

INFOTECH OULU DOCTORAL PROGRAM

The Infotech Oulu Doctoral Program develops and fosters doctoral education and training in the general area of information technology. It is cross-disciplinary across the faculty borders covering research groups within the Faculties of Information Technology and Electrical Engineering, Medicine, and Biochemistry and Molecular Medicine. The training covers the related main subjects of doctoral training, in particular, communications engineering, computer science and engineering, electrical engineering, and information processing science. The Infotech Oulu Doctoral Program is one of programs of the University of Oulu Graduate School (UniOGS).

Infotech Oulu Doctoral Program consists of the following 16 research groups (the director of the group in parenthesis):

- Biomedical Engineering Group – BME (Professor Tapio Seppänen)
- Biomimetics and Intelligent Systems – BISG (Professor Juha Röning)
- Center for Machine Vision Research – CMV (Professor Matti Pietikäinen)
- Circuits and Systems Group – CAS, (Academy Professor Juha Kostamovaara)
- Communications Signal Processing – CSP (Professor Markku Juntti)
- Electronics Materials, Packaging and Reliability Techniques – EMPART (Professor Heli Jantunen)
- Networking –NET (Professor Savo Glisic)
- New Generation Optoelectronics for Measurement Applications – NEGOMA (Senior Research Fellow Matti Kinnunen)
- Radio Access Technologies – RAT (Professor Matti Latva-aho)
- Community Imaging – COMAG (Professor Vassilis Kostakos)
- Human Interaction with Advanced Mobile Services and Intelligent Environments – INTERACT (Professor Kari Kuutti)
- Interactive Spaces – ISPACES (Professor Jukka Riekk)
- M-Group (Professor Markku Oivo)
- Mobile Services Design for All – MOBI (Professor Petri Pulli)
- Oulu Advanced Research on Software and Information Systems – OASIS (Professor Harri Oinas-Kukkonen)
- Urban Computing and Cultures – UCC (Professor Timo Ojala)

The Infotech Oulu Doctoral Program operates in four main areas. These are electronics, communications engineering, computer science and engineering, and software engineering and information systems.

The *Electronics* section consists of electronic circuit and system design, microelectronics, electronics manu-

facturing technology, physical electronics, electronic and optoelectronic measurement technology, and testing and disturbance techniques of electronics.

Communications engineering covers telecommunication systems from the architectures and implementations of transceiver to telecommunication networks, systems and services. The main research themes include broadband wireless access, short range communications and sensor networks.

The *computer science and engineering* section emphasizes information processing technology and its applications and software engineering. The topics include signal processing, machine vision, machine learning, intelligent systems, the development of software applications and their functionality, human-computer interfaces, ubiquitous environments, computer networks, mobile services, digital media, virtual reality techniques and biomedical engineering.

Software engineering and information systems include software processes, requirements engineering, software and system architectures, software testing, global software development, software and data intensive systems and services, human-computer interaction, participatory design, user-centered design, persuasive systems design, usability, social web, value co-creation, user driven innovation, customer engagement, ubiquitous environments, digital media, health informatics, behavior change support systems, and computer-supported cooperative work.

The Doctoral Program Board

The Infotech Oulu Doctoral Program Board has been appointed for the years 2014–2017 consisting of Professors Timo Rahkonen (Chair), Netta Iivari, Heli Jantunen, Timo Jämsä, Matti Latva-aho, Matti Pietikäinen and Juha Röning, Adjunct Professor Antti Töllä and doctoral student representative Mikko Hintikka. Professor Timo Rahkonen has been selected to the Doctoral Program Director for the same time period.



From left: Timo Rahkonen, Netta Iivari, Mikko Hintikka, Juha Röning, Antti Töllä and Matti Pietikäinen.

Funding

In 2015, the Infotech Oulu Doctoral Program had funding for 34 doctoral student positions from the University of Oulu: twenty positions for 2014 – 2017 and 14 positions for 2014 – 2015. From these positions, 25 were allocated only for research groups selected to Infotech Oulu for 2014 – 2017 (first nine in the list above) and the rest for all 16 research groups involved in the program. These doctoral student posts altogether represented EUR 1 258 000 in salary costs in 2015. The University of Oulu granted 12 doctoral student positions for 2016 – 2019 as continuation to the ending posts.

Additional EUR 80 000 was obtained from the University of Oulu for arranging doctoral courses and for other costs and EUR 20 000 for coordination in 2015. Together with the annual direct financial support of EUR 10 000 from Infotech Oulu, the total budget of the doctoral program was EUR 1 368 000. In addition, Infotech Oulu supported its doctoral program by financing international workshops and researcher visits that include doctoral education. The research groups contribute the doctoral program through the work of the staff.

There are a few changes for funding in 2016. The number of doctoral student positions decreased by two. In addition, the worth of one doctoral student position decreased from EUR 37 000 to EUR 27 000, and there are no financial support from Infotech Oulu for its doctoral program, because we do not have this kind of money anymore. The total budget for 2016 is EUR 984 000.

Students and Doctoral Theses

The supervisors of the doctoral program come from the research groups of the Infotech Oulu Doctoral Program. The students who have a supervisor from these groups, and do not belong to any other doctoral program of UniOGS, are considered as the students of Infotech Oulu Doctoral Program. According to the policy of the University of Oulu Graduate School a doctoral student can belong to only one doctoral program. Based on our last statistics, the doctoral program has about 270 active doctoral students.

The output was 34 doctoral theses. Funding from the Infotech Oulu Doctoral Program positions was used for nine of them: *Hirley Alves*, *Daniel Herrera Castro*, *Jorge Goncalves*, *Eija Halkola*, *Jukka Komulainen*, *Olli-Erkki Kursu*, *Minna Pakanen*, *Juha Partala* and *Matteo Pedone* defended their theses in 2015. All the theses can be found in electronic format on the web from http://www.oulu.fi/infotech/doctoral_program/all_dissertations.

Teaching Activities

Strong research contacts with other universities and research institutes are utilized in arranging lecturers for the courses. Several lectures (the Infotech Oulu Lecture Series) and intensive courses are held annually. These all provide a valuable extension to the other doctoral courses in information technology provided by the university. The extent of the courses below is expressed in ECTS credits.

The Infotech Oulu Lecture Series

To gain two credits, a graduate student must follow 20 hours of lectures and make a written summary of one lecture. The following lectures were held in 2015.

- Dr. Lu Wei, Harvard University, USA - Privacy-preserving principal component analysis: results in progress and results in perspectives
- Professor Tero Päivärinta, Luleå University of Technology, Sweden - Genre theory of organizational communication and its use(s) in information systems analysis
- Professor Arkady Zaslavsky, CSIRO, Australia - Big Data meets Internet of Things
- Professor Dirk T.M. Slock, Eurecom Institut, France - Sum utility optimization in MIMO multi-user multi-cell: centralized and distributed, perfect and partial CSIT, fast and slow CSIT
- Professor Kikuhito Kawasue, University of Miyazaki, Japan - Computer vision and its applications: Circular dynamic stereoscopy & Pipe measurement robot
- Professor Lei Xie, Northwestern Polytechnical University, Xi'an, China - Talking avatars: A deep learning approach
- Associate Professor Ruiping Wang, Chinese Academy of Sciences - Learning on Riemannian Manifold for Video-based Face Recognition
- Distinguished Chief Technologist Sudhir Dixit, Hewlett-Packard Enterprise Services - Challenges and opportunities in M2M/IoT: A business perspective
- Professor Visa Koivunen, Aalto University - Analyzing large scale data: Robust and sparse signal processing
- Dr. Shirish Nagaraj, Nokia, Arlington Heights, IL, USA - Co-operation with constraints
- Professor Emeritus Kurt R. Richter, Technical University Graz (TUG), Austria - Body language and oral presentation skills workshops
- Professor Alister Burr, University of York, UK - Linear Physical Layer Network Coding for multihop wireless networks
- Professor Jan Sykora, Czech Technical University, Prague, Czech Republic - Doubly-greedy stage scheduling algorithm and hierarchical network transfer function for half-duplex WPNC network
- Professor Steven M. LaValle, University of Illinois, USA - From Oulu to Oculus: A real tale about virtual reality

- Dr. Iqbal Hussain, Royal Institute of Technology (KTH), Sweden - Error floor analysis of LT codes over the additive white Gaussian noise channel
- Professor John R Farserotu, CSEM, Switzerland - From body area networks (BAN) to SmartBAN and HealthIoT and beyond
- FiDiPro Professor Xilin Chen, Chinese Academy of Sciences, China - Face recognition from video
- Associate Professor Henk Wymeersch, Chalmers University of Technology, Sweden - Accuracy and delay: a fundamental trade-off in indoor positioning
- Dr. Nalin Jayakody and Dr. Vitaly Skachek, University of Tartu, Estonia - A soft network coded multi-level forwarding scheme for multiple access relay systems & Index coding for broadcast channel with side information

Intensive courses and workshops

- Workshop on Biomedical and Life Sciences Application of Synchrotron Radiation
- 4th Oulu BioImaging (OBI) Day ¹⁾

Electronics

- Dr. Alex Doronin, Yale University, USA - Skin spectra and skin colour calculator: On-line object oriented GPU accelerated Monte Carlo tool
- Dr. Tatiana Novikova, Ecole polytechnique, Palaiseau, France - Mueller polarimetry of structured and random media: cutting edge applications
- Professor Andrea Baschiroto, University of Milano-Bicocca, Milan, Italy - Low-offset CMOS opamp design
- Professor Kirill V. Larin, University of Houston, USA - Structural and functional imaging of tissues and cells with optical coherence tomography
- Assistant Professor Jens Eriksson and Professor Rositsa Yakimova, Linköping University, Sweden - Graphene, from early hype to reality, material growth, current and potential applications
- Dr. Karol Malecha, Wroclaw University of Technology, Poland - Microfluidic devices in low temperature co-fired ceramic, 2 credits
- The 3rd Workshop on Nanoparticles and Health ²⁾, 3 credits
- Dr. Pekka Jakkula, Senfit Ltd. - Microwave measurement systems – theory and applications
- Mika Aikio, VTT - The basics of optical design, 5 credits
- Professor Norihiko Kamata, Saitama University, Japan - Fundamentals of light emission and absorption in solid-state: Interaction between light and matter toward efficient light emitters, 2 credits
- Professor Alexander Priezhev, Moscow State University, Russia - Optical assessment of blood micro-rheology in norm, disease and at interaction with nanoparticles
- Dr. Vladimir Sivakov, Leibniz-Institute of Photonic Technology, Jena, Germany - Silicon nanostructures: novel aspects and application perspectives
- Professor Victor Yu. Timoshenko, Moscow State University, Russia - Optical properties and applica-

tions of semiconductor nanocrystals

Communications engineering

- Assistant Professor Josep Miquel Jornet, University at Buffalo, The State University of New York, USA - Terahertz-band communication networks
- Professor Venugopal V. Veeravalli, University of Illinois, USA - Flexible backhaul design for interference management in cellular networks
- Professor Ilango Balasingham, Oslo University Hospital & Norwegian University of Science and Technology, Norway - Nanoscale communication technologies
- Summer School on Distributed Compression with Applications: Alexander von Humboldt Professor Gerhard Kramer, Technische Universität München (TUM), Germany - Information theoretic foundations of distributed compression ³⁾
- Dr. Nicolas Nisse, Inria Sophia Antipolis, France - Graph theory
- Professor Petar Popovski, Aalborg University, Denmark - Wireless Machine-to-Machine (M2M) communications

Computer science and engineering

- Ninth International Crisis Management Workshop (CriM'15) and Oulu Winter School: Professor Sokratis Katsikas, Gjøvik University College, Norway - Security challenges for cyber-physical systems; Gerald Quirchmayr, University of Vienna, Austria - Legislation - safeguard or driver for increasing risk; Professor Juha Röning, University of Oulu - Software security, vulnerabilities and disclosure; Dr. Lotfi ben Othmane, Fraunhofer Institute for Secure Information Technology (SIT), Darmstadt Germany - Empirical research for secure software development; Professor Steve Furnell, Plymouth University - Controlling privacy: user expectations versus usability; Dr. Moussa Ouedraogo, Luxembourg Institute of Science and Technology, Luxembourg - Building trust and assurance in digital ecosystems; Dr. Svetla Nikova, Katholieke Universiteit Leuven, Belgium - Side-channel attack resisting hardware implementations - threshold implementations; Professor Kaisa Nyberg, Aalto University - Securing cryptography
- Big Data Seminar: Dr. Tuomas Tallinen, University of Jyväskylä - Growing organs in silico - a computational approach to morphogenesis; Professor Liisa Holm, University of Helsinki - Protein similarity search in big databases; Professor Mika Ala-Korpela, University of Oulu and University of Bristol, UK - The role of omics profiling in epidemiology, public health and future medicine; Dr. Matti Pirinen, Institute for Molecular Medicine Finland, FIMM - Stories of our past and future written in our genomes, 0.3 credits ⁴⁾
- Professor Sasu Tarkoma, University of Helsinki - Special course in information technology: Big data processing and applications, 5-8 credits
- (FiDiPro) Professor Shuvra S. Bhattacharyya, Uni-

- versity of Maryland, USA and Tampere University of Technology - Design methodologies for adaptive stream mining systems
- UBISS 2015 - 6th International UBI Summer School 2015, workshops: Dr. Per Ola Kristensson, University of Cambridge, UK - Sensor-based intelligent mobile interfaces; Associate Professor Mark Shepard, the State University of New York, USA - Design fictions for data geographies; Associate Professor Florian Mueller, RMIT University, Australia - Designing games for the body; Professor Timo Ojala, University of Oulu - 3D web and open data for smart cities hackathon ⁵⁾



56 students from 14 countries attended UBISS 2015 (6th International UBI Summer School 2015) held in Oulu on June 8-13, 2015.

Co-operation

The following external organizations have provided co-financing or other support for the courses and workshops:

- Biocenter Oulu, MRC Oulu ¹⁾
- University of Eastern Finland, Kuopio ²⁾
- EU RESCUE Project ³⁾
- Biocenter Oulu Doctoral Programme, Genes & Society Argumenta Project, University of Oulu ⁴⁾
- UBI (UrBan Interactions) research program ⁵⁾

Course Information

Information about the courses is distributed through our web-pages and by email. The web address for the doctoral program is http://www.infotech.oulu.fi/doctoral_program.