## FINANCIAL ASSISTANCE

Research assistantships may be available to PhD students through the research grants of individual faculty members. The School of Computer Science also offers merit-based scholarships in the form of tuition waivers to exceptionally qualified incoming PhD students. Assistantships, in particular teaching assistantships, are also frequently available to MSc students.

## INTERNATIONAL COLLABORATION

The School of Computer Science collaborates with many research institutions and universities all over the world giving students the opportunity to go abroad at some point in their studies.

### EXCHANGE PROGRAMMES
At the moment students can choose between more than 35 schools through the ERASMUS student exchange programme and more than 60 schools through the CONAHEC network.

### INTERNSHIPS
MSc and PhD students in Computer Science and Software Engineering can apply for paid internship programmes at The Fraunhofer Center for Experimental Software Engineering at the University of Maryland (US). Students can go several months at a time and apply to get ECTS credits for their work.

### DOUBLE AND JOINT DEGREE PROGRAMMES
The School of Computer Science has two degree programmes allowing students to graduate with degrees from both Reykjavik University and a partner university:

- Two-year (120 ECTS) Double Degree MSc Programme in Computer Science with the University of Camerino (UNICAM), Italy
- Four-year (240 ECTS) Joint Doctoral Programme with the Royal Institute of Technology (KTH), Sweden

"What I liked the most about being a student at the School of Computer Science were the people and the atmosphere there. It is very friendly and open and easy to be involved in many formal and informal discussions where you can learn a lot about your area of research and about other exciting and interesting topics, share your ideas with others and get useful feedback"

*Elena Losievskaja. Graduate of the PhD programme in Computer Science*

To apply and for further information visit: **www.ru.is/cs**

## FACULTY

**Anna Ingólfsdóttir** (Professor, PhD University of Sussex, 1995) is currently the scientific co-director of the ICE-TCS research centre and co-leads the research group in concurrency theory. Her main research interests are in concurrency theory, modal and temporal logics, process algebras, structural operational semantics and logic in computer science.

**Björn Þór Jónsson** (Associate Professor, PhD University of Maryland, College Park, 1999) is currently the Dean of The School of Computer Science at RU. His research interests include multimedia databases and high-dimensional indexing, as well as the impact of new technologies on database performance.

**Hannes Högni Vilhjálmsson** (Associate Professor, PhD MIT Media Lab, Massachusetts Institute of Technology, 2003). His focus is on creating life-like avatars and agents for networked virtual environments in entertainment and education. His research at CADIA bridges human behaviour, artificial intelligence and interactive computer graphics.

**Hrafn Loftsson** (Assistant Professor, PhD University of Sheffield, 2007) is currently a board member of the Icelandic Centre for Language Technology (ICLT) and a member of the RU Curriculum Council. His research area is Natural Language Processing, e.g. part-of-speech tagging, parsing and machine translation.

**Kristinn R. Thórisson** (Associate Professor, PhD from the MIT Media Lab, Massachusetts Institute of Technology, 1996). His research includes holistic artificial intelligence, AI architectures and methodologies, humanoid robots and communicative humanoids, natural communication, virtual and augmented worlds, and agent-based simulation.

**Luca Aceto** (Professor, PhD University of Sussex, 1991) is scientific co-director of the ICE-TCS research centre. His research interests are in concurrency theory, structural operational semantics and logic in computer science.

**Magnús Már Halldórsson** (Professor, PhD Rutgers University, 1991) is currently director of the ICE-TCS research center. His research interests are centered on the analysis of algorithms, with special focus on approximation algorithms on graphs, as well as on wireless and distributed computing and bioinformatics.

**Marjan Sirjani** (Associate Professor, PhD Sharif University of Technology, 2004) is a co-director of ICE-ROSE and her main research interests are investigating and applying formal methods in software engineering. Marjan was the head of the Software Engineering Department at University of Tehran before she joined RU.
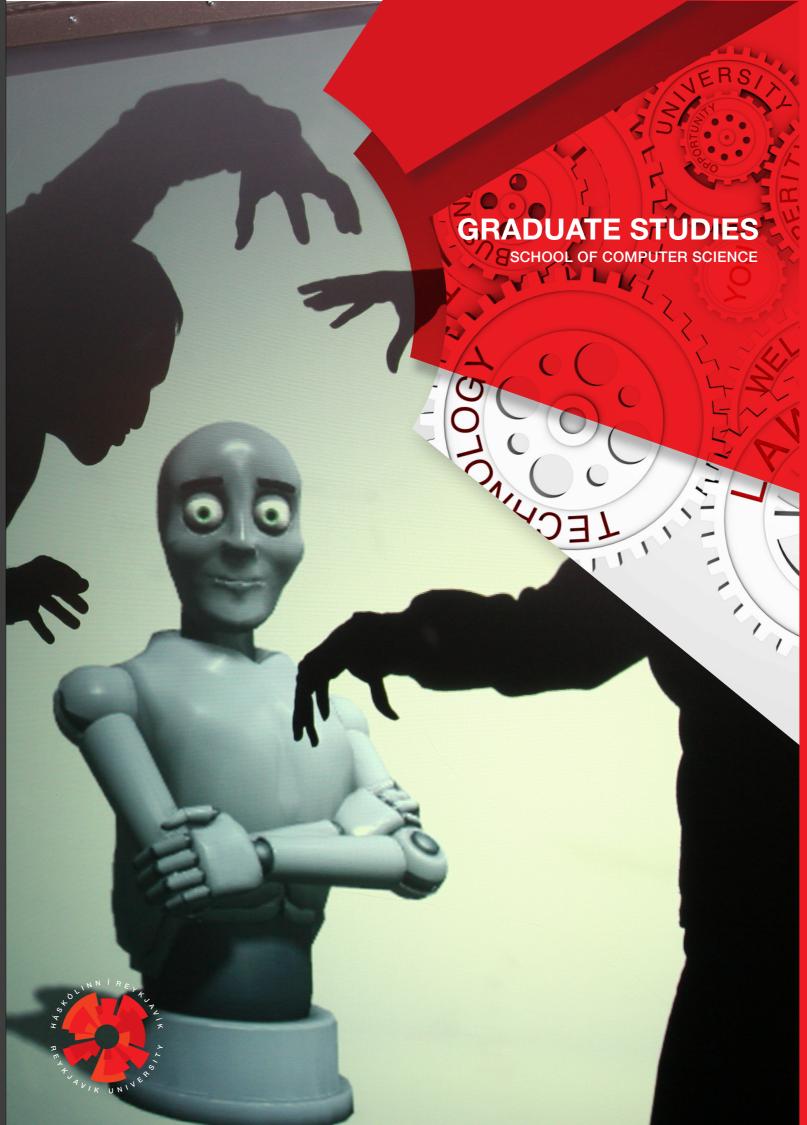
**Marta Kristín Lárusdóttir** (Assistant Professor, PhLic, Uppsala University, 2009) is currently a co-director of the ICE-ROSE research center. Her research area is human computer interaction, user centred software development, user interface design and usability evaluation.

**Yngvi Björnsson** (Associate Professor, PhD University of Alberta, 2002) is the director of the CADIA research center. His research interests are in artificial intelligence, including heuristic search, machine learning, and application of AI to computer games.

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# GRADUATE STUDIES
## SCHOOL OF COMPUTER SCIENCE

## DEAN'S WELCOME

Graduate degrees in Computer Science or Software Engineering are becoming increasingly important in the competitive IT industry around the world. While graduate degrees have always been a requirement for positions in academia, career paths in industry are increasingly calling for such graduate degrees. For management and leadership positions in IT, for example, a graduate degree gives increased mobility and flexibility within the enterprise, and is a better preparation for high-tech industries and start-up companies.

At Reykjavik University we strongly believe that the key to these careers lies in the ability to study complex phenomena, analyse and solve technical problems, and to innovate. We furthermore believe that the path to these skills lies through thorough graduate training.

**CHALLENGING**
Our graduate programmes in Computer Science and Software Engineering are intended to prepare students for the many challenging career paths in industry and academia. Therefore, the programmes are also demanding.

**INNOVATIVE**
Our programmes are innovative in nature. Our faculty puts emphasis on project work and active participation, research methodology and innovation, and courses represent a mixture of classical material and the state-of-the-art in their respective fields.

**PERSONAL**
The relatively small size of the study programmes allows us greater flexibility to work with each student to maximise their learning experience and benefits of attending the school, based on their interests, for example through independent studies and interdisciplinary studies. Furthermore, students are encouraged to visit one of our cooperating institutions abroad for a semester in order to further broaden their horizon.

We wish that every student enjoys his or her studies at Reykjavik University. We work very hard to achieve that goal.

*Björn Þór Jónsson*
*Dean*
*School of Computer Science*
*Reykjavik University*

# MSc PROGRAMMES

The MSc programmes in Computer Science and Software Engineering are two year (120 ECTS) graduate programmes leading to MSc degrees. Typically, students take courses for the first three semesters, while the final semester is dedicated to the MSc project, which may be a group project, and may be done in collaboration with industry. Qualified MSc students that wish to prepare for PhD studies, however, can apply to enter the research-based track, where they spend the first two semesters taking courses, while the remaining two semesters are devoted to an individual research project under the supervision of a faculty member. In the past, such research work has typically led to international publication of the results, which is an invaluable asset when applying for PhD studies.

## MSc IN COMPUTER SCIENCE
The MSc programme in Computer Science is a very flexible programme, which allows each student to tailor the study plan to their needs and ambitions. There are two mandatory courses, Theory of Computation and Research Methodology. The remaining courses can be taken from any area of Computer Science, or even from other disciplines, as long as the course programme is ambitious and carefully assembled to give the student real benefits towards his or her future plans. To this end, each student works with an advisor to create a study plan and monitor the progress in the programme.

## MSc IN SOFTWARE ENGINEERING
The MSc programme in Software Engineering builds on a solid background in Computer Science and traditional Engineering subjects. There are four mandatory courses, Advanced Software Engineering, Modeling and Verification, Theory of Computation, and Research Methodology. The remaining courses can be other Software Engineering or Computer Science topics. For students with sufficient background in traditional engineering subjects, the programme can lead to accreditation in Iceland as an Engineer.

*„What I find the greatest about studying at the School of Computer Science is the motivating atmosphere and how individual-oriented the education is. There is no box. How you study and what you gain from it is completely up to you. Each semester I can select from a number of interesting courses and I've also created my „own" course in the form of an Independent Study. When I carried out my Independent Study I had virtually unlimited access to teachers and other faculty every time I needed assistance. The MSc programme at RU is constantly exceeding my expectations."*

*Steinar Hugi Sigurðarson*
*Second year MSc student*
*in Software Engineering*

### GRADUATE LEVEL COURSES
Graduate course topics range from practical to theoretical. Each course, however, is based on state-of-the-art domain knowledge, and has an emphasis on the practical application of the concepts covered. The following is a subset of the courses given.

- Advanced Sotware Engineering
- Agile Software Development
- Distributed Algorithms
- General Game Playing
- Modeling and Verification
- Natural Language Processing
- Research Methodology
- Semantics: Theory and Applications
- Software Quality Assurance
- Virtual Environments

### UNDERGRADUATE LEVEL COURSES
Students in the MSc programmes can also take a limited number of courses from the undergraduate programme. In addition to traditional electives, a variety of short and intensive courses are given during our three-week semester every year.

- Artificial Intelligence
- Compilers
- Computer Graphics
- Design and Analysis of Algorithms
- Game Engine Architecture
- Human Computer Interaction
- Logic in Computer Science
- Machine Learning
- Software Engineering II
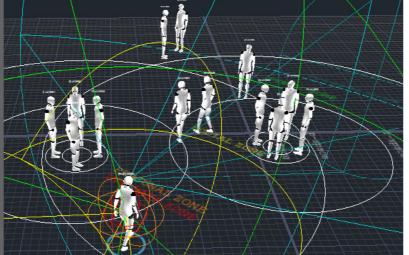- Theory of Computation

# PhD PROGRAMME

The PhD programme in Computer Science is a research based programme for students that wish to lead research and development efforts, work in an academic setting on teaching and research, or lead the high-technology industry of the future. The goal of the study is to give students the training and knowledge needed for leadership in research and development, both in academia and industry. The study programme is therefore very demanding, yet at the same time both rewarding and exciting. The programme is run in collaboration with universities and research institutes abroad, and students are required to spend a part of their study period abroad.

The PhD programme is both flexible and diverse, but is divided into three phases. In the first phase, students must ensure a broad background in Computer Science as a whole, and in their research area in particular. In the next phase, students must prepare and defend a proposal for a research plan, that will create the new knowledge and extend the state-of-the-art in that area. The last phase then consists of following that research plan, and writing and defending the PhD thesis. The programme typically takes 3-4 years to finish.

Throughout this process, the student is supported by a PhD supervisor and a PhD committee. Both the supervisor and the committee members are international experts in the research area, and at least one of the committee members is external to Reykjavík University.

### Some of the advantages of the graduate studies programmes at The School of Computer Science are:

- The programmes are relatively small and there is close interaction between students and faculty
- Students have the flexibility to select courses and topics to suit their ambition and interest
- Courses range from the practical to the theoretical, and teaching is closely knit to the research activity of the department
- Students have the opportunity to work on cutting-edge research, e.g. within one of the many research centres of the department
- Students may spend a semester abroad, at one of many collaborating institutions
- The programmes are international in nature and courses are taught in English

CADIA Populus is a social behaviour engine that brings gatherings of virtual people to life. The project is a collaboration between CADIA and CCP Games and is being funded by the "Humanoid Agents in Social Game Environments" Grant of Excellence from the Icelandic Research Fund.

*„RU offers a creative and inspiring working atmosphere, great support and close contact to the teachers make it a great place for doing research at the high-end of technology. Within my MSc studies our group invented a completely new and blazingly fast database technology for very large multimedia databases, which has received international recognition in academia and in the private sector. As a result, I have chosen to continue this work within the PhD programme at RU"*

*Herwig Lejsek. PhD student at the CS programme RU and co-founder of Videntifier Technologies*

# RESEARCH

The School of Computer Science hosts several research labs in diverse areas. The researchers and students of the labs conduct state-of-the-art research in collaboration with many respected universities and laboratories abroad. All researchers are active participants in the research society at large, and the research projects are funded through various national and international grants.

## THEORETICAL COMPUTER SCIENCE
The Icelandic Centre for Excellence in Theoretical Computer Science (ICE-TCS) deals with fundamental scientific questions on the properties of computing in general. The members of ICE-TCS carry out research in areas such as algorithmic programme verification, algorithmics, bioinformatics, combinatorics, complexity theory, discrete mathematics, machine learning, mathematical logic in computer science, models and logics for reactive systems, semantics of computation and systems biology.

http://icetcs.ru.is

## ARTIFICIAL INTELLIGENCE
The Center for Analysis and Design of Intelligent Agents (CADIA) conducts research in various areas of artificial intelligence, with a strong emphasis on intelligent agents, virtual environments, and real-time performance. Our current research projects include agent-based modeling, heuristic search, machine learning, large-scale modular A.I. systems, virtual humans, visualisation, games, and interactive entertainment. As an example, we are working with the Icelandic gaming industry on several projects relating to building in-game characters that learn and adapt as well as exhibiting believable nonverbal social behavior.

http://cadia.ru.is

## SOFTWARE ENGINEERING
The Icelandic Center for Research on Software Engineering (ICE-ROSE) is a research centre which aims to build high quality software systems. The main research areas at ICE-ROSE include: applying formal methods in Software Engineering, e.g. concurrent systems, component based modeling and analysis, and compositional verification; and software usability, e.g. user centred software development, agile methods and Human Computer Interaction.

http://icerose.ru.is

## LANGUAGE TECHNOLOGY
The Icelandic Centre for Language Technology (ICLT) is a collaboration between the Institute of Linguistics at the University of Iceland, the School of Computer Science at Reykjavík University and the Department of Lexicography at the Árni Magnússon Institute for Icelandic Studies. The members of ICLT carry out research and development in various areas of language technology, such as morphological analysis, part-of-speech tagging, parsing, corpus construction, and machine translation.

http://iclt.is

## DATABASES
The Database Research Laboratory (Datalab) conducts research on various aspects of database management systems, with a strong focus on the performance and scalability of systems. Current research projects include work on media browsing, large-scale high-dimensional indexing for multimedia retrieval and classification, and database performance and benchmarking for new computing architectures, such as solid-state disks.

http://datalab.ru.is/

The goal of the HUMANOBS project is to develop new cognitive principles to allow intelligent machines to learn socio-communicative skills by observing and imitating people. The final system will be demonstrated by having it control a virtual humanoid television showhost, the TV-host will learn increasingly complex interaction skills over time and by the end of the project it should match those of an average human television show host. The project is a collaboration between six institutions in five different countries and is funded by a €2M grant from the European Union's FP7 program.

**HÁSKÓLINN Í REYKJAVÍK**
REYKJAVIK UNIVERSITY

One active project in algorithms research within ICE-TCS is to study fundamental properties of wireless networks. For instance, how much communication can you have simultaneously in general in a wireless network, taking noise and interference into account? Better understanding can lead to more effective protocols (e.g. instead of WiFi, or GPSR), certain to be increasingly important with the growing assortment of wireless gadgets in the world.

The aim of General Game Playing (GGP) is to create intelligent agents that can autonomously learn how to play many different games at an expert level without any human intervention, given only a description of the game rules. This requires that the agents learn diverse game-playing strategies without any game-specific knowledge being provided by their developers. A successful realisation of this task poses interesting research challenges for artificial intelligence sub-disciplines such as knowledge representation, agent-based reasoning, heuristic search, and machine learning. CadiaPlayer, the GGP agent developed under this project has proven its effectiveness by winning the international GGP competition in both 2007 and 2008.

For further information visit: **www.ru.is/cs**