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 Riekki)
- 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 has operated in three main areas, corresponding to the major research fields of Infotech Oulu. These are electronics, communications engineering, and computer science and information engineering.

The Electronics section consists of electronic circuit and system design, microelectronics, electronics manufacturing technology, physical electronics, electronic and optoelectronic measurement technology, and testing and disturbance techniques in electronics.

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

Computer science and information engineering emphasizes information processing methods, ubiquitous systems and human-computer interaction. The topics include machine vision, bio-signal analysis, data mining, intelligent robots, software security, mobile computing, urban computing and ubiquitous internet.

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 Tölli 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 Tölli and Matti Pietikäinen.

Funding

The Infotech Oulu Doctoral Program received funding for doctoral student positions from the Ministry of Education and Culture during years 1999-2013. All these positions will cease nationally by the end of 2015. All positions obtained by the Infotech Oulu Doctoral Program ended at the close of 2013, like most of the positions of other doctoral programs where the research groups of Infotech Oulu Doctoral Program were involved. The continuation for the funding of the
doctoral student positions was secured when the doctoral program received 34 doctoral student positions funded by University of Oulu. The program obtained 20 four-year and 14 two-year doctoral student positions starting from the beginning of 2014. From these 34 positions, 25 are 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 1 020 000 in salary costs in 2014.

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. Together with the annual direct financial support of EUR 10 000 from Infotech Oulu, the total budget of the doctoral program was EUR 1 130 000. In addition, Infotech Oulu supports 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. The funding for 2015 is the same except that the worth of one doctoral student position rises from EUR 30 000 to EUR 37 000. The total budget for 2015 is EUR 1 368 000.

**Students and Doctoral Theses**

The supervisors of the doctoral program come from the research groups of the Infotech Oulu Doctoral Program. Based on our statistics in autumn 2014, the doctoral program had 265 active doctoral students having a supervisor from these groups. According to the policy of the University of Oulu Graduate School they cannot belong to any other doctoral program of UniOGS.

The output was 34 doctoral theses. Funding from the Infotech Oulu Doctoral Program positions was used for eight of them: Eero Väyrynen, Rafal Sliz, Eveliina Juntunen, Marja Harjumaa, Hamed Rezaazadegan Tavakoli, Maciej Sobocinski, Huang Xiaohua and Miguel Bordallo Lopez defended their theses in 2014. 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. In each of the three major areas covered by the doctoral program, 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 2014.

- Assistant Professor Luca Sanguinetti, Dipartimento di Ingegneria dell’Informazione, University of Pisa, Italy - Optimal design of energy-efficient multi-user MIMO systems: Is massive MIMO the answer?
- Professor Marcus Foth, Queensland University of Technology, Australia - Digital soapboxes: towards an interaction design agenda for situated civic innovation
- Professor Eric Granger, École de technologie supérieure, Université du Québec, Montreal, Canada - Adaptive systems for face recognition in video surveillance
- Dr. Farid Ghanem, Centre de Development des Technologies Avancees (CDTA), Algeria - Antennas for cognitive radios
- Dr. Tomi Kinnunen, University of Eastern Finland - Speaker recognition – a brief overview and vulnerability under spoofing attacks
- Dr. Gerard Chollet, Emeritus senior researcher, CNRS-LTCI, Telecom-ParisTech and Nokia Visiting Professor at University of Eastern Finland - Audiovisual speech processing
- Dr. Rahim Saeidi, University of Eastern Finland - Quality metrics in calibration of biometric match scores
- Dr. Ville Hautamäki, University of Eastern Finland - Automatic regularization of cross-entropy cost for speaker recognition fusion
- Dr. Stefanos Zafeiriou, Imperial College London, UK - Robust methods for spatial and temporal alignment
- Professor Ahmad Safari, Rutgers, the State University of New Jersey, USA - Advances in pb-free piezoelectric ceramics and transducers
- Professor L’ubomíra Balková, Czech Technical University - Random number generation and combinatorics on words
- Dr. Evgeni Avrutin, University of York, UK and Dr. Boris Ryvkin, Ioffe Institute, Russia - Gain switching lasers with highly asymmetric waveguide designs
- Dr. Xiaobo Zhou, JAIST, Ishikawa, Japan - Multi-dimensional correlation exploited cooperative wireless communications: theoretical analysis and performance evaluation
- Professor Eugene Kovshov, Moscow State Technological University (Stankin), Russia - MIVAR technology as a new generation in Artificial Intelligence
- Allyson Sim, Institute IMDEA Networks, Spain - Adaptive modulation for finite horizon multicasting of erasure-coded data
- Arash Asadi, Institute IMDEA Networks, Spain - Impact of opportunistic scheduling and D2D communications in cellular networks
Intensive courses and workshops
- Multidisciplinary Workshop: Visual/Image Data Analysis in Science 1)
- OBI Network Workshop - Oulu BioImaging day 2)

Electronics
- Dr. Tarmo Ruotsalainen, Ericsson - CMOS full custom IC layout design, 6 credits
- Dr. Artashes Karmenyan, National Yang-Ming University, Taïpei, Taiwan - Some aspects of short pulse laser applications in life sciences
- Professor Zuo-Guang Ye, Simon Fraser University, Burnaby, Canada - Property relations of functional materials, 3 credits
- Professor Andrea Baschirotto, University of Milano-Bicocca, Milan, Italy - Low-voltage CMOS analog design in scaled technology, 6 credits
- Nanoparticles and Health, the 2nd CHEMPACK workshop 3)

Communications engineering
- Dr. Marcello Luiz Rodrigues de Campos, Cidade Universitária, Rio de Janeiro, Brazil - A compressive sensing primer with applications, 3 credits
- Professor Brian Kurkoski, the Japan Advanced Institute of Science and Technology (JAIST), Japan - Lattice coding from theory to practice, Part 1
- Professor Paolo Ienne, EPFL, Lausanne, Switzerland - Advanced computer architectures, 2 credits
- Professor Evsey Morozov, Karelian Research Centre, Russian Academy of Sciences, Russia - Stochastic modeling of communication systems
- WiFiUS Summer School 2014, 3 credits, tutorials by 1) Adjunct Professor Antti Tölli, University of Oulu, 2) Professor Markku Renfors, Tampere University of Technology, 3) Professor Markku Juntti, University of Oulu; Professor Shuva S. Bhattacharyya, University of Maryland, College Park, USA; Professor Joseph R. Cavallaro, Rice University, Houston, TX, USA, Dr. Jani Boutilier, University of Oulu and Professor Mikko Valkama, Tampere University of Technology
- Assistant Professor Lorenzo Mcucci, University of Florence, Italy - Physical layer wireless security, 3 credits
- DELTA Winter School: Platforms, services and applications in localization, Ruka 4)
- Professor David Gesbert, EURECOM - Interference management in cellular networks

Computer science and information engineering
- Eighth International Crisis Management Workshop (CRI*M’14) and Oulu Winter School; Professor Sokrates Katsikas, University of Piraeus, Greece; Greg Soukiassian, IBM, Paris, France; Dr. Francesco Di Cerbo, SAP Research, Germany; Gerald Quierchmayr, University of Vienna, Austria; Juhani Anttila, Kari Jussila and Professor Jarno Limnéll, Aalto University
- Dr. Ross B. Girshick, University of California, Berkeley, USA - Learning architectures for visual object recognition, 4 credits
- UBISS 2014 - 5th International UBI Summer School 2014 5), courses: Professor Martin Brynskov, Aarhus University, Denmark - Designing urban interaction for participatory publics; Professor Steven Feiner, Columbia University, USA – Urban augmented reality; Professor Oskar Juhlin, Stockholm University, Sweden – Learning from people to design future “enjoying machines”; Dr. Florian ‘Floyd’ Mueller, RMIT University, Australia – Designing bodily play, 5 credits

59 students from 16 countries attended UBISS 2014 (5th International UBI Summer School 2014) held in Oulu on June 9-14, 2014.

Co-operation
The following external organizations have provided co-financing or other support for the courses and workshops:
- Biocenter Oulu, Medical Research Center, Eudaimonia – Human Sciences Research Center, Exactus-DP – Doctoral Program in exact sciences, Immuno Diagnostics, Leica Microsystems, Carl Zeiss, Hamamatsu Photonics, Cheos Ltd. 1)
- Biocenter Oulu 2)
- National Doctoral Programme in Nanoscience 3)
- DELTA national doctoral training network 4)
- UrBan Interactions program, Center for Internet Excellence (CIE) 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/doc toral_program.