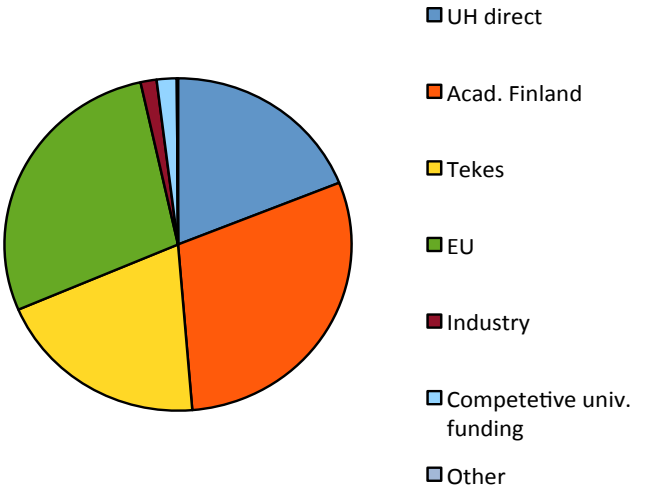
Kumpula's funding figures are shown in Table 1. Direct funding from University of Helsinki (UH) is a bit less than 1 MEur, of which a portion is directly transferred to Aalto University to account for common administrative duties.

Kumpula	**2012**	**2013**	**2014**	**2015**	**%**
Total funding	3 792 231	3 879 859	4 290 970	4 334 400	
UH direct funding	810 000	780 000	780 000	821 240	19%
Academy of Finland	1 694 815	1 806 589	1 020 354	1 289 084	30%
National Technology Agency Tekes	342 377	484 742	917 338	862 766	20%
European Union	528 457	325 067	1 107 425	1 210 979	28%
Industry	45 770	0	16 400	64 659	1%
Competetive univ. funding		237 397	449 269	80 816	2%
Other (Foundations, 2012 competitive univ. f.)	370 812	246 064	184	4 857	0%

Total expenses	3 720 441	3 738 007	3 961 395	4 247 727	
Salaries	2 535 348	2 602 229	2 609 278	2 889 940	68%
Other operational expenses	448 765	540 849	650 553	551 656	13%
Service charge to UH (rents included)	736 328	594 928	701 564	806 132	19%

Table 1: Kumpula funding 2012-2015.

Figure 1: Kumpula funding 2015.



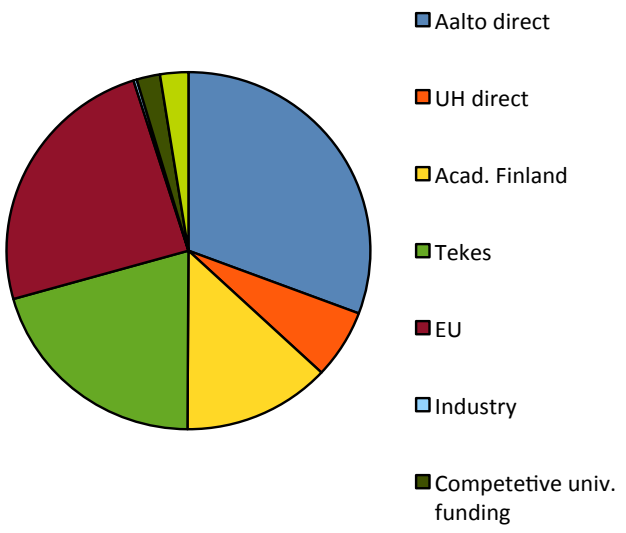
Otaniemi OIH's funding figures are shown in Table 2. HIIT's activities OIH are slightly decreasing.

OIH	2012	2013	2014	2015	%
Total funding	5 976 738	4 882 452	4 065 399	2 694 804	
Aalto direct funding	1 000 000	1 000 000	887 817	827 634	31%
UH direct funding	168 200	168 200	168 200	168 200	6%
Academy of Finland	2 194 628	1 129 727	587 221	353 915	13%
National Technology Agency Tekes	1 135 342	1 191 938	1 208 372	553 788	21%
European Union	519 359	722 156	741 460	659 596	24%
Industry	57 566	25 206	2 275	8 012	0%
Competetive univ. funding	0	233 356	248 357	56 000	2%
Other (Foundations, 2012 competitive univ. f.)	901 642	411 869	221 697	67 659	3%

Total expenses	6 159 939	4 718 032	3 977 803	2 976 962	
Salaries	2 999 485	2 978 904	2 557 426	1 981 379	67%
Other operational expenses	2 310 708	1 079 708	724 290	531 259	18%
Rents	396 274	265 002	322 378	293 714	10%
Service charge to Aalto	453 472	394 418	373 709	170 611	6%

Table 2: OIH funding 2012-2015.

Figure 2: OIH funding 2015.



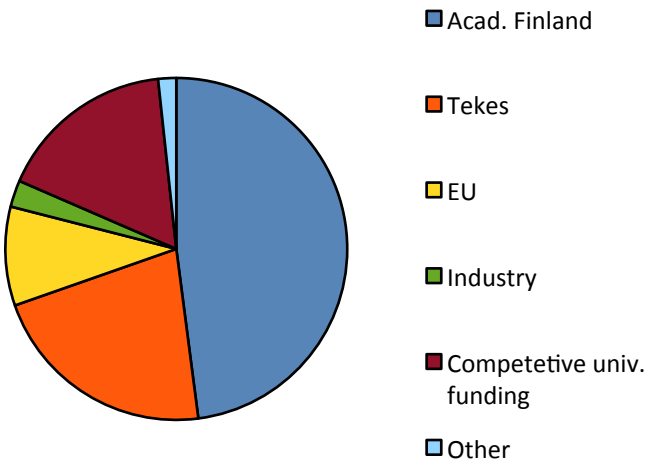
Otaniemi CS department's funding figures are shown in Table 3.

Otaniemi CS dept	2012	2013	2014	2015	%
Total funding	1 713 521	1 266 407	2 101 043	2 054 953	
Academy of Finland	858 812	771 810	1 296 749	985 117	48%
National Technology Agency Tekes	320 361	222 088	272 655	445 920	22%
European Union	72 999	81 071	62 366	192 155	9%
Industry	85 033	0	25 000	51 762	3%
Competetive univ. funding		155 050	320 837	345 000	17%
Other (Foundations, 2012 competitive univ. f.)	376 316	36 388	123 437	35 000	2%

Total expenses	1 637 327	1 117 904	2 016 376	1 725 631	
Salaries	1 070 927	865 979	1 563 122	1 199 999	70%
Other operational expenses	328 914	68 514	144 817	168 326	10%
Service charge to Aalto (rents included)	237 485	183 411	308 438	357 305	21%

Table 3: Otaniemi CS department funding 2012-2015.

Figure 3: Otaniemi CS department funding 2015.

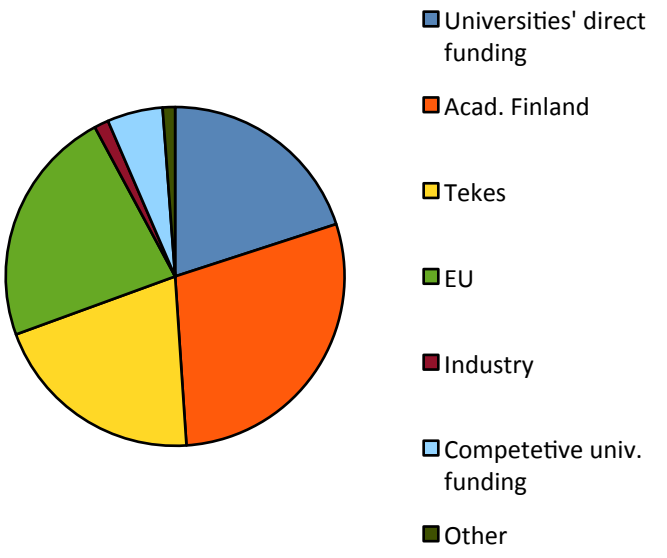


Finally we list the funding sources and the distribution of expenses for the whole HIIT in Table 4.

HIIT	2012	2013	2014	2015	%
Total funding	11 482 489	10 028 717	10 457 412	9 084 157	
Universities' direct funding	1 978 200	1 948 200	1 836 017	1 817 074	20%
Academy of Finland	4 748 256	3 708 126	2 904 324	2 628 116	29%
National Technology Agency Tekes	1 798 080	1 898 768	2 398 365	1 862 474	21%
European Union (EU)	1 120 815	1 128 294	1 911 251	2 062 730	23%
Industry	188 369	25 206	43 675	124 432	1%
Competetive univ. funding	0	625 803	1 018 463	481 816	5%
Other (Foundations, 2012 competitive univ. f.)	1 648 770	694 321	345 318	107 516	1%
Total expenses	11 517 707	9 573 942	9 955 574	8 950 320	
Salaries	6 605 761	6 447 112	6 729 826	6 071 318	68%
Other operational expenses	3 088 387	1 689 071	1 519 659	1 251 241	14%
Service charge to UH/Aalto incl.rents	1 427 286	1 172 757	1 383 711	1 334 047	15%
Rents at OIH	396 274	265 002	322 378	293 714	3%
Rents at OIH	473 016	396 274	265 002	322 378	3%

Table 4: HIIT funding 2012-2015.

Figure 4: HIIT funding 2015.



C. Personnel

In 2015 HIIT faculty and staff completed 138 person-years on HIIT funding. In addition, many persons affiliated with HIIT are funded by participating departments or personal grants either from the Academy of Finland or Foundations. The diversity of affiliations is characteristic of HIIT personnel: the 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. Thus the total number of personnel (almost 300) is much higher than the number of person-years completed by HIIT funding.

The distribution of person-years per sites is shown in Table 1. In 2015 HIIT's activities at Aalto University were administratively at HIIT's own "department" at Open Innovation House (OIH) and at Computer Science department (CS). In 2016, these will be joined.

Staff (person-years)	2011	2012	2013	2014	2015
Kumpula	40	58	57	60	64
Otaniemi OIH	66	50	60	47	41
Otaniemi CS dept	29	36	37	27	33
total	135	144	154	134	138

Table 5: Number of person-years paid by HIIT 2011-2015

.

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; see Table 6.

Staff (person-years)	Kumpula	Otaniemi OIH	Otaniemi CS dept	total
senior researchers	4	4	6	14
postdocs	12	13	10	35
doctoral students	21	11	9	41
project researchers		4	1	5
research assistants	23	5	7	35
administration	4	4	0	8
total	64	41	33	138

Table 6: Distribution of person-years by personnel groups 2015.

The number of non-Finnish staff members is large. Almost all non-Finns come from Europe, China, India and India's neighbouring countries.

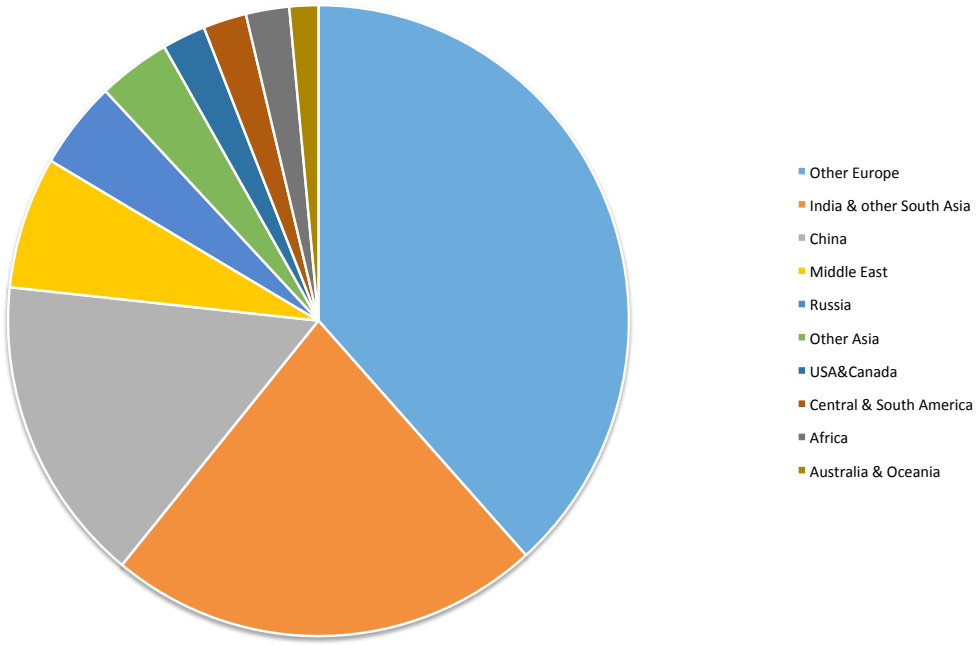


Figure 5: Nationalities of non-Finnish staff members 2015.

D. Publications

Publications 2008 - 2015	2008	2009	2010	2011	2012	2013	2014	2015
Articles in international scientific journals with referee practice	67	51	69	79	81	101	122	128
Articles in international edited works and conference proceedings with referee practice	126	126	153	134	128	137	152	161
Scientific monographs and edited books	3	6	8	9	8	5	10	12
Other publications	40	25	25	29	31	16	13	9
Computer programs and algorithms	0	1	10	8	3	2	3	10
Doctoral theses	14	13	10	7	10	18	22	20
Licenciate theses	1	1	0	0	0	1	0	1
Master's theses	76	27	33	53	55	53	45	74
Total	327	250	308	319	316	333	367	415

D.1. Articles in international scientific journals with referee practice

1. Prem Raj Adhikari and Jaakko Hollmen. Fast progressive training of mixture models for model selection. Journal of Intelligent Information Systems, 44(2):223–241, 2015.
2. Ijaz Ahmad, Suneth Namal, Mika Ylianttila, and Andrei Gurtov. Security in software defined networks: A survey. IEEE Communications Surveys and Tutorials, 17(4):2317–2346, 2015.
3. Bilal Alsallakh, Luana Micallef, Wolfgang Aigner, Helwig Hauser, Silvia Miksch, and Peter Rodgers. The state-of-the-art of set visualization. Computer Graphics Forum, (-), 2015.
4. Mario Alviano, Wolfgang Faber, and Martin Gebser. Rewriting recursive aggregates in answer set programming: back to monotonicity. Theory and Practice of Logic Programming, 15(4-5):559–573, 2015.
5. Diego Arroyuelo, Francisco Claude, Sebastian Maneth, Veli Mäkinen, Gonzalo Navarro, Kim Nguyen, Jouni Sirén, and Niko Välimäki. Fast in-memory XPath search using compressed indexes. Software: Practice & Experience, 45(3):399–434, 3 2015.
6. Giorgio Audrito, Alexandru I. Tomescu, and Stephan Wagner. Enumeration of the adjunctive hierarchy of hereditarily finite sets. Journal of Logic and Computation, 25(3):943–963, 6 2015.
7. Abiyad Baig, Alan Mcnally, Steven Dunn, Konrad Paszkiewicz, Jukka Corander, and Georgina Manning. Genetic import and phenotype specific alleles associated with hyper-invasion in Campylobacter jejuni. BMC Genomics, 16:852. doi: 10.1186/s12864-015-2087-y, 2015.
8. Adrian Balint, Anton Belov, Matti Järvisalo, and Carsten Sinz. Overview and analysis of the SAT challenge 2012 solver competition. Artificial Intelligence, 223:120–155, 2015.
9. Mark de Been, Mette Pinholt, Janetta Top, Stefan Bletz, Alexander Mellmann, Willem van Schaik, Ellen Brouwer, Malbert Rogers, Yvette Kraat, Marc Bonten, Jukka Corander, Henrik Westh, Dag Harmsen, ans Rob J. L. Willems. A core genome MLST scheme for high-resolution typing of Enterococcus faecium. Journal of Clinical Microbiology, doi: 10.1128/JCM.01946-15, 2015.

10. Sergei S. Belanov, Dmitrii Bychkov, Christian Benner, Samuli Ripatti, Teija Ojala, Matti Kankainen, Hong Kai Lee, Julian Wei-Tang, and Denis Kainov. Genome-wide analysis of evolutionary markers of human influenza A(H1N1)pdm09 and A(H3N2) viruses may guide selection of vaccine strain candidates. Genome Biology and Evolution, 7(12):3472–3483, 11 2015.

11. Djamal Belazzougui. Improved space-time tradeoffs for approximate full-text indexing with one edit error. Algorithmica, 72(3):791–817, 7 2015.

12. Djamal Belazzougui and Gonzalo Navarro. Optimal lower and upper bounds for representing sequences. ACM Transactions on Algorithms, 11(4), 2015.

13. Michael A. Bender, Sándor P. Fekete, Alexander Kröller, Vincenzo Liberatore, Joseph S. B. Mitchell, Valentin Polishchuk, and Jukka Suomela. The minimum backlog problem. Theoretical Computer Science, (605):51–61, 2015.

14. Sourav Bhattacharya, Henrik Blunck, Mikkel Baun Kjaergaard, and Petteri Nurmi. Robust and energy-efficient trajectory tracking for mobile devices. IEEE transactions on mobile computing., 14(2):430–443, 2 2015.

15. Concha Bielza, Joao Gama, Alipio Jorge, and Indre Zliobaite. Guest editors introduction: special issue of the ECML PKDD 2015 journal track. Machine Learning, 100(2):157–159, 2015.

16. Concha Bielza, Joao Gama, Alipio Jorge, and Indre Zliobaite. Guest editors introduction: special issue of the ECML PKDD 2015 journal track. Data Mining and Knowledge Discovery, 29(5):1113–1115, 2015.

17. Andreas Björklund, Thore Husfeldt, Petteri Kaski, Mikko Koivisto, Jesper Nederlof, and Pekka Parviainen. Fast Zeta transforms for lattices with few irreducibles. ACM Transactions on Algorithms, 12(1):4, 2015.

18. Paul Blomstedt and Jukka Corander. Posterior predictive comparisons for the two-sample problem. Communications in Statistics: Theory and Methods, 44(2):376–389, 2015.

19. Paul Blomstedt, Jing Tang, Jie Xiong, Christian Granlund, and Jukka Corander. A Bayesian predictive model for clustering data of mixed discrete and continuous type. IEEE Transactions on Pattern Analysis and Machine Intelligence, 37(3):489–498, 2015.

20. Francesco Bonchi, Aristides Gionis, Francesco Gullo, Charalampos E. Tsourakakis, and Antti Ukkonen. Chromatic correlation clustering. ACM Transactions on Knowledge Discovery from Data, 9(4):000034/1–24, 2015.

21. Monica Bugallo, Luca Martino, and Jukka Corander. Adaptive importance sampling in signal processing. Digital Signal Processing, doi:10.1016/j.dsp.2015.05.014, 2015.

22. Ho-Lin Chen, David Doty, and Shinnosuke Seki. Program size and temperature in self-assembly. Algorithmica, 72(3):884–899, 2015.

23. Anna Cichonska, Juho Rousu, and Tero Aittokallio. Identification of drug candidates and repurposing opportunities through compound-target interaction networks. Expert Opinion on Drug Discovery, 10(12):1333–1345, 2015.

24. Maxime Crochemore, Roberto Grossi, Juha Kärkkäinen, and Gad M. Landau. Computing the Burrows-Wheeler transform in place and in small space. Journal of Discrete Algorithms, 32:44–52, 2015.

25. Yaqiong Cui, Jukka Sirén, Timo Koski, and Jukka Corander. Simultaneous predictive Gaussian classifiers. Journal of Classification, doi: 10.1007/s00357-016-9197-3, 2015.

26. Giovanna D'Agostino, Eugenio G. Omodeo, Alberto Policriti, and Alexandru I. Tomescu. Mapping sets and hypersets into numbers. Fundamenta Informaticae, 140(3-4):307–328, 9 2015. 140 (2015) : 3-4 is a Special Issue on the Italian Conference on Computational Logic: CILC 2013.

27. Onur Dikmen, Zhirong Yang, and Erkki Oja. Learning the information divergence. IEEE Transactions on Pattern Analysis and Machine Intelligence, 37(7):1442–1554, 6 2015.

28. Kai Dührkop, Huibin Shen, Marvin Meusel, Juho Rousu, and Sebastian Böcker. Searching molecular structure databases with tandem mass spectra using CSI:FingerID. National Academy of Sciences. Proceedings, 112(41):12580–12585, 2015.

29. Alon Efrat, Sándor P. Fekete, Joseph S. B. Mitchell, Valentin Polishchuk, and Jukka Suomela. Improved approximation algorithms for relay placement. ACM Transactions on Algorithms, 12(2):28 p., 2015.

30. Ralf Eggeling, Teemu Roos, Petri Myllymäki, and Ivo Grosse. Inferring intra-motif dependencies of DNA binding sites from ChIP-seq data. BMC Bioinformatics, 16, 11 2015.

31. Ali Faisal and Mirva Peltoniemi. Establishing video game genres using data-driven modeling and product databases. Games and Culture, page 24 p., 2015.

32. Robert Fitak, Elmira Mohandesan, Jukka Corander, and Pamela A. Burger. The de novo genome assembly and annotation of a female domestic dromedary of North African origin. Molecular Ecology Resources, DOI: 10.1111/1755-0998.12443, 2015.

33. Huber Flores, Pan Hui, Sasu Tarkoma, Yong Li, Satish Srirama, and Rajkumar Buyya. Mobile code offloading: From concept to practice and beyond. IEEE Communications Magazine, 53(3):80– 88, 2015.

34. Sarah Gaggl, Norbert Manthey, Alessandro Ronca, Johannes Wallner, and Stefan Woltran. Improved answer-set programming encodings for abstract argumentation. Theory and Practice of Logic Programming, 15(special issue 4-5):434–448, 2015.

35. Travis Gagie, Pawel Gawrychowski, and Simon J. Puglisi. Approximate pattern matching in LZ77-compressed texts. Journal of Discrete Algorithms, 32:64–68, 2015. Special Issue on StringMasters 2012 & 2013.

36. Serge Gaspers, Mikko Koivisto, Mathieu Liedloff, Sebastian Ordyniak, and Stefan Szeider. On finding optimal polytrees. Theoretical Computer Science, 592(C):49–58, 2015. This article is based on a paper presented in the 26th Conference of Artifical Intelligence (AAA-1), Toronto July 2012.

37. Martin Gebser, Amelia Harrison, Roland Kaminski, Vladimir Lifschitz, and Torsten Schaub. Abstract gringo. Theory and Practice of Logic Programming, 15(4-5):449–463, 2015.

38. Roland Grafström, Penny Nymark, Vesa Hongisto, Ola Spjuth, Rebecca Ceder, Egon Willighagen, Barry Hardy, Samuel Kaski, and Pekka Kohonen. Toward the replacement of animal experiments through the bioinformatics-driven analysis of 'omics' data from human cell cultures. ATLA: Alternatives to Laboratory Animals, 43(5):325–332, 2015.

39. Lauri Hella, Matti Järvisalo, Antti Kuusisto, Juhana Laurinharju, Tuomo Lempiäinen, Kerkko Luosto, Jukka Suomela, and Jonni Virtema. Weak Models of Distributed Computing, with Connections to Modal Logic. Distributed Computing, 28(1):31-53, 2015.

40. Sumi Helal and Sasu Tarkoma. Smart spaces. IEEE Pervasive Computing, 14(2):22–23, 2015. Guest editors' introduction.

41. James Hensman, Panagiotis Papastamoulis, Peter Glaus, Antti Honkela, and Magnus Rattray. Fast and accurate approximate inference of transcript expression from RNA-seq data. Bioinformatics, 31(24):3881–3889, 12 2015.

42. Aleksandra Herbec, Jukka-Pekka Kauppi, Corinne Jola, Jussi Tohka, and Frank E. Pollick. Differences in fMRI intersubject correlation while viewing unedited and edited videos of dance performance. Cortex, 71:341–348, 10 2015.

43. Marijn Heule, Matti Järvisalo, Florian Lonsing, Martina Seidl, and Armin Biere. Clause elimination for SAT and QSAT. Journal of Artificial Intelligence Research, 53:127–168, 2015.

44. Antti Honkela, Jaakko Peltonen, Hande Topa, Iryna Charapitsa, Filomena Matarese, Korbinian Grote, Hendrik G. Stunnenberg, George Reid, Neil D. Lawrence, and Magnus Rattray. Genome-wide modeling of transcription kinetics reveals patterns of RNA production delays. Proceedings of the National Academy of Sciences of the United States of America, 112(42):13115–13120, 10 2015.

45. Mohammad A Hoque, Matti Siekkinen, Jukka K. Nurminen, Mika Aalto, and Sasu Tarkoma. Mobile multimedia streaming techniques: QoE and energy saving perspective. Pervasive and Mobile Computing, 16(Part A):96 114, 2015.

46. Mohammad Ashraful Hoque, Matti Siekkinen, Kashif Khan, Yu Xiao, and Sasu Tarkoma. Modeling, profiling, and debugging the energy consumption of mobile devices. ACM Computing Surveys, 48(3), 2015.

47. Haruo Hosoya and Aapo Hyvärinen. A hierarchical statistical model of natural images explains tuning properties in V2. Journal of Neuroscience, 35(29):10412–10428, 2015.

48. Teemy Hynninen, Ville Parkkinen, Tiziana Musso, Lauri Himanen, Jukka Corander, and Adam Foster. An object oriented Python interface for atomistic simulations. Computer Physics Communications, doi:10.1016/j.cpc.2015.09.010, 2015

49. Sampsa Hyysalo, Pia Helminen, Samuli Mäkinen, Mikael Johnson, Jouni K. Juntunen, and Stephanie Freeman. Intermediate search elements and method combination in lead-user searches. International Journal of Innovation Management, 19(1), 2015.

50. Oscar H. Ibarra and Shinnosuke Seki. Semilinear sets and counter machines: a brief survey. Fundamenta informaticae, 138(1-2):61–76, 2015.

51. Jun ichiro Hirayama, Takeshi Ogawa, and Aapo Hyvärinen. Unifying blind separation and clustering for resting-state EEG/MEG functional connectivity analysis. Neural Computation, 27(7):1373–1404, 7 2015.

52. Giulio Jacucci, Stephen Fairclough, and Erin T. Solovey. Physiological computing. Computer : a publication of the IEEE Computer Society, 48(10):12–16, 10 2015.

53. Tomi Janhunen, Martin Gebser, Jussi Rintanen, Henrik Nyman, Johan Pensar, and Jukka Corander. Learning Discrete Decomposable Graphical Models via Constraint Optimization. Statistics and Computing, DOI: 10.1007/s11222-015-9611-4, 2015.

54. Natasa Jonoska, Daria Karpenko, and Shinnosuke Seki. Dynamic simulation of 1D cellular automata in the active aTAM. New generation computing, 33(3):271–295, 2015.

55. Lila Kari, Steffen Kopecki, and Shinnosuke Seki. 3-color bounded patterned self-assembly. Natural computing, 14(2):279–292, 2015.

56. Petteri Kaski, Patric R.J. Östergård, and Alexandru Popa. Enumeration of Steiner triple systems with subsystems,. Mathematics of Computation, 84(-):3051– 3067, 2015.

57. Jukka-Pekka Kauppi, Janne Hahne, Klaus-Robert Müller, and Aapo Hyvärinen. Three-way analysis of spectrospatial electromyography data: Classification and interpretation. PLoS One, 10(6), 6 2015.

58. Jukka-Pekka Kauppi, Melih Kandemir, Veli-Matti Saarinen, Lotta Hirvenkari, Lauri Parkkonen, Arto Klami, Riitta Hari, and Samuel Kaski. Towards brain-activity-controlled information retrieval: Decoding image relevance from MEG signals. NeuroImage, 112(1):288–298, 2015.

59. Arto Klami, Seppo Virtanen, Eemeli Leppäaho, and Samuel Kaski. Group factor analysis. IEEE Transactions on Neural Networks and Learning Systems, 26(9):2136– 2147, 2015.

60. Laura Koponen, Emilia Oikarinen, Tomi Janhunen, and Laura Säilä. Optimizing phylogenetic supertrees using answer set programming. Theory and Practice of Logic Programming, 15(4-5):604–619, 2015.

61. David Koslicki, Saikat Chatterjee, Damon Shahrivar, Alan W. Walker, Suzanna C. Francis, Louise J. Fraser, Mikko Vehkaperä, Yueheng Lan, and Jukka Corander. ARK: Aggregation of reads by K-means for estimation of bacterial community composition. PLoS One, 10(10), 10 2015.

62. Orestis Kostakis and Panagiotis Papapetrou. Finding the longest common sub-pattern in sequences of temporal intervals. Data mining and knowledge discovery, 29(5):1178–1210, 2015.

63. Pardeep Kumar, Andrei Gurtov, Jari Iinatti, Mika Ylianttila, and Mangal Sain. Lightweight and secure session-key establishment scheme in smart home environments. IEEE Sensors, (PP), 2015.

64. Jouni Kvist, Anniina L. K. Mattila, Panu Somervuo, Virpi Ahola, Patrik Koskinen, Lars Paulin, Leena Salmela, Toby Fountain, Pasi Rastas, Annukka Ruokolainen, Minna Taipale, Liisa Holm, Petri Auvinen, Rainer Lehtonen, Mikko J. Frilander, and Ilkka Hanski. Flight-induced changes in gene expression in the Glanville fritillary butterfly. Molecular Ecology, 24(19):4886–4900, 10 2015.

65. Jussi Lahtinen, Tuomas Kuismin, and Keijo Heljanko. Verifying large modular systems using iterative abstraction refinement. Reliability Engineering & System Safety, 139(-):120–130, 2015.

66. Lassi Antero Liikkanen, Kelly Jakubowski, and Jukka Mikael Toivanen. Catching earworms on twitter: Using big data to study involuntary musical imagery. 2015.

67. Youming Lin, Teemu Kämäräinen, Mario Di Francesco, and Antti Ylä-Jääski. Performance evaluation of remote display access for mobile cloud computing. Computer Communications, 72(-):17–25, 2015.

68. Madhusanka Liyanage, Ahmed Abro, Mika Ylianttila, and Andrei Gurtov. Opportunities and challenges of software-defined mobile networks in network security perspective. IEEE Security and Privacy Magazine, 2015.

69. Madhusanka Liyanage, Mika Ylianttila, and Andrei Gurtov. Secure hierarchical VPLS architecture for provider provisioned networks. IEEE Access, (3):967–984, 2015.

70. Justyna Maculewicz, Antti Jylhä, Stefania Serafin, and Cumhur Erkut. The effects of ecological auditory feedback on rhythmic walking interaction. IEEE MultiMedia Magazine, 22(1):24– 31, 2015.

71. Ilias Maglogiannis, Spyros Georgakopoulos, Sotirios Tasoulis, and Vasilis Plagianakos. A software tool for the automatic detection and quantification of fibrotic tissues in microscopy images. Information Sciences, 308:125–139, 2015.

72. Luca Martino, Víctor Elvira, David Luengo, and Jukka Corander (2015). An Adaptive Population Importance Sampler: Learning from Uncertainty. IEEE Transactions on Signal Processing, DOI: 10.1109/TSP.2015.2440215.

73. Luca Martino, Jesse Read, and David Luengo. Independent doubly adaptive rejection metropolis sampling within Gibbs sampling. IEEE Transactions on Signal Processing, 63(12):3123–3138, 2015.

74. Luca Martino, Hanxue Yang, David Luengo, Juho Kanniainen, and Jukka Corander. A Fast Universal Self-tuned Sampler within Gibbs sampling. Digital Signal Processing, doi: 10.1016/j.dsp.2015.04.005, 2015.

75. Pekka Marttinen, Nicholas J. Croucher, Michael U. Gutmann, Jukka Corander, and William P. Hanage. Recombination produces coherent bacterial species clusters in both core and accessory genomes. Microbial Genomics, (1):5, 2015.

76. Guillaume Méric, Maria Miragaia, Mark de Been, Koji Yahara, Ben Pascoe, Leonardos Mageiros, Jane Mikhail, Llinos G. Harris, Thomas S. Wilkinson, Joana Rolo, Sarah Lamble, James E. Bray, Keith A. Jolley, William P. Hanage, Rory Bowden, Martin C. J. Maiden, Dietrich Mack, Hermínia de Lencastre, Edward J. Feil, Jukka Corander, and Samuel K. Sheppard. Ecological overlap and horizontal gene transfer in Staphylococcus aureus and Staphylococcus epidermidis. Genome Biology and Evolution, doi:10.1093/gbe/evv066, 2015.

77. Polina Mishel, Teija Ojala, Christian Benner, Triin Lakspere, Dmitrii Bychkov, Petri Jalovaara, Laura Kakkola, Anu Kantele-Häkkinen, Matti Kankainen, Niina Ikonen, Samuli Ripatti, Ilkka Julkunen, and Denis Kainov. Comparative analysis of whole-genome sequences of influenza A(H1N1)pdm09 viruses isolated from hospitalized and nonhospitalized patients identifies missense mutations that might be associated with patient hospital admissions in Finland during 2009 to 2014. Genome Announcements, 3(4), 2015.

78. Laura Morley, Alan McNally, Konrad Paszkiewicz, Jukka Corander, Guillaume Méric, Samuel Sheppard, Jochen Blom, and Georgina Manning. Gene loss and lineage specific restriction-modification systems associated with niche differentiation in the Campylobacter jejuni Sequence Type 403 clonal complex. Applied and Environmental Microbiology, doi: 10.1128/AEM.00546-15, 2015.

79. Martin D. Muggli, Simon J. Puglisi, Roy Ronen, and Christina Boucher. Misassembly detection using paired-end sequence reads and optical mapping data. Bioinformatics, 31(12):80–88, 2015.

80. Hanna Mäenpää, Arto Vihavainen, Samu Varjonen, and Sasu Tarkoma. Blending problem- and project-based learning in internet of things education: Case Exact Greenhouse. Internet of Things, 2015(1):49–52, 2015.

81. Suneth Namal, Ijaz Ahmad, Saad Saud, Markku Jokinen, and Andrei Gurtov. Implementation of OpenFlow based cognitive radio network architecture: SDN&R. Wireless Networks, 2015.

82. Gonzalo Navarro, Simon J. Puglisi, and Daniel Valenzuela. General document retrieval in compact space. ACM Journal of Experimental Algorithmics, 19:2.3:1.1–2.3:1.46, 1 2015.

83. Matti Nelimarkka, Vilma Lehtinen, Antti Ukkonen, Kai Kuikkaniemi, and Giulio Jacucci. Threading and conversation in co-located chats. Computers in Human Behavior, (53):324–331, 2015.

84. Ilya Nikolaevskiy, Andrey Lukyanenko, Tatiana Polishchuk, Valentin Polishchuk, and Andrei Gurtov. isBF: Scalable in-packet bloom filter based multicast. Computer communications, 70(70):85, 2015.

85. Eija Nukarinen, Outi Lindström, Krista Kuuliala, Leena Kylänpää, Ville Pettila, Pauli Puolakkainen, Antti Kuuliala, Mika Hämäläinen, Eeva Moilanen, Heikki Repo, and Johanna Hästbacka. MMPs-7,-8,-9 and TIMP-1 in acute pancreatitis. Pancreas, 44(8):1404–1404, 11 2015.

86. Elina Numminen, Claire Chewapreecha, Claudia Turner, David Goldblatt, Francois Nosten, Stephen D. Bentley, Paul Turner, and Jukka Corander. Climate induces seasonality in pneumococcal transmission. Scientific Reports, 5:11344, DOI: 10.1038/srep11344, 2015.

87. Henrik Nyman, Johan Pensar, and Jukka Corander. Stratified Gaussian graphical models. Communications in Statistics – Theory and Methods, in press, 2015.

88. Henrik Nyman, Johan Pensar, Timo Koski, and Jukka Corander. Context-specific independence in graphical log-linear models. Computational Statistics, DOI: 10.1007/S00180-015-0606-6, 2015.

89. Eugenio G. Omodeo and Alexandru I. Tomescu. Set graphs. V. On representing graphs as membership digraphs. Journal of Logic and Computation, 25(3):899–919, 6 2015.

90. Joonas Paalasmaa, Hannu Toivonen, and Markku Partinen. Adaptive heartbeat modeling for beat-to-beat heart rate measurement in ballistocardiograms. IEEE Journal of Biomedical and Health Informatics, 19(6):1945–1952, 11 2015.

91. Johan Pensar, Henrik Nyman, Jarno Lintusaari, and Jukka Corander. The role of local partial independence in learning of Bayesian networks. International Journal of Approximate Reasoning, DOI: 10.1016./j.ijar.2015.11008, 2015.

92. Anssi Peräkylä, Pentti Henttonen, Liisa Voutilainen, Mikko Kahri, Tuire Stevanovic, Mikko Sams, and Niklas Ravaja. Sharing the emotional load: Recipient affiliation calms down the storyteller. Social Psychology Quarterly, 78(4):301–323, 2015.

93. Alberto Pessia, Yonatan Grad, Sarah Cobey, Juha Santeri Puranen, and Jukka Corander. K-Pax2: Bayesian identification of cluster-defining amino acid positions in large sequence datasets. Microbial Genomics, doi: 10.1099/mgen.0.000025, 2015.

94. Pawani Porambage, An Braeken, Corinna Schmitt, Andrei Gurtov, Mika Ylianttila, and Burkhard Stiller. Group key establishment for enabling secure multicast communication in wireless sensor networks deployed for IoT applications. IEEE Access, 3(3):1503–1511, 2015.

95. Tanjona Ramiadantsoa, Otso Ovaskainen, Joel Rybicki, and Ilkka Hanski. Large-scale habitat corridors for biodiversity conservation: A forest corridor in Madagascar. PLoS One, (7), 2015.

96. Weixiong Rao, Roman Vitenberg, Lei Chen, and Sasu Tarkoma. MTAF: An adaptive design for keyword-based content dissemination on DHT networks. IEEE Transactions on Parallel and Distributed Systems, 26(4):1071–1084, 4 2015.

97. Sandra Reuter, Jukka Corander, Mark de Been, Simon Harris, Lu Cheng, Miquette Hall, Nicholas R. Thomson, and Alan McNally. Directional gene flow and ecological separation in Yersinia enterocolitica. Microbial Genomics, doi: 10.1099/mgen.0.000030, 2015.

98. Tuukka Ruotsalo, Giulio Jacucci, Petri Myllymaki, and Samuel Kaski. Interactive intent modeling: Information discovery beyond search. Communications of the ACM, 58(1):86–92, 2015.

99. Deborah Serrien and Michiel Sovijärvi-Spapé. Hemispheric asymmetries and the control of motor sequences. Behavioural Brain Research, 283:30–36, 2015.

100. Sohan Seth and Manuel Eugster. Archetypal analysis for nominal observations. IEEE Transactions on Pattern Analysis and Machine Intelligence, 20 August 2015.

101. Sohan Seth and Manuel Eugster. Probabilistic archetypal analysis. Machine learning, 102(1):85–113, 2015.

102. Antti Siirtola and Keijo Heljanko. Parametrised modal interface automata. ACM Transactions on Embedded Computing Systems, 14(4):1–15, 2015.

103. Antti Siirtola and Juha Kortelainen. Multi-parameterised compositional verification of safety properties. Information and Computation, (244):23–48, 2015.

104. Michiel M. Spapé, Imtiaj Ahmed, Giulio Jacucci, and Niklas Ravaja. The self in conflict: Actors and agency in the mediated sequential Simon task. Frontiers in Psychology, 6, 3 2015.

105. Michiel M. Spapé, Eve E. Hoggan, Giulio Jacucci, and Niklas Ravaja. The meaning of the virtual Midas touch: An ERP study in economic decision making. Psychophysiology, 52(3):378–387, 3 2015.

106. Laura E Spoor, Emily Richardson, Amy C Richards, Gillian J Wilson, Chriselle Mendonca, Ravi Kr Gupta, Paul R McAdam, Stephen Nutbeam-Tuffs, Nikki S Black, James P O'Gara, Chia Y Lee, Jukka Corander, and J Ross Fitzgerald. Recombination-mediated remodelling of host-pathogen interactions during Staphylococcus aureus niche adaptation. Microbial Genomics, doi: 10.1099/mgen.0.000036., 2015.

107. Minna Stenius, Nelli Hankonen, Ari Haukkala, and Niklas Ravaja. Understanding knowledge sharing in the work context by applying a belief elicitation study. Journal of Knowledge Management, 19(3):497–513, 2015.

108. Marijn Stok, Laura König, Johanna Nurmi, and Andre Matthias Müller. Create workshop 2014: Leveraging mobile technology and social media in behavioral research. The European Health Psychologist, 16(6):260–262, 2015.

109. Hongyu Su and Juho Rousu. Multilabel classification through random graph ensembles. Machine Learning, 99(2):231–256, 2015.

110. Aino Tietäväinen, Jukka Corander, and Edward Hæggström. Baseline adjustment increases accurate interpretation of posturographic sway scores. Gait and Posture, doi:10.1016/j.gaitpost.2015.06.002, 2015.

111. Hannu Toivonen and Oskar Gross. Data mining and machine learning in computational creativity. Wiley Interdisciplinary Reviews. Data Mining and Knowledge Discovery, 5(6):265–275, 2015.

112. Alexandru I. Tomescu, Travis Gagie, Alexandru Popa, Romeo Rizzi, Anna Kuosmanen, and Veli Mäkinen. Explaining a weighted DAG with few paths for solving genome-guided multi-assembly. IEEE/ACM Transactions on Computational Biology and Bioinformatics, 12(6):1345–1354, 12 2015.

113. Hande Topa, Àgnes Jònàs, Robert Kofler, Carolin Kosiol, and Antti Honkela. Gaussian process test for high-throughput sequencing time series: application to experimental evolution. Bioinformatics, 31(11):1762–1770, 2015.

114. Hien Truong, Xiang Gao, Babins Shrestha, Nitesh Saxena, N. Asokan, and Petteri Nurmi. Using contextual co-presence to strengthen zero-interaction authentication: Design, integration and usability. Pervasive and Mobile Computing, 16(Part B):187–204, 1 2015. Paper from the Twelfth Annual IEEE International Conference on Pervasive Computing and Communications (PerCom 2014).

115. Ikram Ullah, Pekka Parviainen, and Jens Lagergren. Species tree inference using a mixture model. Molecular Biology and Evolution, 32(9):2469–2482, 2015.

116. Karolis Uziela and Antti Honkela. Probe region expression estimation for RNA-Seq data for improved microarray comparability. PLoS One, 10(5), 5 2015.

117. Karen E. van Rens, Veli Mäkinen, and Alexandru I. Tomescu. SNV-PPILP: refined SNV calling for tumor data using perfect phylogenies and ILP. Bioinformatics, 31(7):1133– 1135, 4 2015.

118. Stephan Verschoor, Marcus Paulus, Michiel Sovijärvi-Spapé, Szilvia Biro, and Bernhard Hommel. The developing cognitive substrate of sequential action control in 9-to 12-month-olds: Evidence for concurrent activation models. Cognition, 138(-):64–78, 2015.

119. Kazuho Watanabe and Teemu Roos. Achievability of asymptotic minimax regret by horizon-dependent and horizon-independent strategies. Journal of Machine Learning Research, 16:2357 2375, 11 2015.

120. Lu Wei, Zhong Zheng, Jukka Corander, and Giorgio Taricco. On the outage capacity of orthogonal space-time block codes over multi-cluster scattering MIMO channels. IEEE Transactions on Communications, DOI: 10.1109/TCOMM.2015.2419258, 2015.

121. Lucy Weinert, Roy Chaudhuri, Jinhong Wang, Sarah Peters, Jukka Corander, Thibaut Jombart, Abiyad Baig, Kate Howell, Minna Vehkala, Niko Välimäki, David Harris, Bich Chieu Tran Thi, Chau Nguyen Van Vinh, James Campbell, Constance Schultsz, Julian Parkhill, Stephen Bentley, Paul Langford, Andrew Rycroft, Brendan Wren, Jeremy Farrar, Stephen Baker, Ngo Hoa, Matthew Holden, Alexander Tucker, and Duncan Maskell. Genomic signatures of human and animal disease in the zoonotic pathogen Streptococcus suis. Nature Communications, doi:10.1038/ncomms7740, 2015.

122. Roland Wittler, Tobias Marschall, Alexander Schönhuth, and Veli Mäkinen. Repeat- and error-aware comparison of deletions. Bioinformatics, 31(18):2947–2954, 9 2015.

123. Jie Xiong, Väinö Jääskinen, and Jukka Corander. Recursive learning of sparse Markov models. Bayesian Analysis, doi: 10.1214/15-BA949, 2015.

124. Kai Zhao, Mirco Musolesi, Pan Hui, Weixiong Rao, and Sasu Tarkoma. Explaining the power-law distribution of human mobility through transportation modality decomposition. Scientific Reports, 5, 2015.

125. Indre Zliobaite, Albert Bifet, Jesse Read, Bernhard Pfahringer, and Geoff Holmes. Evaluation methods and decision theory for classification of streaming data with temporal dependence. Machine Learning, 98(3):455–482, 2015.

126. Indre Zliobaite, Marcin Budka, and Frederic Stahl. Towards cost-sensitive adaptation: when is it worth updating your predictive model? Neurocomputing, 150(Part A):249, 2015.

127. Indre Zliobaite and Jaakko Hollmen. Optimizing regression models for data streams with missing values. Machine Learning, 99(1):47–73, 2015.

128. Alexia Zoumpoulaki, Abdulmajeed Alsufyani, Marco Filetti, Mick Brammer, and Howard Bowman. Latency as a region contrast: Measuring ERP latency differences with dynamic time warping. Psychophysiology, 52(12):1559–1576, 2015.

D. 2. Articles in international edited works and conference proceedings with referee practice

1. Michael Abseher, Martin Gebser, Nysret Musliu, Torsten Schaub, and Stefan Woltran. Shift design with answer set programming. In Proceedings of Logic Programming and Non-monotonic Reasoning, Volume 9345 of the series Lecture Notes in Computer Science, pages 32–39. Springer, September 2015.
2. Prem Raj Adhikari and Jaakko Hollmen. Resolution transfer in cancer classification based on amplification patterns. In Discovery Science: 18th International Conference (DS), Banff, AB, Canada, October 4-6, 2015, LNCS 9356, pages 1–8. Springer International Publishing, October 2015.
3. Ijaz Ahmad, Suneth Namal, Mika Ylianttila, and Andrei Gurtov. Towards software defined cognitive networking. In IFIP-IEEE NTMS'2015, Proceedings of, 2015.
4. Imtiaj Ahmed, Yina Ye, Sourav Bhattacharya, N. Asokan, Giulio Jacucci, Petteri Nurmi, and Sasu Tarkoma. Checksum gestures: continuous gestures as an out-of-band channel for secure pairing. In Proceedings of the 2015 ACM International Joint Conference on Pervasive and Ubiquitous Computing, pages 391– 401, New York, 2015. ACM.
5. Ehsan Amid, Aristides Gionis, and Antti Ukkonen. A kernel-learning approach to semi-supervised clustering with relative distance comparisons. In Machine Learning and Knowledge Discovery in Databases: European Conference, ECML PKDD 2015, Porto, Portugal, September 7-11, 2015, Proceedings, Part I, page 234, Porto, Portugal, September 2015. Springer International Publishing.
6. Salvatore Andolina, Khalil Klouche, Diogo Cabral, Tuukka Ruotsalo, and Giulio Jacucci. InspirationWall: Supporting idea generation through automatic information exploration. In Tom Maver II and Ellen Yi-Luen Do, editors, Proceedings of the 2015 ACM SIGCHI Conference on Creativity and Cognition, pages 103–106, New York, 2015. ACM.
7. Salvatore Andolina, Khalil Klouche, Jaakko Peltonen, Mohammad Hoque, Tuukka Ruotsalo, Diogo Cabral, Arto Klami, Dorota Glowacka, Patrik Floréen, and Giulio Jacucci. IntentStreams: Smart parallel search streams for branching exploratory search. In Proceedings of the 20th International Conference on Intelligent User Interfaces, pages 103–106. ACM, March 2015.
8. Esther M. Arkin, Alon Efrat, Christian Knauer, Joseph S. B. Mitchell, Valentin Polishchuk, Gunter Rote, Lena Schlipf, and Topi Talvitie. Shortest path to a segment and quickest visibility queries. In Lars Arge and János Pach, editors, 31st International Symposium on Computational Geometry (SoCG 2015), volume 34 of Leibniz International Proceedings in Informatics (LIPIcs), pages 658–673. Schloss Dagstuhl–eibniz-Zentrum fuer Informatik, 2015.
9. Konstantinos Athanasiou, Hernán Ponce de León, and Stefan Schwoon. Test case generation for concurrent systems using event structures. In Jasmin Christian Blanchette and Nikolai Kosmatov, editors, Tests and Proofs - 9th International Conference, TAP 2015, pages 19–37, L'Aquila, Italy, July 2015. Springer.
10. Kumaripaba Athukorala, Alan Medlar, Kalle Ilves, and Dorota Glowacka. Balancing exploration and exploitation: Empirical parameterization of exploratory search systems. In Proceedings of the 24th ACM International on Conference on Information and Knowledge Management, CIKM '15, pages 1703–1706, 2015.
11. Per Austrin, Petteri Kaski, Mikko Koivisto, and Jesper Nederlof. Subset sum in the absence of concentration. In Ernst W. Mayr and Nicolas Ollinger, editors, 32nd International Symposium on Theoretical Aspects of Computer Science (STACS 2015), volume 30 of Leibniz International Proceedings in Informatics (LIPIcs), pages 48– 61. Schloss Dagstuhl–eibniz-Zentrum fuer Informatik, 2015.
12. Mutsunori Banbara, Martin Gebser, Katsumi Inoue, Max Ostrowski, Andrea Peano, Torsten Schaub, Takehide Soh, Naoyuki Tamura, and Matthias Weise. aspartame: Solving constraint satisfaction problems with answer set programming. In 13th International Conference on Logic Programming and Non-monotonic Reasoning (LPNMR), Lexington, KY, USA, September 27-30, 2015, Proceedings, LNCS 9345, pages 112–126. Springer, September 2015.

13. Hideo Bannai, Travis Gagie, Shunsuke Inenaga, Juha Kärkkäinen, Dominik Kempa, Marcin Piatkowski, Simon Puglisi, and Shiho Sugimoto. Diverse palindromic factorization is NP-complete. In Igor Potapov, editor, 19th International Conference, DLT 2015, LNCS 9168, pages 85–96. Springer, 2015.

14. Oswald Barral, Manuel J. A. Eugster, Tuukka Ruotsalo, Michiel Sovijärvi-Spapé, Ilkka Kosunen, Niklas Ravaja, Samuel Kaski, and Giulio Jacucci. Exploring peripheral physiology as a predictor of perceived relevance in information retrieval. In Proceedings of the 20th International Conference on Intelligent User Interfaces, pages 389–399, New York, NY, March 2015. ACM.

15. Suzan Bayhan, Esa Hyytiä, Jussi Kangasharju, and Jörg Ott. Analysis of hop limit in opportunistic networks by static and time-aggregated graphs. In 2015 IEEE International Conference on Communications (ICC), pages 3288–3292, 6 2015.

16. Suzan Bayhan, Esa Hyytiä, Jussi Kangasharju, and Jörg Ott. Two hops or more: On hop-limited search in opportunistic networks. In Proceedings of the 18th ACM International Conference on Modeling, Analysis and Simulation of Wireless and Mobile Systems, MSWiM?15, pages 115–124, 11 2015.

17. Djamal Belazzougui, Patrick Hagge Cording, Simon J. Puglisi, and Yasuo Tabei. Access, rank, and select in grammar-compressed strings. In Nikhil Bansal and Irene Finocchi, editors, Algorithms –ESA 2015, Proceedings of the 23rd Annual European Symposium, volume 9294 of Lecture Notes in Computer Science, pages 142–154, 2015.

18. Djamal Belazzougui and Fabio Cunial. A framework for space-efficient string kernels. In Ferdinando Cicalese, Ely Porat, and Ugo Vaccaro, editors, Proceedings of 26th Annual Symposium, CPM 2015, Lecture Notes in Computer Science, pages 13–25. Springer, 2015.

19. Djamal Belazzougui, Fabio Cunial, Travis Gagie, Nicola Prezza, and Mathieu Raffinot. Composite repetition-aware data structures. In Ferdinando Cicalese, Ely Porat, and Ugo Vaccaro, editors, Combinatorial Pattern Matching: 26th Annual Symposium, CPM 2015, Lecture Notes in Computer Science, pages 26–39, 2015.

20. Djamal Belazzougui, Travis Gagie, Pawe Gawrychowski, Juha Kärkkäinen, Alberto Ordóñez Pereira, Simon J. Puglisi, and Yasuo Tabei. Queries on lz-bounded encodings. In DCC 2015 Data Compression Conference: 2015 Data Compression Conference, Data Compression Conference. Proceedings, pages 83–92, 2015.

21. Djamal Belazzougui, Veli Mäkinen, and Daniel Valenzuela. Compressed suffix array. In Ming-Yang Kao, editor, Encyclopedia of Algorithms. Springer, 2015.

22. Andrea Bellucci, Giulio Jacucci, Veera Kotkavuori, Baris Serim, Imtiaj Ahmed, and Salu Ylirisku. Extreme co-design: Prototyping with and by the user for appropriation of web-connected tags. In Paloma Díaz, Volkmar Pipek, Carmelo Ardito, Carlos Jensen, Ignacio Aedo, and Alexander Boden, editors, End-User Development, Lecture Notes in Computer Science, pages 109–124. Springer International Publishing, 2015.

23. Petra Berenbrink, Ralf Klasing, Adrian Kosowski, Frederik Mallmann-Trenn, and Przemyslaw Uznanski. Improved analysis of deterministic load-balancing schemes. In Chryssis Georgiou and Paul G. Spirakis, editors, Proceedings of the 2015 ACM Symposium on Principles of Distributed Computing, PODC 2015, Donostia-San Sebastián, Spain, July 21 - 23, 2015, pages 301–310, July 2015.

24. Jeremias Berg, Paul Saikko, and Matti Järvisalo. Improving the effectiveness of sat-based preprocessing for maxsat. In Qiang Yang and Michael Wooldridge, editors, Proceedings of the 24th International Conference on Artificial Intelligence (IJCAI 2015), pages 239–245, 2015.

25. Jeremias Berg, Paul Saikko, and Matti Järvisalo. Re-using auxiliary variables for maxsat preprocessing. In Proceedings of the IEEE 27th International Conference on Tools with Artificial Intelligence (ICTAI 2015), Proceedings, pages 813–820. International Conference on Tools with Artificial Intelligence, 2015.

26. Albert Bifet, Gianmarco De Francisci Morales, Jesse Read, Bernhard Pfahringer, and Geoff Holmes. Efficient online evaluation of big data stream classifiers. In 21st ACM SIGKDD Conference on Knowledge Discovery and Data Mining (KDD-2015), pages 59–68. AAAI Press, August 2015.

27. Ella Bingham and Heikki Mannila. On the applicability of latent variable modeling to research system data. In Ella Bingham, Samuel Kaski, Jorma Laaksonen, and Jouko Lampinen, editors, Advances in Independent Component Analysis and Learning Machines, pages 279–288. Elsevier, Academic Press, 2015.

28. Andreas Björklund, Petteri Kaski, Lukasz Kowalik, and Juho Lauri. Engineering motif search for large graphs. In Ulrik Brandes and David Eppstein, editors, Proceedings of the Seventeenth Workshop on Algorithm Engineering and Experiments, ALENEX 2015, San Diego, CA, USA, January 5, 2015, pages 104–118, Philadelphia, PA, January 2015. SIAM.

29. Jori Bomanson, Martin Gebser, Tomi Janhunen, Benjamin Kaufmann, and Torsten Schaub. Answer set programming modulo acyclicity. In Proceedings of Logic Programming and Non-monotonic Reasoning, Volume 9345 of the series Lecture Notes in Computer Science, pages 143–150. Springer, September 2015.

30. Christina Boucher, Alexander Bowe, Travis Gagie, Simon J. Puglisi, and Kunihiko Sadakane. Variable-order de bruijn graphs. In Ali Bilgin, Michael W. Marcellin, Joan Serra-Sagrista, and James A. Storer, editors, Proceedings of DCC 2015, Data Compression Conference. Proceedings, pages 383–392, 2015.

31. Howard Bowman, Abdulmajeed Alsufyani, Omid Hajilou, Marco Filetti, and Alexia Zoumpoulaki. Breakthroug percepts - (sub)liminal salience search and eeg deception detection on the fringe of awareness. In Proceedings of Vision Science Society, page 1242, USA, 2015. Journal of Vision. Poster.

32. Remi Brochenin, Thomas Linsbichler, Marco Maratea, Johannes Wallner, and Stefan Woltran. Abstract solvers for Dung's argumentation frameworks. In Elizabeth Black, Sanjay Modgil, and Nir Oren, editors, Third International Workshop, TAFA 2015, Lecture Notes in Computer Science, pages 40–58. Springer, 2015.

33. Keren Censor-Hillel, Petteri Kaski, Janne H. Korhonen, Christoph Lenzen, Ami Paz, and Jukka Suomela. Algebraic methods in the congested clique. In Proceedings of the 2015 ACM Symposium on Principles of Distributed Computing, pages 143–152. ACM, July 2015.

34. Jérémie Chalopin, Shantanu Das, Pawel Gawrychowski, , Adrian Kosowski, Arnaud Labourel, and Przemyslaw Uznanski. Limit behavior of the multi-agent rotor-router system. In Distributed Computing, Volume 9363 of the series Lecture Notes in Computer Science, pages 123–139, October 2015.

35. Jurek Czyzowicz, Leszek Gasieniec, Adrian Kosowski, Evangelos Kranakis, Paul G. Spirakis, and Przemyslaw Uznanski. On convergence and threshold properties of discrete Lotka-Volterra population protocols. In Magnús M. Halldórsson, Kazuo Iwama, Naoki Kobayashi, and Bettina Speckmann, editors, Automata, Languages, and Programming - 42nd International Colloquium, ICALP 2015, Kyoto, Japan, July 6-10, 2015, Proceedings, Part I, pages 393–405. European Association for Theoretical Computer Science (EATCS), July 2015.

36. Aaron Yi Ding, Jouni Korhonen, Teemu Savolainen, Yanhe Liu, Markku Kojo, Sasu Tarkoma, and Henning Schulzrinne. Reflections on middlebox detection mechanisms in ipv6 transition. In IAB Workshop on Stack Evolution in a Middlebox Internet (SEMI) 2015, 1 2015.

37. Jiang Dong, Yu Xiao, Marius Noreikis, Zhonghong Ou, and Antti Ylä-Jääski. iMoon: Using smartphones for image-based indoor navigation. In Junehwa Song, Tarek Abdelzaher, and Cecilia Mascolo, editors, SenSys '15 Proceedings of the 13th ACM Conference on Embedded Networked Sensor Systems, pages 85– 97, New York, NY, USA, November 2015. ACM.

38. Jiang Dong, Yu Xiao, Zhonghong Ou, and Antti Ylä-Jääski. Utilizing internet photos for indoor mapping and localization - opportunities and challenges. In Falko Dressler and Jiangchuan Liu, editors, 2015 IEEE Conference on Computer Communications Workshops (INFOCOM WKSHPS), pages 636–641. IEEE, May 2015.

39. Wolfgang Dvorak, Matti Järvisalo, Johannes Wallner, and Stefan Woltran. Complexity-sensitive decision procedures for abstract argumentation (extended abstract). In Qiang Yang and Michael Wooldridge, editors, Proceedings of the Twenty-Fourth International Joint Conference on Artificial Intelligence, IJCAI 2015, pages 4073–4077, 2015.

40. Karmen Dykstra, Jefrey Lijffijt, and Aristides Gionis. Covering the egonet: A crowdsourcing approach to social circle discovery on Twitter. In Proceedings of the 9th International Conference on Weblogs and Social Media, pages 606– 609, University of Oxford, Oxford, UK, May 2015.

41. Ralf Eggeling, Mikko Koivisto, and Ivo Grosse. Dealing with small data: On the generalization of context trees. In Proceedings of the 32nd International Conference on Machine Learning (ICML-15), JMLR: Workshop and Conference Proceedings, pages 1245– 1253. JMLR, 2015.

42. Victor Elvira, Luca Martino, David Luengo, and Jukka Corander. A Gradient Adaptive Population Importance Sampler. IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP) (2015), DOI: 10.1109/ICASSP.2015.7178737, 2015.

43. Mehmet Emre, Gurkan Gür, Suzan Bayhan, and Fatih Alagöz. CooperativeQ: Energy-efficient channel access based on cooperative reinforcement learning. In 2015 IEEE International Conference on Communications (ICC), pages 2799 – 2805, 6 2015.

44. Sylvester Eriksson-Bique, John Hershberger, Valentin Polishchuk, Bettina Speckmann, Subhash Suri, Topi Talvitie, Kevin Verbeek, and Hakan Yildiz. Geometric k shortest paths. In Piotr Indyk, editor, Proceedings of the 26th Annual ACM-SIAM Symposium on Discrete Algorithms, pages 1616–1625, 2015.

45. Laurent Feuilloley, Juho Hirvonen, and Jukka Suomela. Locally optimal load balancing. In Distributed Computing. 29th International Symposium, DISC 2015, Tokyo, Japan, October 7-9, 2015, Proceedings, LNCS 9363, pages 544– 558, October 2015.

46. Pierre Fraigniaud, Juho Hirvonen, and Jukka Suomela. Node labels in local decision. In Structural Information and Communication Complexity. 22nd International Colloquium, SIROCCO 2015, Montserrat, Spain, July 14-16, 2015. Post-Proceedings, LNCS 9439, pages 31–45, July 2015.

47. Travis Gagie. Rank and select operations on sequences. In Ming-Yang Kao , editor, Encyclopedia of Algorithms. Springer, 2015.

48. Travis Gagie, Aleksi Hartikainen, Juha Kärkkäinen, Gonzalo Navarro, Simon J. Puglisi, and Jouni Sirén. Document counting in compressed space. In Ali Bilgin, Michael W. Marcellin, Joan Serra-Sagrista, and James A. Storer, editors, Data Compression Conference (DCC), 2015, Proceedings, pages 103–112, 2015.

49. Luciano Gamberini, Anna Spagnolli, Benjamin Blankertz, Samuel Kaski, Jonathan Freeman, Laura Acqualagna, Oswald Barral, Maura Bellio, Luca Chech, Manuel Eugster, Eva Ferrari, Paolo Negri, Valeria Orso, Patrik Pluchino, Filippo Minelle, Baris Serim, Markus Wenzel, and Giulio Jacucci. Developing a symbiotic system for scientific information seeking: The mindsee project. In Benjamin Blankertz, Giulio Jacucci, Luciano Gamberini, Anna Spagnolli, and Jonathan Freeman, editors, Proceedings of the 4th International Workshop, Symbiotic 2015, Lecture Notes in Computer Science, pages 68–80. Springer International Publishing, 2015.

50. Yuan Gao, Kalle Ilves, and Dorota Gl□owacka. OfficeHours: A System for Student Supervisor Matching through Reinforcement Learning. IUI 2015: 20th International Conference on Intelligent User Interfaces, Atlanta, USA, 2015.

51. Kiran Garimella, Gianmarco De Francisci Morales, Aristides Gionis, and Mauro Sozio. Scalable facility location for massive graphs on Pregel-like systems. In 24th ACM International Conference on Information and Knowledge Management (CIKM 2015), pages 273–282, October 2015.

52. Martin Gebser, Tomi Janhunen, Holger Jost, Roland Kaminski, and Torsten Schaub. ASP solving for expanding universes. In Proceedings of Logic Programming and Nonmonotonic Reasoning, Volume 9345 of the series Lecture Notes in Computer Science, pages 354–367. Springer, September 2015.

53. Martin Gebser, Roland Kaminski, Benjamin Kaufmann, Javier Romero, and Torsten Schaub. Progress in clasp series 3. In Proceedings of Logic Programming and Non-monotonic Reasoning, Volume 9345 of the series Lecture Notes in Computer Science, pages 368–383. Springer, September 2015.

54. Martin Gebser, Roland Kaminski, Philipp Obermeier, and Torsten Schaub. Ricochet robots reloaded: A case-study in multi-shot ASP solving. In Thomas Eiter, Hannes Strass, Miroslaw Truszczynski, and Stefan Woltran, editors, Advances in Knowledge Representation, Logic Programming, and Abstract Argumentation: Essays Dedicated to Gerhard Brewka on the Occasion of His 60th Birthday, pages 17–32. Springer International Publishing, Switzerland, 2015.

55. Martin Gebser, Marco Maratea, and Francesco Ricca. The design of the sixth answer set programming competition. In Proceedings of Logic Programming and Nonmonotonic Reasoning, Volume 9345 of the series Lecture Notes in Computer Science, pages 531–544. Springer, September 2015.

56. Martin Gebser, Anna Ryabokon, and Gottfried Schenner. Combining heuristics for configuration problems using answer set programming. In Proceedings of Logic Programming and Nonmonotonic Reasoning, Volume 9345 of the series Lecture Notes in Computer Science, pages 384–397. Springer, September 2015.

57. Aristides Gionis, Michael Mathioudakis, and Antti Ukkonen. Bump hunting in the dark: Local discrepancy maximization on graphs. In 31st IEEE International Conference on Data engineering (ICDE), 2015.

58. Javier Gonzalez-Nova, Travis Gagie, Susana Ladra, Gonzalo Navarro, and Diego Seco. Faster compressed quadtrees. In Ali Bilgin, Michael W. Marcellin, Edit Joan Serra-Sagrista, and James A. Storer, editors, Data Compression Conference (DCC), 2015, Proceedings, pages 93–102. IEEE, 2015.

59. Ibbad Hafeez, Yi Ding, Lauri Juhani Suomalainen, Seppo Juho Kalervo Hätönen, Pentti Valtteri Niemi, and Sasu Tarkoma. Demo: Cloud-based security as a service for smart IoT environments. In S3'15 Proceedings of the 2015 Workshop on Wireless of the Students, page 20, 9 2015.

60. Mohammad Ashraful Hoque, Kasperi Saarikoski, Eemil Lagerspetz, Julien Vincent Mineraud, and Sasu Tarkoma. Poster: Vpn tunnels for energy efficient multimedia streaming. In Proceedings of the 21st Annual International Conference on Mobile Computing and Networking, MobiCom '15, pages 239–241, 9 2015.

61. Mohammad Ashraful Hoque and Sasu Tarkoma. Sudden drop in the battery level?: Understanding smartphone state of charge anomaly. In 7th Workshop on Power-Aware Computing and Systems HotPower'2015, pages 26–30, 10 2015.

62. Mohammad Ashraful Hoque, Sasu Tarkoma, and Tuikku Attila. Poster: Extremely parallel resource pre-fetching for energy optimized mobile web browsing. In Proceedings of the 21st Annual International Conference on Mobile Computing and Networking, MobiCom '15, pages 236–238, 9 2015.

63. Sayantan Hore, Dorota Gl□owacka, Ilkka Kosunen, Kumaripaba Athukorala, and Giulio Jacucci. FutureView: Enhancing Exploratory Image Search. RecSys Workshop on Interfaces and Human Decision Making for Recommender Systems, Vienna, Austria, 2015.

64. Ademir Hujdurovic, Ursa Kacar, Martin Milanic, Bernard Ries, and Alexandru I. Tomescu. Finding a perfect phylogeny from mixed tumor samples. In Mihai Pop and Hélène Touzet, editors, Algorithms in Bioinformatics: 15th International Workshop, WABI 2015, Atlanta, GA, USA, September 10-12, 2015, Proceedings, volume 9289 of Lecture Notes in Computer Science, pages 80–92. Springer-Verlag, 2015.

65. Antti Hyttinen, Frederick Eberhardt, and Matti Järvisalo. Do-calculus when the true graph is unknown. In Marina Meila and Tom Heskes, editors, Proceedings of UAI 2015,ÿ31st Conference on Uncertainty in Artificial Intelligence, Uncertainty in Artificial Intelligence, pages 395–404, 2015.

66. Aapo Hyvärinen. A unified probabilistic model for independent and principal component analysis. In Ella Bingham, Samuel Kaski, Jorma Laaksonen, and Jouko Lampinen, editors, Advances in Independent Component Analysis and Learning Machines, pages 75–82. Elsevier Scientific Publ. Co, International, 2015.

67. Tapio Ikkala and Airi Lampinen. Monetizing network hospitality: Hospitality and sociability in the context of Airbnb. In Proceedings of the ACM 2015 conference on Computer supported cooperative work, March 2015.

68. Kalle Ilves, Alan Medlar, and Dorota Gl□owacka. Visualizing User Model in Exploratory Search Tasks. Proceedings of the 4th Workshop on Machine Learning for Interactive Systems, JMLR W& CP vol. 43, Lille, France, 2015.

69. Saturo Ishikawa, Rao Anwer, Juha Markus Koskela, and Jorma Laaksonen. Picsom experiments in trecvid 2015. In Proceedings of the TRECVID 2015 Workshop, 11 2015.

70. Tomi Janhunen and Ilkka Niemelä. Cumulativity tailored for non-monotonic reasoning. In Thomas Eiter, Hannes Strass, Miroslaw Truszczynski, and Stefan Woltran, editors, Advances in Knowledge Representation, Logic Programming, and Abstract Argumentation - Essays Dedicated to Gerhard Brewka on the Occassion of his 60th Birthday, pages 96–111, Switzerland, February 2015. Springer.

71. Antti Jylhä, Yi-Ta Hsieh, Valeria Orso, Salvatore Andolina, Luciano Gamberini, and Giulio Jacucci. A wearable multimodal interface for exploring urban points of interest. In ICMI '15 Proceedings of the 2015 ACM on International Conference on Multimodal Interaction, pages 175–182, 2015.

72. Simo Järvelä, Inger Ekman, Matias Kivikangas, and Niklas Ravaja. Stimulus games. In Petri Lankoski and Staffan Björk, editors, Game research methods, pages 193–206. ETC Press, 2015.

73. Juho-Kustaa Kangas, Teppo Niinimäki, and Mikko Koivisto. Averaging of decomposable graphs by dynamic programming and sampling. In Marina Meila and Tom Heskes, editors, Uncertainty In Artificial Intelligence : Proceedings of the Thirty-First Conference (2015), pages 415–424, 2015.

74. Antti Kangasrääsiö, Dorota Glowacka, and Samuel Kaski. Improving controllability and predictability of interactive recommendation interfaces for exploratory search. In Proceedings of the 20th International Conference on Intelligent User Interfaces, pages 247–251, Atlanta, GA, March 2015. ACM.

75. Anna Kantosalo, Jukka Toivanen, and Hannu Toivonen. Interaction evaluation for human-computer co-creativity: A case study. In Hannu Toivonen, Simon Colton, Michael Cook, and Dan Ventura, editors, Sixth International Conference on Computational Creativity (ICCC 2015), pages 276–283, 2015.

76. Lila Kari, Steffen Kopecki, Pierre-Étienne Meunier, Matthew J. Patitz, and Shinnosuke Seki. Binary pattern tileset synthesis is NP-hard. In Automata, Languages, and Programming, pages 1022–1034. Springer Berlin Heidelberg, July 2015.

77. Ossi Karkulahti and Jussi Kangasharju. Youtube revisited: On the importance of correct measurement methodology. In Moritz Steiner, Pere Barlet-Ros, and Olivier Bonaventure, editors, 2015 IEEE Trustcom/BigDataSE/ISPA, Lecture Notes in Computer Science, pages 17–30, 2015.

78. Petteri Kaski. Fast subset convolution. In Ming-Yang Kao, editor, Encyclopedia of Algorithms, pages 1–5. Springer, Berlin Heidelberg, 2015.

79. Arto Klami, Abhishek Tripathi, Jalmar Sirola, Lauri Väre, and Frederic Roulland. Latent feature regression for multivariate count data. In Guy Lebanon and S.V.N. Vishwanathan, editors, Proceedings of the Eighteenth International Conference on Artificial Intelligence and Statistics (AISTATS 2015), JMLR: Workshop and Conference Proceedings, pages 462–470. JMLR, 2015.

80. Khalil Klouche, Tuukka Ruotsalo, Diogo Cabral, Salvatore Andolina, Andrea Bellucci, and Giulio Jacucci. Designing for exploratory search on touch devices. In Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems, page 10, NY, USA, April 2015. ACM.

81. Janne H. Korhonen and Pekka Parviainen. Tractable Bayesian network structure learning with bounded vertex cover number. In Corinna Cortes, Neil D. Lawrence, Daniel D. Lee, Masashi Sugiyama, and Roman Garnett, editors, Advances in Neural Information Processing Systems 28, pages 622–630, December 2015.

82. Dmitry Korzun, Dmitriy Kuptsov, and Andrei Gurtov. A simulation study of the stochastic compensation effect for packet reordering in multipath data streaming. In Proc. of 9th European Modelling Symposium on Mathematical Modelling and Computer Simulation (EMS'15), October 2015.

83. Dmitry G. Korzun, Ilya Nikolaevskiy, and Andrei Gurtov. Service intelligence support for medical sensor networks in personalized mobile health systems. In Internet of Things, Smart Spaces, and Next Generation Networks and Systems. 15th International Conference, NEW2AN 2015, and 8th Conference, ruSMART 2015, St. Petersburg, Russia, August 26-28, 2015, Proceedings, LNCS 9247, pages 116–127. Springer, August 2015.

84. Orestis Kostakis and Aristides Gionis. Subsequence search in event-interval sequences. In 38th International ACM SIGIR Conference on Research and Development in Information Retrieval, pages 851–854, New York, NY, USA, August 2015.

85. Rohit Kumar, Toon Calders, Aristides Gionis, and Nikolaj Tatti. Maintaining sliding-window neighborhood profiles in interaction networks. In Machine Learning and Knowledge Discovery in Databases: European Conference, ECML PKDD 2015, Porto, Portugal, September 7-11, 2015, Proceedings, Part II, pages 719–735, Berlin, 2015. Springer-Verlag Berlin.

86. Juha Kärkkäinen. Suffix array construction. In Ming-Yang Kao, editor, Encyclopedia of Algorithms. Springer, 2015.

87. Juha Kärkkäinen, Dominik Kempa, and Marcin Piatkowski. Tighter bounds for the sum of irreducible lcp values. In Ferdinando Cicalese, Ely Porat, and Ugo Vaccaro, editors, Proceedings of the 6th Annual Symposium, CPM 2015, Lecture Notes in Computer Science, pages 316–328. Springer International Publishing, 6 2015.

88. Juha Kärkkäinen, Dominik Kempa, and Simon J. Puglisi. Parallel external memory suffix sorting. In Ferdinando Cicalese, Ely Porat, and Ugo Vaccaro, editors, Proceedings of the 26th Annual Symposium, CPM 2015, Lecture Notes in Computer Science, pages 329– 342. Springer International Publishing, 6 2015.

89. Jari Laarni, Niklas Ravaja, Timo Saari, Saskia Böcking, Tilo Hartmann, and Holger Schramm. Ways to measure spatial presence: Review and future directions. In Matthew Lombard, Frank Biocca, Jonathan Freeman, Wijnand IJsselsteijn, and Rachel J. Schaevitz, editors, Immersed in Media, pages 139–185. Springer International Publishing Switzerland, 2015.

90. Airi Lampinen, Kai Huotari, and Coye Cheshire. Access to participation in the sharing economy: The case of local online exchange in a single parents' network. In Erika et al. Pearson, editor, IR15: Boundaries and Intersections. Association of Internet Researchers, United States, 2015.

91. Geraud Le Falher, Aristides Gionis, and Michael Mathioudakis. Where is the Soho of Rome? measures and algorithms for finding similar neighborhoods in cities. In Proceedings of the 9th International Conference on Weblogs and Social Media, page 237, University of Oxford, Oxford, UK, May 2015.

92. Christoph Lenzen and Joel Rybicki. Efficient counting with optimal resilience. In Distributed Computing, LNCS 9363, pages 16–30, 2015.

93. Christoph Lenzen, Joel Rybicki, and Jukka Suomela. Towards optimal synchronous counting. In ACM Symposium on Principles of Distributed Computing (PODC), pages 441–450, July 2015.

94. Heikki Lindholm, Lirim Osmani, Hannu Flinck, Sasu Tarkoma, and Ashwin Rao. State space analysis to refactor the mobile core. In AllThingsCellular '15 Proceedings of the 5th Workshop on All Things Cellular: Operations, Applications and Challenges, pages 31– 36, 2015.

95. Madhusanka Liyanage, Jude Okwuibe, Mika Ylianttila, and Andrei Gurtov. Secure virtual private LAN services: An overview with performance evaluation. In Proc. of IEEE ICC, 2015.

96. Krista Longi, Juho Leinonen, Henrik Nygren, Joni Salmi, Arto Klami, and Arto Vihavainen. Identification of programmers from typing patterns. In Proceedings of the 15th Koli Calling Conference on Computing Education Research, Koli Calling '15, pages 60–67. ACM, 11 2015.

97. Vilen Looga, Zhonghong Ou, Yang Deng, and Antti Ylä-Jääski. Remote inference energy model for internet of things devices. In Proceedings of the 2015 IEEE 11th International Conference on Wireless and Mobile Computing, Networking and Communications (WiMob), pages 716–723, 2015.

98. Vilen Looga, Zhonghong Ou, Yu Xiao, and Antti Ylä-Jääski. The great expectations of smartphone traffic scheduling. In Proceedings of the 20th IEEE Symposium on Computers and Communication (ISCC) (ISCC2015), pages 884–890, 2015.

99. Eric Malmi, Arno Solin, and Aristides Gionis. The blind leading the blind: Network-based location estimation under uncertainty. In Annalisa Appice, Pedro Pereira Rodrigues, Vítor Santos Costa, João Gama, Alípio Jorge, and Carlos Soares, editors, Machine Learning and Knowledge Discovery in Databases: European Conference, ECML PKDD 2015, Porto, Portugal, September 7-11, 2015, Proceedings, Part I, pages 406–421. Springer International Publishing, September 2015.

100. Brandon Malone, Matti Järvisalo, and Petri Myllymäki. Impact of learning strategies on the quality of Bayesian networks: An empirical evaluation. In Marina Meila and Tom Heskes, editors, Proceedings of the 31st Conference on Uncertainty in Artificial Intelligence (UAI 2015), pages 562–571, 2015.

101. Florin Manea and Shinnosuke Seki. Square-density increasing mappings. In Combinatorics on Words. 10th International Conference, WORDS 2015, Kiel, Germany, September 14-17, 2015, Proceedings, LNCS 9304, pages 160–169. Springer-verlag Berlin, September 2015.

102. Luca Martino, Victor Elvira, David Luengo, A. Artés-Rodríguez, and Jukka Corander. Smelly Parallel MCMC Chains. IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP) (2015), DOI: 10.1109/ICASSP.2015.7178736, 2015.

103. Luca Martino, Victor Elvira, David Luengo, and Jukka Corander. Interacting Parallel Markov Adaptive Importance Sampling. European Signal Processing Conference (EUSIPCO), accepted for publication, 2015.

104. Charalampos Mavroforakis, Michael Mathioudakis, and Aristides Gionis. Absorbing random-walk centrality: Theory and algorithms. In IEEE International Conference on Data Mining (ICDM), Atlantic City, New Jersey, United States of America, 2015. IEEE Computer Society.

105. Pierre-Étienne Meunier. Noncooperative algorithms in self-assembly. In Springer International Publishing, editor, Unconventional Computation and Natural Computation, LNCS 9252, pages 263–276, September 2015.

106. Julien Vincent Mineraud, Federico Lancerin, Sasitharan Balasubramaniam, and Sasu Tarkoma. You are AIRing too much: Assessing the privacy of users in crowdsourcing environmental data. In Proceedings of Trustcom/BigDataSE/ISPA, pages 523–530, 2015.

107. Ionut Mironic, Bogdan Ionescu, Mats Sjöberg, Markus Schedl, and Marcin Skowron. Rfa at mediaeval 2015 affective impact of movies task: A multimodal approach. In Martha Larson, Bogdan Ionescu, Mats Sjöberg, Xavier Anguera, Johann Poignant, Michael Riegler, Maria Eskevich, Claudia Hauff, Richard Sutchliff, Gareth J.F. Jones, Yi-Hsuan Yang, Mohammad Soleymani , and Symeon Papadopoulos, editors, MediaEval 2015 Multimedia Benchmark Workshop, CEUR Workshop Proceedings, 9 2015.

108. Veli Mäkinen and Daniel Valenzuela. Diploid alignments and haplotyping. In Robert Harrison, Yaohang Li, and Ion Mandoiu, editors, Bioinformatics Research and Applications. 11th International Symposium, ISBRA 2015 Norfolk, USA, June 7-10, 2015 Proceedings, Lecture Notes in Computer Science, pages 235–246, 2015.

109. Marcin Nagy, Thanh Bui, Emiliano De Cristofaro, N Asokan, Jörg Ott, and Ahmad-Reza Sadeghi. How far removed are you? Scalable privacy-preserving estimation of social path length with social PaL. In The 8th ACM Conference on Security & Privacy in Wireless and Mobile Networks, June 2015.

110. Paolo Negri, Pedro Omedas, Luca Chech, Patrik Pluchino, Filippo Minelle, Paul F.M.J. Verschure, Giulio Jacucci, Jonathan Freeman, Anna Spagnolli, and Luciano Gamberini. Comparing input sensors in an immersive mixed-reality environment for human-computer symbiosis. In Benjamin Blankertz, Giulio Jacucci,

Luciano Gamberini, Anna Spagnolli, and Jonathan Freeman, editors, Proceedings of the 4th International Workshop, Symbiotic 2015, Lecture Notes in Computer Science, pages 111–125. Springer International Publishing, 2015.

111. Matti Nelimarkka and Arto Vihavainen. Alumni & tenured participants in MOOCs. In Proceedings of Learning@Scale 2016, 2015.

112. Matti Nelimarkka and Arto Vihavainen. Alumni & tenured participants in MOOCs: Analysis of two years of MOOC discussion channel activity. In L@S '15 Proceedings of the Second 2015 ACM Conference on Learning @ Scale, pages 85–93, 3 2015.

113. Quan Nguyen and Teemu Roos. Likelihood-based inference of phylogenetic networks from sequence data by phylodag. In Adrian Horia Dediu, Francisco Hernández Quiroz, Carlos Martín-Vide, and David A. Rosenblueth, editors, In the Proceedings of the Second International Conference, AlCoB 2015, Lecture Notes in Computer Science - Lecture Notes in Bioinformatics, pages 126–140, 2015.

114. Ilya Nikolaevskiy, Andrey Lukyanenko, and Andrei Gurtov. STEM+: Allocating bandwidth fairly to tasks. In Computer Communications Workshop (IEEE INFOCOM'15 (poster abstract)), pages 67–68. IEEE, May 2015.

115. Rui Nóbrega, Diogo Cabral, Giulio Jacucci, and António Coelho. Nari: Natural augmented reality interface - interaction challenges for ar applications. In José Braz , Julien Pettré , and Paul Richard, editors, GRAPP 2015 - International Conference on Computer Graphics Theory and Applications, pages 504– 510, 2015.

116. Zhonghong Ou, Zhen-Huan Hwang, Antti Ylä-Jääski, Feng Chen, and Ren Wang. Is cloud storage ready? a comprehensive study of IP-based storage systems. In 8th IEEE/ACM International Conference on Utility and Cloud Computing (UCC 2015), page 10. IEEE, December 2015.

117. Zhonghong Ou, Wu Jun, and Antti Ylä-Jääski. Big-little-cell based handprint positioning system. In Kuai Xu and Haojin Zhu, editors, Wireless Algorithms, Systems, and Applications 2015, pages 417–426. Springer International Publishing, August 2015.

118. Jay Patel, Gil Gershoni, Sanjay Krishnan, Matti Nelimarkka, Brandie Nonnecke, and Ken Goldberg. A case study in mobile-optimized vs. responsive web application design. In Proceedings of MobileCHI, 2015.

119. Ella Peltonen. Iterative data analysis for sensing applications. In 2015 IEEE International Conference on Pervasive Computing and Communication Workshops (PerCom Workshops), pages 251– 252, 3 2015. Runner-up: Best PhD Forum Presentation Award.

120. Ella Peltonen, Eemil Lagerspetz, Petteri Tapio Nurmi, and Sasu Tarkoma. Energy modeling of system settings: A crowdsourced approach. In 2015 IEEE International Conference on Pervasive Computing and Communications (PerCom), pages 37–45, 3 2015.

121. Renaud-Alexandre Pitaval, Lu Wei, Olav Tirkkonen, and Jukka Corander. On the Exact Volume of Metric Balls in Complex Grassmann Manifolds. IEEE Information Theory Workshop (ITW2015), accepted for publication, 2015.

122. Hernán Ponce de León, Josep Carmona, and Seppe K.L.M vanden Broucke. Incorporating negative information in process discovery. In Jan Recker Hamid Reza Motahari-Nezhad and Matthias Weidlich, editors, 13th International Conference, BPM 2015, pages 126–143. Springer, September 2015.

123. Hernán Ponce de León and Andrey Mokhov. Building bridges between sets of partial orders. In Enrico Formenti Adrian-Horia Dediu and Bianca Truthe Carlos Martín-Vide, editors, Language and Automata Theory and Applications, 9th International Conference LATA 2015, pages 145–160, France, March 2015. Springer International Publishing.

124. Hernán Ponce de León, Olli Saarikivi, Kari Kähkönen, Keijo Heljanko, and Javier Esparza. Unfolding based minimal test suites for testing multithreaded programs. In Roland Meyer Stefan Haar, editor, 15th International Conference on Application of Concurrency to System Design, Brussels, 2015. IEEE.

125. Pawani Porambage, An Braeken, Andrei Gurtov, Mika Ylianttila, and Susanna Spinsante. Secure end-to-end communication for constrained devices in IoT-enabled ambient assisted living systems. 2015.

126. Pawani Porambage, An Braeken, Pardeep Kumar, Andrei Gurtov, and Mika Ylianttila. Efficient key establishment for constrained iot devices with collaborative hip-based approach. In IEEE Globecom, December 2015.

127. Pawani Porambage, An Braeken, Pardeep Kumar, Andrei Gurtov, and Mika Ylianttila. Proxy-based end-to-end key establishment protocol for the internet of things. In Proc. of IEEE ICC, 2015.

128. Pawani Porambage, An Braeken, Corinna Schmitt, Andrei Gurtov, Mika Ylianttila, and Burkhard Stiller. Group key establishment for secure multicasting in IoT-enabled wireless sensor networks. In Local Computer Networks (LCN), 2015 IEEE 40th Conference on, pages 1503–1511. IEEE/Institute of Electrical and Electronics Engineers, October 2015.

129. Dorina Rajanen, Mikko Salminen, and Niklas Ravaja. Psychophysiological responses to digital media: Frontal eeg alpha asymmetry during newspaper reading on a tablet versus print. In Proceedings of Academic MindTrek 2015, pages 155–162, 2015.

130. Jesse Read, Albert Bifet, and Fernando Perez-Cruz. Deep learning in partially-labeled data streams. In 30th ACM Symposium on Applied Computing (SAC 2015), April 2015.

131. Olli-Pekka Rinta-Koski, Jaakko Hollmén, Markus Leskinen, and Sture Andersson. Variation in oxygen saturation measurements in very low birth weight infants. In Fillia Makedon, editor, Proceedings of the 8th ACM International Conference on PErvasive Technologies Related to Assistive Environments, New York, NY, USA, July 2015. ACM.

132. Jussi Rintanen. Discretization of temporal models with application to planning with SMT. In Proceedings of the 29th AAAI Conference on Artificial Intelligence (AAAI-15), pages 3349–3355. AAAI, 2015.

133. Jussi Rintanen. Impact of modeling languages on the theory and practice in planning research. In Blai Bonet and Sven Koenig, editors, Proceedings of the 29th AAAI Conference on Artificial Intelligence (AAAI), pages 4052–4056, Palo Alto, California, January 2015. AAAI Press.

134. Jussi Rintanen. Models of action concurrency in temporal planning. In Proceedings of the Twenty-Fourth International Joint Conference on Artificial Intelligence, pages 1659–1665. AAAI Press, July 2015.

135. Tuukka Ruotsalo and Eero Hyvönen. Exploiting semantic annotations for domain-specific entity search. In Allan Hanbury, Gabriella Kazai, Andreas Rauber, and Norbert Fuhr, editors, Advances in Information Retrieval, pages 358–369. Springer International Publishing, Heidelberg, 2015.

136. Tuukka Ruotsalo, Jaakko Peltonen, Manuel J.A. Eugster, Dorota Glowacka, Aki Reijonen, Giulio Jacucci, Petri Myllymäki, and Samuel Kaski. SciNet: Interactive intent modeling for information discovery. In USA Ricardo Baeza-Yates Yahoo Labs, UK Alistair Moffat University of Melbourne Mounia Lalmas Yahoo Labs, Brazil Australia Berthier Ribeiro-Neto Google, and Brazil UFMG, editors, Proceedings of the 38th International ACM SIGIR Conference on Research and Development in Information Retrieval, pages 1043–1044. ACM, New York, 2015.

137. Joel Rybicki and Jukka Suomela. Exact bounds for distributed graph colouring. In Structural Information and Communication Complexity Volume 9439 of the series Lecture Notes in Computer Science, pages 46–60, July 2015.

138. Paul Saikko, Brandon Malone, and Matti Järvisalo. Maxsat-based cutting planes for learning graphical models. In Laurent Michel, editor, Proceedings of the 12th International Conference on Integration of Artificial Intelligence and Operations Research Techniques in Constraint Programming (CPAIOR 2015), Lecture Notes in Computer Science, pages 347–356. Springer, 2015.

139. Leena Salmela, Kristoffer Sahlin, Veli Mäkinen, and Alexandru I. Tomescu. Gap filling as exact path length problem. In Teresa M. Przytycka, editor, Research in Computational Molecular Biology: 19th Annual International Conference, RECOMB 2015, Warsaw, Poland, April 12-15, 2015, Proceedings, volume 9029 of Lecture Notes in Bioinformatics, pages 281–292, 2015.

140. Markus Schedl, Mats Sjöberg, Ionut Mironica, Bogdan Ionescu, Vu Lam Quang, Yu-Gang Jiang, and Claire-Helene Demarty. Vsd2014: a dataset for violent scenes detection in hollywood movies and web videos. In 2015 13th International Workshop on Content-Based Multimedia Indexing (CBMI), Proceedings (International Workshop on Content-Based Multimedia Indexing), pages 1–6, 6 2015.

141. Mats Sjöberg, Yoann Baveye, Hanli Wang, Vu Lam Quang, Bogdan Ionescu, Emmanuel Dellandréa, Markus Schedl, Claire-Hélène Demarty, and Liming Chen. The mediaeval 2015 affective impact of movies task. In Martha Larson, Bogdan Ionescu, Mats Sjöberg, Xavier Anguera, Johann Poignant, Michael Riegler, Maria Eskevich, Claudia Hauff, Richard Sutchliff, Gareth J.F. Jones, Yi-Hsuan Yang, Mohammad Soleymani, and Symeon Papadopoulos, editors, Proceedings of the MediaEval 2015 Workshop, CEUR Workshop Proceedings, 9 2015.

142. Dag Sonntag, Matti Järvisalo, Jose Pena, and Antti Hyttinen. Learning optimal chain graphs with answer set programming. In Tom Heskes and Marina Meila, editors, Conference on Uncertainty in Artificial Intelligence, pages 822–831, 2015. (UAI 2015).

143. Michiel Spapé, Marco Filetti, Manuel Eugster, Giulio Jacucci, and Niklas Ravaja. Human computer interaction meets psychophysiology: A critical perspective. In B. Blankertz, G. Jacucci, L. Gamberini, A. Spagnolli, and J. Freeman, editors, Symbiotic Interaction, volume 9359 of Lecture Notes in Computer Science, Germany, 2015. Springer.

144. Nikolaj Tatti and Aristides Gionis. Density-friendly graph decomposition. In Proceedings of the 24th International Conference on World Wide Web (WWW 2015), page 1099, 2015.

145. Hande Topa and Antti Honkela. Gaussian process modelling of multiple short time series. In 23rd European Symposium on Artificial Neural Networks, Computational Intelligence and Machine Learning (ESANN), Bruges, Belgium, 22-24 April 2015, Proceedings, pages 83–88, Belgium, April 2015.

146. Viivi Uurtio, Malin Bomberg, Kristian Nybo, Merja Itävaara, and Juho Rousu. Canonical correlation methods for exploring microbe-environment interactions in deep subsurface. In Discovery Science. 18th International Conference, DS 2015, Banff, AB, Canada, October 4-6, 2015. Proceedings, LNCS 9356, pages 299–307. Springer International Publishing, October 2015.

147. Matthijs van Leeuwen and Antti Ukkonen. Same bang, fewer bucks: Efficient discovery of the cost-influence skyline. In 2015 SIAM International Conference on Data Mining, May 2015.

148. Jouni Vepsäläinen, Antonella Di Rienzo, Matti Nelimarkka, Jouni A. Ojala, Petri Savolainen, Kai Kuikkaniemi, Sasu Tarkoma, and Giulio Jacucci. Personal device as a controller for interactive surfaces. In Proceedings of the 2015 International Conference on Interactive Tabletops & Surfaces - ITS '15, pages 201–2014, 2015.

149. Ville Viitaniemi, Mats Sjöberg, Juha Koskela, Satoru Ishikawa, and Jorma Laaksonen. Advances in visual concept detection: Ten years of TRECVID. In Ella Bingham, Samuel Kaski, Jorma Laaksonen, and Jouko Lampinen, editors, Advances in Independent Component Analysis and Learning Machines, pages 249–278. Elsevier Scientific Publ. Co, International, 2015.

150. Liang Wang, Suzan Bayhan, Jörg Ott, Jussi Kangasharju, Arjuna Sathiaseelan, and Jon Crowcroft. Pro-diluvian: Understanding scoped-flooding for content discovery in information-centric networking. In Proceedings of the 2nd International Conference on Information-Centric Networking, ICN15, page 9, 9 2015.

151. Liang Wang, Sotirios Tasoulis, Teemu Roos, and Jussi Kangasharju. Kvasir: Seamless integration of latent semantic analysis-based content provision into web browsing. In Proceedings of the 24th International Conference on World Wide Web (WWW?15 Companion), pages 251–254, 2015.

152. Lu Wei, Renaud-Alexandre Pitaval, Jukka Corander, and Olav Tirkkonen. On the volume of a metric ball in unitary group. IEEE International Symposium on Information Theory, DOI: 10.1109/ISIT.2015.7282443, 2015.

153. Chirayu Wongchokprasitti, Jaakko Peltonen, Tuukka Ruotsalo, Payel Bandyopadhyay, Giulio Jacucci, and Peter Brusilovsky. User model in a box: Cross-system user model transfer for resolving cold start problems. In Francesco Ricci, Kalina Bontcheva, Owen Conlan, and Seamus Lawless, editors, The 23rd Conference on User Modeling, Adaptation and Personalization (UMAP), Dublin, Ireland, June 29-July 3, 2015, Proceedings, volume 9146 of Lecture Notes in Computer Science, pages 289–301, Switzerland, July 2015. Springer International Publishing.

154. Ping Xiao and Simo Matias Linkola. Vismantic: Meaning-making with images. In Hannu Toivonen, Simon Colton, Michael Cook, and Dan Ventura, editors, Sixth Interantional Conference on Computational Creativity (ICCC 2015), pages 158–165, 6 2015. Jufo-ID 72909. (ICCC 2015).

155. Zhirong Yang, Jaakko Peltonen, and Samuel Kaski. Majorization-minimization for manifold embedding. In Guy Lebanon and S.V.N. Vishwanathan, editors, The 18th International Conference on Artificial Intellgence and Statistics (AISTATS'15), pages 1088–1097, USA, May 2015. JMLR W&CP.

156. Yina Ye and Petteri Tapio Nurmi. Gestimator: Shape and stroke similarity based gesture recognition. In Proceedings of the 2015 ACM on International Conference on Multimodal Interaction ICMI ?15, pages 219–226, 11 2015.

157. Ruqi Zhang, Zhirong Yang, and Jukka Corander. Denoising Cluster Analysis. 22nd International Conference on Neural Information Processing (ICONIP2015), accepted for publication, 2015.

158. Kai Zhao. Urban mobility and networking. In Proceedings of the 2015 on MobiSys PhD Forum (PhDForum?15), pages 17–18, 2015.

159. Zhong Zheng, Lu Wei, Roland Speicher, Ralf Müller, Jyri Hämäläinen, and Jukka Corander. On the finite-SNR diversity-multiplexing tradeoff in large Rayleigh product channels. IEEE International Symposium on Information Theory, DOI: 10.1109/ISIT.2015.7282925, 2015.

160. Indre Zliobaite, Michael Mathioudakis, Tuukka Lehtiniemi, Pekka Parviainen, and Tomi Janhunen. Accessibility by public transport predicts residential real estate prices: A case study in Helsinki region. In Ioannis Katakis, Francois Schnitzler, Thomas Liebig, Dimitrios Gunopulos, Katharina Morik, Gennady L. Andrienko, and Shie Mannor, editors, Proceedings of the 2nd International Workshop on Mining Urban Data, pages 65–71. CEUR-WS.org, 2015.

161. Yuan Zou and Teemu Roos. On model selection, bayesian networks, and the Fisher information integral. In Joe Suzuki and Maomi Ueno, editors, Proceedings of the second International Workshop, AMBN 2015, Lecture notes in computer science, pages 122–135, 2015.

D.3. Scientific monographs and edited books

1. Concha Bielza, Joao Gama, Alipio Jorge, and Indre Zliobaite. Special issue of the ECMLPKDD 2015 journal track in Machine Learning Journal. Springer US, USA, 2015.

2. Ella Bingham, Samuel Kaski, Jorma Laaksonen, and Jouko Lampinen. Advances in Independent Component Analysis and Learning Machines. Elsevier, Academic Press, 2015.

3. Benjamin Blankertz, Giulio Jacucci, Luciano Gamberini, Anna Spagnolli, and Jonathan Freeman. Symbiotic Interaction: 4th International Workshop, Symbiotic 2015, Berlin, Germany, October 7-8, 2015, Proceedings. Lecture Notes in Computer Science. Springer International Publishing, 2015.

4. Yi Ding. Collaborative Traffic Offloading for Mobile Systems. Series of publications A. University of Helsinki, Finland, 11 2015.

5. Jaakko Hollmén and Panagiotis Papapetrou. Proceedings of the ECMLPKDD 2015 Doctoral Consortium, Aalto University publication series SCIENCE + TECHNOLOGY. Aalto University School of Science, Espoo, 2015.
6. Costas S. Iliopoulos, Simon J. Puglisi, and Emine Yilmaz. String Processing and Information Retrieval: 22nd International Symposium, SPIRE 2015, London, UK, September 1-4, 2015, Proceedings. Lecture Notes in Computer Science. Springer International Publishing, 2015.
7. Madhusanka Liyanage, Andrei Gurtov, and Mika Ylianttila. Software Defined Mobile Networks (SDMN): Beyond LTE Network Architecture. Wiley & Sons, UK, 2015.
8. Veli Mäkinen, Djamal Belazzougui, Fabio Cunial, and Alexandru Ioan Tomescu. Genome-Scale Algorithm Design: Biological Sequence Analysis in the Era of High-Throughput Sequencing. Cambrigde University Press, United Kingdom, 5 2015.
9. Matti Nelimarkka, Noora Vainio, and Nyyti Kinnunen. Ohjelmointia Scratchin kanssa. Finn Lectura, Helsinki, 2015.
10. Teppo Niinimäki. Approximation strategies for structure learning in Bayesian networks. Series of publications. A. University of Helsinki, Finland, 2015.
11. Jorma Rissanen, Peter Harremoës, Søren Forchhammer, Teemu Roos, and Petri Myllymäki. Proceedings of the Eighth Workshop on Information Theoretic Methods in Science and Engineering. Series of Publications B. University of Helsinki, Department of Computer Science, Finland, 2015. Proceedings of the Eighth Workshop on Information Theoretic Methods in Science and Engineering (WITMSE 2015) held in Copenhagen, Denmark, 24-26 June 2015; published in the series of the Department of Computer Science, University of Helsinki.
12. Hannu Toivonen, Simon Colton, Michael Cook, and Dan Ventura. Proceedings of the Sixth International Conference on Computational Creativity: Park City, UT, USA, June 29-2 July 2 2015. Brigham Young University, 2015.

D.4. Other publications

1. Ayca Cankorur-Cetinkaya, Duygu Dikicioglu, Jana Kludas, Juho Rousu, and Stephen G. Oliver. Optimization of environmental parameters for improving recombinant protein production by the host Komagataella (Pichia) pastoris. In Yeast. Abstracts of the 27th International Conference on Yeast Genetics and Molecular Biology, volume 32, page 148, September 2015. Poster.
2. Suleiman Ali Khan. Bayesian multi-view models for data-driven drug response analysis. Technical Report 105/2015, Aalto University School of Science, Helsinki, 2015.
3. Ziyuan Lin and Jaakko Peltonen. An information retrieval approach to finding dependent subspaces of multiple views. Technical report, ArXiv, USA, 2015.
4. Petri Myllys, Juho Laitinen, Heikki Nikula, and Hannu Toivonen. Live improvisation session with Musicreatures, 2015.
5. Matti Nelimarkka and Pertti Ahonen. Can deliberation be detected computationally?, 2015.
6. Eugenio Omodeo and Alexandru Ioan Tomescu. On representing graphs as membership digraphs - a proof scenario checked by referee, 2015. This proof scenario accompanies the paper: Eugenio G. Omodeo, Alexandru I. Tomescu, Set Graphs. V. On representing graphs as membership digraphs, Journal of Logic and Computation 25(3), 899-919, 2015.
7. Hongyu Su. Multilabel classification through structured output learning - methods and applications. Technical Report 28/2015, Aalto University, School of Science, Espoo, 2015.

8. Jukka Suomela. Local coordination and symmetry breaking. Bulletin of the EATCS, (115):83–110, 2015.
9. Lotta Wennäkoski and Hannu Toivonen. Koodike: A composition by computer and Lotta Wennäkoski, 1 2015.

D.5. Computer programs and algorithms

1. Marco Filetti. JustUsed - Mac Desktop Tracker for DiMe, 2015.
2. Mikko Korpela. sisal: Sequential input selection algorithm, 2015.
3. Petri Lievonen. Presemo v4, 2015.
4. Petri Myllys and Hannu Toivonen. Musicreatures, 2015. An iPhone app for creating music in a simple, game-like environment.
5. Matti Nelimarkka, Arto Vihavainen, and Jesper Hjorth. Codemodules, 2015.
6. Quan Nguyen and Teemu Roos. PhyloDAG, software for likelihood-based inference of phylogenetic networks from sequence data. phylomemetic.wordpress.com/2015/04/17/phylodag, 2015.
7. Andreas Niskanen, Johannes Wallner, and Matti Järvisalo. Pakota: A system for extension enforcement in abstract argumentation based on constraint optimization, 2015.
8. Paul Saikko and Matti Järvisalo. LMHS: A SAT-IP hybrid MaxSAT solver, 2015.
9. Leena Salmela, Kristoffer Sahlin, Veli Mäkinen, and Alexandru I. Tomescu. Gap2Seq, 2015.
10. Karen van Rens, Veli Mäkinen, and Alexandru Ioan Tomescu. SNV-PPILP, 2015. This program accompanies the paper: Karen E. van Rens, Veli Mäkinen, Alexandru I. Tomescu SNV-PPILP: Refined SNV calling for tumor data using perfect phylogenies and ILP Bioinformatics 31(7), 1133-1135, 2015.

D.6. Doctoral dissertations by HIIT researcher

1. Xi Chen. Real-time Action Recognition for RGB-¬D and Motion Capture Data. PhD thesis, Aalto University, School of Science, Espoo, Finland, 2015.
2. Yi DIng. Collaborative Traffic Offloading for Mobile Systems. PhD thesis, University of Helsinki, Department of Computer Science, 2015.
3. Väinö Jääskinen. Bayesian Stochastic Partition Models For Markovian Dependence Structures. PhD thesis, University of Helsinki, Department of Mathematics and Statistics, 2015.
4. Dominik Kempa. Efficient Construction of Fundamental Data Structures in Large-scale Text Indexing. PhD thesis, University of Helsinki, Department of Computer Science, 2015.
5. Jukka Kohonen. Exact Inference Algorithms and Their Optimization in Bayesian Clustering. PhD thesis, University of Helsinki, Department of Mathematics and Statistics, 2015.
6. Joakim Koskela. A Secure Peer-to-Peer Application Framework. PhD thesis, Aalto University, School of Science, Espoo, Finland, 2015.
7. Kari Kähkönen. Automated Systematic Testing Methods for Multithreaded Programs. PhD thesis, Aalto University, School of Science, Espoo, Finland, 2015.
8. Antti Laaksonen. Algorithms for Melody Search and Transcription. PhD thesis, University of Helsinki, Department of Computer Science, 2015.
9. Teppo Niinimäki. Approximation Strategies for Structure Learning in Bayesian Networks. PhD thesis, University of Helsinki, Department of Computer Science, 2015.

10. Elina Numminen. Statistical studies on bacterial transmission and community dynamics : with a special emphasis on the colonization dynamics of Streptococcus pneumoniae during early childhood. PhD thesis, University of Helsinki, Department of Mathematics and Statistics, 2015.
11. Tomi Peltola. Sparse Bayesian Linear Models: Computational Advances and Applications in Epidemiology. PhD thesis, Aalto University, School of Science, Espoo, Finland, 2015.
12. Eeva Raita. The social mediation of everyday user experiences. PhD thesis, University of Helsinki, Department of Social Research, 2015.
13. Hongyu Su. Multilabel Classification through Structured Output Learning - Methods and Applications. PhD thesis, Aalto University, School of Science, Espoo, Finland, 2015.
14. Khan Suleiman. Bayesian multi-view models for data-driven drug response analysis. PhD thesis, Aalto University, School of Science, Espoo, Finland, 2015.
15. Saha Sumanta. Efficient Methods on Reducing Data Redundancy in the Internet. PhD thesis, Aalto University, School of Science, Espoo, Finland, 2015.
16. Xi Chen. Real-time Action Recognition for RGB-¬D and Motion Capture Data. PhD thesis, Aalto University, School of Science, Espoo, Finland, 2015.
17. Jaakko Talonen. Advances in Methods of Anomaly Detection and Visualization of Multivariate Data. PhD thesis, Aalto University, School of Science, Espoo, Finland, 2015.
18. Suvi Uski. Profile work for authenticity : Self-presentation in social network services. PhD thesis, University of Helsinki, Department of Social Research, 2015.
19. Liang Wang. Content, Topology and Cooperation in In-network Caching. PhD thesis, University of Helsinki, Department of Computer Science, 2015.
20. Kai Zhao. Understanding Urban Human Mobility for Network Applications. PhD thesis, University of Helsinki, Department of Computer Science, 2015.

D.7. Licenciate theses by HIIT researcher

Vesa Luukkala. Rule-based Metaprogramming for Smart Spaces. Licenciate of Science thesis, Department of Computer Science, Aalto University, 2015.

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

1. Kimmo Ahokas. Load balancing in LTE core network with OpenStack clouds: Design and implementation. Master's thesis, Department of Computer Science, Aalto University, 2015.
2. Mehreen Ali. Survival Modeling Using Factor Analysis Data Integration. Master's thesis, Department of Computer Science, Aalto University, 2015.
3. Pedro Alonso. A Comparison Between Some Discriminative And Generative Classifiers. Master's thesis, Department of Mathematics and Statistics, University of Helsinki, 2015.
4. Eric Andrews. Empirical analysis of reciprocal recommender systems for online dating. Master's thesis, Department of Computer Science, University of Helsinki, 2015.
5. Evgenia Antonova. Applying Answer Set Programming in Game Level Design. Master's thesis, Department of Computer Science, Aalto University, 2015.

6. Tuikku Anttila. Trukkitöiden reittioptimointi varastossa. Master's thesis, Department of Computer Science, Aalto University, 2015.
7. Namrata Bajpai. Cell Lineage Tracking. Implementation of automated lineage tracking on 4D confocal image data in the MorphoGraphX software. Master's thesis, Department of Computer Science, Aalto University, 2015.
8. Payel Bandyopadhyay. A portfolio theory approach to ease navigation task of users. Master's thesis, Department of Computer Science, University of Helsinki, 2015.
9. Juhani Bergström. Ironisten ilmaisujen automaattinen tuottaminen suomeksi. Master's thesis, Department of Computer Science, University of Helsinki, 2015.
10. Tineka Blake. High-resolution analysis of the human intestinal microbiota stability landscape. Master's thesis, Department of Computer Science, Aalto University, 2015.
11. Eduardo Castellanos Najera. Evaluating mobile edge-computing on base stations: Case study of a sign recognition application. Master's thesis, Department of Computer Science, Aalto University, 2015.
12. Yat Hin Chan. Experimentally-based mathematical modelling to analyze t helper 17 cell differentiation in heterogeneous cell populations. Master's thesis, Department of Mathematics and Statistics, University of Helsinki, 2015.
13. Visakh Chandramohanan Nair Rani. Aligning Machine Learning for the Lambda Architecture. Master's thesis, Department of Computer Science, Aalto University, 2015.
14. Jun Chen. Bayesian Estimation of Multivariate Conditional Correlation GARCH models and Their Application. Master's thesis, Department of Mathematics and Statistics, University of Helsinki, 2015.
15. Patrick Coe. ForcePhone: new prototype with bend sensing and thermal Feedback. Master's thesis, Department of Computer Science, University of Helsinki, 2015.
16. Huining Deng. Implementation and evaluation of a parallel algorithm for structure learning in Bayesian networks. Master's thesis, Department of Computer Science, University of Helsinki, 2015.
17. Behrouz Derakhshan. Maximizing influence in big social networks. Master's thesis, Department of Computer Science, University of Helsinki, 2015.
18. Yogesh Dhungana. Truncated small chaperone HSPB1 in peripheral neuropathy: molecular mechanisms and altered cellular pathways. Master's thesis, Department of Computer Science, Aalto University, 2015.
19. Krister Eklund. Ilmaiset tyypin 1 virtualisointijärjestelmät. Master's thesis, Department of Computer Science, University of Helsinki, 2015.
20. Shiqing Feng. A study on social-based cooperative sensing in cognitive radio networks. Master's thesis, Department of Computer Science, University of Helsinki, 2015.
21. Mauri Flinckman. Flexible Data Synchronization for Supporting Mobile Offloading Applications. Master's thesis, Department of Computer Science, Aalto University, 2015.
22. Lei Hailin. Modeling for Mainland-island Metapopulation of Common Shrews (Sore araneus) in Eastern Finland. Master's thesis, Department of Mathematics and Statistics, University of Helsinki, 2015.
23. Heikki Havukainen. A Distributed Publish/Subscribe Architecture for Telecommunications Network Management. Master's thesis, Department of Computer Science, University of Helsinki, 2015.
24. Peter Hedman. Sequential Monte Carlo Instant Radiosity. Master's thesis, Department of Computer Science, University of Helsinki, 2015.
25. Tomas Heiskanen. Ranking extension for kernelized Bayesian matrix factorization. Master's thesis, Department of Computer Science, Aalto University, 2015.

26. Hendrik Heuer. Semantic and stylistic text analysis and text summary evaluation. Master's thesis, Department of Computer Science, Aalto University, 2015.
27. Sayantan Hore. Designing Interfaces for Exploratory Content Based Image Retrieval Systems. Master's thesis, Department of Computer Science, University of Helsinki, 2015.
28. Ville Hyvönen. Approximate nearest neighbor search using multiple parallel random projection trees. Master's thesis, Department of Mathematics and Statistics, University of Helsinki, 2015.
29. Niklas Jahnsson. Hashing-based delayed duplicate detection as an approach to improve the scalability of optimal. Master's thesis, Department of Computer Science, University of Helsinki, 2015.
30. Laura Koponen. Constraint-Based Optimization of Phylogenetic Supertrees. Master's thesis, Department of Computer Science, Aalto University, 2015.
31. Veera Kotkavuori. The role of Facebook and extraversion in the formation and maintenance of individuals' social capital. Master's thesis, Department of Social Researh, University of Helsinki, 2015.
32. Iitu Kuittinen. Discovery of Mycobacterium tuberculosis gene expression biomarkers for drug therapy response. Master's thesis, Department of Computer Science, Aalto University, 2015.
33. Teemu Kuusisto. Learning and predicting prosodic stress. Master's thesis, Department of Computer Science, University of Helsinki, 2015.
34. Carolina Lindqvist. Benchmarking Hadoop performance on different distributed storage systems. Master's thesis, Department of Computer Science, Aalto University, 2015.
35. Yanhe Liu. An SDN Platform for Traffic Offloading. Master's thesis, Department of Computer Science, University of Helsinki, 2015.
36. Patrik Lod. Superresoluutio. Master's thesis, Department of Mathematics and Statistics, University of Helsinki, 2015.
37. Yao Lu. Understanding image coding in deep convolutional neural network. Master's thesis, Department of Computer Science, University of Helsinki, 2015.
38. Petri Luukkonen. Learning Image Dictionary using Non-negative Matrix Factorization and K-SVD. Master's thesis, Department of Mathematics and Statistics, University of Helsinki, 2015.
39. Mari Marttila. #vainkansanedustajajutut. Tutkielma Suomen kansanedustajien twitter-aktiivisuudesta. Master's thesis, Department of Political and Economic Studies, University of Helsinki, 2015.
40. Alapan Mukherjee. Benchmarking Hadoop performance on different distributed storage systems. Master's thesis, Department of Computer Science, Aalto University, 2015.
41. Morteza Neishaboori. Functional data depth in Monte Carlo tests for spatial marked point processes. Master's thesis, Department of Computer Science, Aalto University, 2015.
42. Quan Nguyen. Likelihood-based Phylogenetic Network Inference by Approximate Structural Expectation Maximization. Master's thesis, Department of Computer Science, University of Helsinki, 2015.
43. Heikki Niiranen. Analyzing the Impact of Software-Defined Video Networking to Broadcast Technology Business. Master's thesis, Department of Computer Science, Aalto University, 2015.
44. Mikko Nikkilä. Application of k-order α-shapes to geospatial data processing and time series analysis. Master's thesis, Department of Mathematics and Statistics, University of Helsinki, 2015.
45. Dennis Noordsij. Evaluation of different machine learning methods for MEG-based brain-function decoder. Master's thesis, Department of Computer Science, University of Helsinki, 2015.
46. Vladimir Orekhov. Improvement of the Contextual Multi-armed Bandit Algorithm for Persuasion Profiling. Master's thesis, Department of Computer Science, Aalto University, 2015.

47. Anne-Marie Paavonen. Uhattu itse: Tulkinnallinen fenomenologinen analyysi sosiaalisen ahdistuneisuuden kokemuksesta. Master's thesis, Department of Social Researh, University of Helsinki, 2015.
48. Preston Palon. Comparison of popular methods for prediction of film Ratings. Master's thesis, Department of Computer Science, University of Helsinki, 2015.
49. Silja Polvi-Huttunen. Matrix Factorization for Learning Metagenomic Pathways and Species. Master's thesis, Department of Mathematics and Statistics, University of Helsinki, 2015.
50. Sailendra Pradhananga. Association studies of exome sequencing data of lung cancer patients undergoing gemcitabine/carboplatin chemotherapy with myelosuppression toxity. Master's thesis, Department of Computer Science, Aalto University, 2015.
51. Gopika Premsankar. Design and Implementation of a Distributed Mobility Management Entity (MME) on OpenStack. Master's thesis, Department of Computer Science, Aalto University, 2015.
52. Taneli Pusa. Marginal Pseudolikelihood in Labelled Graphical Models. Master's thesis, Department of Mathematics and Statistics, University of Helsinki, 2015.
53. Marko Rasa. Instrumentation of OpenMP task scheduling. Master's thesis, Department of Computer Science, Aalto University, 2015.
54. Lari Rasku. Two-point geodesic distance queries in polygonal domains. Master's thesis, Department of Computer Science, University of Helsinki, 2015.
55. Paul Saikko. Re-implementing and extending a hybrid SAT-IP approach to maximum satisfiability. Master's thesis, Department of Computer Science, University of Helsinki, 2015.
56. Joseph Sakaya. Scalable Bayesian induction of word embeddings. Master's thesis, Department of Computer Science, University of Helsinki, 2015.
57. Aravind Sankar. Identification of bacterial strains from sequencing data using probabilistic modelling. Master's thesis, Department of Computer Science, University of Helsinki, 2015.
58. Henri Seijo. Functional data depth in Monte Carlo tests for spatial marked point processes. Master's thesis, Department of Computer Science, Aalto University, 2015.
59. Kuldeep Singh. Survey of NoSqL Database Engines for Big Data. Master's thesis, Department of Computer Science, Aalto University, 2015.
60. Tuomas Sivula. Distributed Bayesian inference using expectation propagation. Master's thesis, Department of Computer Science, Aalto University, 2015.
61. Daniel Soares Vieira. Prediction and modelling of hospital visits: machine learning approach. Master's thesis, Department of Computer Science, Aalto University, 2015.
62. Kaj Sotala. Bayes Academy An Educational Game for Learning Bayesian Networks. Master's thesis, Department of Computer Science, University of Helsinki, 2015.
63. Paul Strahl. Patient appointment scheduling system: with supervised learning prediction. Master's thesis, Department of Computer Science, Aalto University, 2015.
64. Kimmo Suotsalo. Machine learning for Structure Discovery in Vector Autoregressive Processes. Master's thesis, Department of Mathematics and Statistics, University of Helsinki, 2015.
65. Mikael Svenn. Static Web content distribution and request routing in a P2P overlay. Master's thesis, Department of Computer Science, University of Helsinki, 2015.
66. Juhani Toivonen. HIP based mobility for Cloudlets. Master's thesis, Department of Computer Science, University of Helsinki, 2015.

67. Paul Tötterman. Performance and Scalability of a Sensor Data Storage Framework. Master's thesis, Department of Computer Science, Aalto University, 2015.

68. Cagatay Ulusoy. Android Library Design and Implementation for Smart Lock Access Control Systems. Master's thesis, Department of Computer Science, Aalto University, 2015.

69. Weiming Wu. Design and Implementation of a Shared Task Queue Groupware. Master's thesis, Department of Computer Science, Aalto University, 2015.

70. Zhe Xie. From Exploration to Sensemaking: an Interactive Exploratory Search System. Master's thesis, Department of Computer Science, Aalto University, 2015.

71. Jie Xion. Predictive Classification and Bayesian Inference. Master's thesis, Department of Mathematics and Statistics, University of Helsinki, 2015.

72. Rui Xue. SQL Engines for Big Data Analytics: SQL on Hadoop. Master's thesis, Department of Computer Science, Aalto University, 2015.

73. Sezin Yaman. Multi-touch tables in high school science education. Master's thesis, Department of Computer Science, University of Helsinki, 2015.

74. Yine Ye. Gestimator: A Fast, Accurate and Robust Gesture Recognition Method. Master's thesis, Department of Computer Science, University of Helsinki, 2015.