Computer Science and Communication
Biennial Report
2010-2011
# Computer Science and Communication

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7. **Thesis Computer Science and Communication**

Photo: Maria Malmqvist
We can be proud of having leading research in the theoretical areas like computer science and numerical analysis. Furthermore, we are also in the forefront in the more applied research, all concerning different forms of interaction with the surroundings. Our applied research is ranging from robotics, computational biology, media and human computer interaction, to speech and music communication.

You can in this publication read about some of the renowned CSC researchers, all with world-leading research. They have, in a tough international competition, managed to get some of the most prestigious research grants, such as ERC Grants and SSF’s Future Research Leaders.

Cooperation is often a prerequisite for successful research. CSC has partnerships with Stockholm University, with who we are sharing NADA – the department of numerical analysis and computer science, but we also collaborate in a number of strategic projects. Other important partners are the Karolinska Institute, where we cooperate in the Science for Life Laboratory, and a number of industrial players.

The pace of the technological development in the field of computer science and communication is high and CSC will continue to do research and education in the forefront of this development.

Jan Gulliksen, Dean
Focus on Education

Photo: Håkan Lindgren
Focus on Education

The CSC school has been rewarded for our high quality education. A new educational development fund at CSC will give the teachers a possibility to start projects that will improve the education further. Other educational efforts are made in optimizing the graduation of students.

When the Swedish National Agency for Higher Education (HSV) 2009 gave the CSC school the prestigious award for a Distinguished educational environment, the KTH management responded by rewarding CSC with SEK 500 000 per year over six years. The money will be used to further develop the education in different ways, says Olle Bälter, Director of Undergraduate and Masters’ studies at CSC.

“We already have a very good education at CSC. Our programs in Computer science and engineering and Media technology are the most popular in Sweden. But there is always room for improvement, our goal is to be leading in Computer Science and Communication education in Sweden, and Europe.”

The money will be used for two main purposes, he tells. Half of the money will support teachers who want to go on sabbatical. The other half is earmarked for a new educational development fund from which teachers can apply for project funding.

“These are the things we believe will have the best long term effect. Taking a sabbatical year abroad often involves a lot of personal effort regarding living and accommodation, childcare etc, and we want to help out by supporting the journey. With the fund we support teachers who improve the educational development.”

A model used at Uppsala University inspired CSC when forming the educational development fund. The first application round was performed in January 2012.

“The projects should be about ideas that may impact more than just the individual courses, like a whole program or part of the school even. We have appointed a committee that will review and rank the ideas”, says Olle Bälter.
Optimizing the Examination

An important area that CSC has worked hard to improve over the last years is optimizing the graduation of the students. It is a general problem in universities that too many students quit their studies before taking their degree, and CSC is no exception. A contributing factor here is that students from CSC are very attractive on the job market; the fact is that a lot of them already have a job during their study period, and many are offered employment when doing their masters project, states Olle Bälter.

“Yes, in the IT sector the job portfolio, what the students actually have achieved, has higher value than a formal degree. We have worked hard with a “kick-out” project in order to find ways to make the students finish their studies and get their diploma.”

The kick-out project is lead by educational developer, Monica Lundell. She has worked with the CSC administrative support systems to make it easier to find students who have dropped out before taking their degree. Furthermore, she has developed a computer program that facilitates the examination review as well as the identification of students with special needs.

“With this program we have defined how the students can be credited courses, and the process has become more systematic and incredibly faster”, says Olle Bälter.

The future work involves more of student follow-ups, to identify their need of support earlier. Olle Bälter gives an example of actions planned: In the fall 2012, after the first math control exam, all the students that do not pass will be contacted in order to understand why and to offer support.

“Our hope is that this will make them understand that we care about their study situation, and thereby encourage them to ask if something is too difficult,” he says.

Susanne Rosén
Focus on Doctoral Studies

Since February 2011 CSC, as all the other schools at KTH, have Doctoral programs to which the admitted postgraduate students automatically belong. The Doctoral Program Councils are working hard to increase the quality of the postgraduate education and to create arenas for the students to exchange information and ideas.

CSC is responsible for the doctoral programs Computer Science and Mediated Communication, and also shares the programs Computational and Applied Mathematics as well as Physics with the School of Engineering Sciences, SCI.

One of KTH’s incentives to start the graduate programs was to ensure that students along with their supervisors can benefit from common resources and activities. Everyone should feel that they are part of a larger environment, says Erik Fransén, Director of doctoral studies at CSC.

“The doctoral programs are a lot about meeting each other, information exchange, and giving the students a broader view - and also about creating new platforms for collaboration between the divisions.”

It is also an organization for handling the doctoral courses. Each program has a Program Director as well as Program Council consisting of supervisors, postgraduate students and the Program Director. The programs organize a variety of activities, like starting new courses and arranging seminars and workshops.

Quality development is an important question that all programs work with in different ways. Activities supported by the programs all contribute to improve quality by engaging the students and the supervisors.

"We have managed to recruit very good postgraduate students to CSC, which we of course are very happy for. A challenge, and also a positive thing, is that such talented people also have high demands. That means we have to have high quality supervisors and projects so that the students feel that they can make use of their full potential,” says Erik Fransén.

Many of the about 135 postgraduate students at CSC coming from countries outside Sweden. It is a trend over the last years that the students have become more global when searching for a school for their postgraduate studies. This multitude offers a great potential by preparing the students for a career in industry or academia, both are increasingly more international.

As Director of Doctoral studies, an assignment from the KTH Faculty Board, Erik is responsible for the overall quality in the doctoral programs and to ensure that existing regulations are followed. He is also responsible for the individual study plans and the academic review of postgraduate applications as well as thesis and diploma applications.

“The biggest challenge when it comes to doctoral education is that scientific work is a creative process, and learning how to become a researcher means mastering all aspects needed. Continuous development of the supervisors is an important issue in relation to this, the supervisor’s role has changed a lot and my job, amongst others, is to help them see new possibilities,” says Erik Fransén.
Focus on Research

In my role as new Assistant Dean with the overall responsibility of the research at the CSC School, says Professor Danica Kragic, I see the importance of creating an arena for strategic and interdisciplinary discussions with our researchers.

Our monthly Professor’s lunches where we amongst others talk about leadership and funding issues, is one meeting point in this arena. So are the Young Faculty lunches, during which we discuss various topics such as how to write a winning grant application, or share our experience in combining family life with an academic research career.

It’s also important to encourage external communication of the School’s research, like giving popular science lectures and organizing international conferences. We need to think about how we can improve the presentation of our research to the public. But also how we generally take advantage of various opportunities to present the research.

In supporting small visionary projects, the CSC School want to promote interdisciplinary research between the Departments. During 2011 five visionary projects comprising at least 2 senior researchers from at least 2 Departments was granted 300-600 thousand SEK per year.

Finally, I would like to highlight the fact that 130 PhD students are doing their doctoral work at the CSC School. We are responsible for the doctoral programs Computer Science and Mediated Communication, and share the programs Computational and Applied Mathematics as well as Physics with the School of Engineering Sciences, SCI.
New Professors 2010 -2011

Olof Runborg new professor in Numerical Analysis, 2010

Numerical analysis is the science of methods for computer simulation of complex physical processes. The subject is interdisciplinary and includes development and implementation of algorithms for various applications, as well as analysis of how fast, robust and accurate the algorithms are.

Olof Runborg is doing research on numerical methods for partial differential equations, focusing on wave propagation problems at high frequencies, including for instance electromagnetic waves (light, radar, radio), acoustic waves (sound) and elastic waves (seismic waves). He is also working on methods for multi-scale problems where coupled processes with widely different time or spatial scales must be simulated simultaneously. Examples are the coupling of particle and continuum models, as well as differential equations with rapidly varying coefficients. Faster and more accurate numerical methods makes computer simulations an increasingly important tool in many research fields and in industry.

Henrik Artman, new professor in Human Computer Interaction, 2011

Human-Computer Interaction is a subject that studies the human ability to use digital technology, as well as how that technology should be designed to meet human needs.

Artman’s research has management and systems development as key themes. He researched the use of computerized systems in command and control, the management of how to procure usable computer systems and how students embrace the design of interactive systems.

This research has contributed to a better understanding of how people use technology as well as management of technology development projects. The procurement competence within authorities has slowly increased due to the research, which has pinpointed the problem of the organization not being able to translate business into need of technical aids.
Mads Dam new professor in Telecommunications and Informatics

Computers and their software are nowadays fully integrated into the central nervous system of society: payments and finance, energy, industrial control systems, logistics and transport systems, entertainment and communication. Without reliably and securely functioning software vital parts of this infrastructure is put at risk, with potentially catastrophic results.

To prevent this, robust and usable formal models and analysis methods are essential. What makes this difficult is the complexity of today’s computing systems. In face of this, the program analysis community has nonetheless demonstrated that robust answers can in many cases be obtained, even for very large programs. Central techniques are model checking, automated theorem proving, and symbolic techniques, all areas in which KTH has active research.

An example of an important current challenge is to develop the foundations for a fully verified operating system for mobile terminals such as smartphones. This will allow us to produce mobile software stacks with unprecedented guarantees regarding security and robustness. This will be vital to counter the spiralling threats to embedded systems in their various application domains, which we are likely to see in the coming 5-10 years.

Örjan Ekeberg new professor in Computational Biology (Dec 2011)

Johan Hoffman new professor in Numerical Analysis (Nov 2011)

Affiliated and Visiting Professors

Jean Pierre Seifert, Affiliated Professor in Computer Security

Martha Cleveland-Innes, Visiting Professor in Digital Learning

Erwin Laure, Visiting Professor in Computer Science Specifically Applied Parallel and Distributed Computing
New Associate Professors

Jonas Beskow, Speech Communication
Focus on Multimodal Human-Like Systems

Mårten Björkman, Computer Science
– Focus in Database Technology,
and General Computer Science

Cristian Bogdan Associate Professor
in Media Technology,
Lectureship in HCI - Focus on Interaction Design

Johan Boye, Lectureship in Computer Science

Sonja Buchegger, Lectureship in Computer Science

Olov Engwall, Speech Communication

Ylva Fernaeus, Lectureship in HCI
– Focus on Interaction Design

Kristina Groth, Lectureship in HCI
– Focus on Interaction Design

Joakim Gustafson, Speech Communication

Anders Hedman, Lectureship in HCI
– Specialization in Human Sciences.

Hedvig Kjellström, Lectureship
in Computer Science

Supriya Krishnamurthy, Computer Science (SRA)
– Stochastic Modeling and Dynamic Network

Michael Minock, Computer science
– Focus in Database

Technology, and General Computer Science

Gustav Taxén, Human-Computer Interaction
with Technical Focus.

Eva-Lotta Sallnäs, Human-Computer Interaction

Joel Brynielsson, Lectureship in Computer Science

Stefan Hrastinski, Associate Professor
in Media Technology

Jakob Nordström, Lectureship in Computer Science
Liam Bannon
New Honorary Doctor at KTH

Professor Liam Bannon has had a profound impact on the Scandinavian tradition of HCI and Interaction Design. He was awarded the KTH Honorary Doctorate 2011 for his influence on the development of the interdisciplinary Human Computer Interaction (HCI) and Computer Supported Co-operative Work (CSCW) fields.

"It is a great honour, I am extremely humbled and flattered", says Liam Bannon.

The motivation for the KTH Honorary Doctorate award is Liam Bannon’s profound influence on the development of the Human Computer Interaction (HCI) discipline and on Computer Supported Co-operative Work (CSCW)

“Essentially, the issues that concern me have not changed over the years. As an undergraduate student I studied psychology and computing, and that has really shaped the rest of my life. Psychology is about understanding the human and computing gave me the understanding of technology. The questions I have been interested in are about the relation between these.”

Liam Bannon has a long academic career in the field of human-computer interaction, working several years in Canada and the US, as well as holding positions at several Universities in Europe. In 1993 he returned to his home country Ireland and started the Interaction Design Centre at the University of Limerick. He directed the centre until his early retirement from this position at the end of 2009.

Still very active in the field of HCI, he now holds a position as Adjunct Professor in the Department of Computer Science and Information Systems at the University of Limerick. He is also Honorary Professor in Human-Computer Interaction at Aarhus University, Denmark, has spent time as Visiting Professor in Sassari, Italy and Troyes, France, and also works as an Independent Consultant.

The issue of how to design better computer systems, and the area of human-computer interface design, started to emerge in the early 80’s.
Ever since, as the field has evolved, Liam Bannon has been part of that story.

His relationship with KTH and the people at CSC School goes back some time, to the late 80’s when he first met Yngve Sundblad, the former head of Nada, and learned about his work on participatory involvement. He later collaborated with the people at Nada in several EU projects. Together with CSC Dean Jan Gulliksen, Liam Bannon has also worked on EU projects developing the field of HCI in India and in China.

Over the years Liam Bannon has inspired and influenced many PhD and graduate students at KTH through his insightful discussions and inspiring talks, and he wants to continue to do so on a regular basis as Honorary Doctor.

“Yes, it is inspiring in many ways to visit. Normally when I come to KTH for a day or two, I meet most of the graduate students either in a group or individually, and try to give them advice on their work.”

He has been on the scientific advisory board for the former Graduate School of Human Machine Interaction, and has acted as doctoral dissertation opponent at KTH.

Liam has been called “the leading advocate for the Scandinavian tradition of user-centred design outside Scandinavia.” And he has influenced the move “From Human Factors to Human Actors” in Participatory Design, advocating a change away from treating users as passive subjects towards an approach that sees users as active and collaborative partners in driving HCI design.

“I found the underlying philosophy of user involvement interesting. I had been brought up with this artificial intelligence model, trying to make computers substitute for human intelligence. But I became disillusioned, since it left out a lot of things of what it means to be a human and the fact that we have a body. I was searching for another way of exploring the technology’s capabilities. So, rather than trying to build expert systems, we wanted to build systems that support people’s expertise.”

On a practical level he also did work in what is called Human Factors, “dealing with fitting machines to people, or you could say on occasion, the reverse, fitting people to machines!”. What he found though, was that even in the Human Factors field, that is supposedly dealing with the human qualities, it often seemed to be an assumption that the humans were the problem; making mistakes, having bad memory etc., and that we had to build systems that were protected from misuse by people.

“That didn’t seem to reflect to me what people are really like. We are also adaptable, flexible, able to break rules on occasion, judge the relevance of something, etc. And I was arguing that we should start to pay more attention to the human actor in the field of HCI.”

“My interest is, having been influenced by Participatory Design and focusing on human capabilities - skills and expertise, that rather than talking about substitution and automation all the time, instead we should at times talk about augmentation, and adding to human capabilities and skills with technology. That is a different design position and opens up new lines of research.”

A lot is happening in the field of HCI right now, where the technology is changing, and it opens up new spaces that are interesting to explore. But Liam Bannon is not all positive:

“Well, I have been quite concerned over the last years by the direction of EU research. While they do have some programs dealing with people and technology, they are, in general, too technology-focused. And they do not seem to be grounded in the practical world.”

“I have raised some criticism of the model of Ambient Intelligence, and there is also a line of research on ‘robot companions’ more recently. What is missing in a lot of that work is a nuanced understanding of the world of the people that you are supposed to be helping. It seems that EU has taken a very narrow technical viewpoint. So, I am trying, along with some colleagues, to see if we can change or open up their approach to other viewpoints.”

Susanne Rosén
Sources Of Income

2008

- NA  6 901  10,2%
- CVAP  14 734  21,8%

2008 Costs

- Depreciation Equipment -9468  3,6 %
- Other operating costs -24403  9,1 %

External Financing

2008 tot 145357 kSEK

- Staff - 158470 kSEK 59,0  

Costs

2008 tot 268451 kSEK

- Staff - 158470 kSEK 59,0  

External Research Financing

by Department.

2008 tot 73072 kSEK

- Media  5974  8,2%
- TCS
- CVAP
- NA
- PDC research 6113  9,1%

External Financing

2008 tot 91415 kSEK

- Staff - 158470 kSEK 59,0  

External Research Financing

by Department.

2008 tot 86023 kSEK

- Media  5974  8,2%
- TCS
- CVAP
- NA
- PDC research 6113  9,1%

External Financing

2008 tot 91415 kSEK

- Staff - 158470 kSEK 59,0  

Ex. Research Financing by Dept

TCS  13065 kSEK
CVAP  20745 kSEK
CB  15191 kSEK
NA  10011 MSEK
PDC research           *

Costs

2008 tot 356453 kSEK

- Staff - 173903 kSEK 59,0  

Costs

2008 tot 268451 kSEK

- Staff - 158470 kSEK 59,0  

Sources Of Income

2011

- Government Grants for Undergraduate Education 102540 kSEK
- Government Grants for Research and Postgraduate Studies 98399 kSEK
- External Financing 145357 kSEK
- Other 16515 kSEK

External Financing

2011 tot 145357 kSEK

- Swedish Research Councils 67341 kSEK
- EU 30572 kSEK
- Other Swedish Universities 54316 kSEK
- Strategic Foundations 19545 kSEK
- Other Government Agencies 10583 kSEK
- Other 11880 kSEK

External Research Financing

by Department.

2011 tot 86023 kSEK

- Media  7613 kSEK
- TCS
- CVAP
- NA
- PDC research 13328 kSEK

External Financing

2011 tot 145357 kSEK

- Swedish Research Councils 67341 kSEK
- EU 30572 kSEK
- Other Swedish Universities 54316 kSEK
- Strategic Foundations 19545 kSEK
- Other Government Agencies 10583 kSEK
- Other 11880 kSEK

Ex. Research Financing by Dept

TCS  13065 kSEK
CVAP  20745 kSEK
CB  15191 kSEK
NA  10011 MSEK
PDC research           *

Costs

2011 tot 356453 kSEK

- Staff - 173903 kSEK 59,0  

Costs

2011 tot 268451 kSEK

- Staff - 158470 kSEK 59,0  

* In addition to this PDC has had external funding amounting to 53 MSEK and other centers to 3 MSEK.
Computer Science
A Secure Social Network

Sonja Buchegger is studying ways to improve the user’s privacy and regain control of our own personal data in social networks like Facebook and Twitter.

Today it is almost impossible to protect your personal information from the owners of social networks such as Facebook, states Sonja Buchegger, Associate Professor at the Department Theoretical Computer Science.

“We want to get away from the central data collection in these networks, and instead have it distributed. My research is aimed at developing a secure social network with peer-to-peer technology (p2p) and encryption to protect user data and information about the users”.

In the beginning of 2011 Sonja was chosen to be a future research leader by the Swedish Foundation for Strategic Research, SSF, and awarded a SEK 10 million grant over 5 years. Before that, in 2010, Sonja got a SEK 3.2 million grant over 4 years, following a research fellow grant from the Swedish Research Council at the end of 2009.

“The grants are for different parts of the project PeerSoN, which is about giving control of the data back to the user, in particular user privacy. The different parts concern security/privacy and networking/distributed systems aspects. The research is also a part of the KTH ACCESS Centre.”

PeerSoN is has had collaboration between researchers in five countries: KTH, NTU in Singapore, Deutsche Telekom Laboratories in Germany, Warsaw University and EPFL in Lausanne, Switzerland.

Sonja is originally from Austria, but with a PhD from EPFL in Lausanne, and postdoc studies in Berkeley, California. Before she came to KTH in 2010 she worked as a research scientist at Deutsche Telekom Laboratories in Berlin.

She favours a holistic approach to research and takes a multi-disciplinary perspective in order to come to terms with the privacy problem. Her extensive background in
The Department of Theoretical Computer Science

The mission of the Theory group is to carry the culture of theoretical computer science, and to develop and disseminate new, interesting and useful theory and applications of theory in computer science.

www.csc.kth.se/tcs

Experimental Math Lecture Provoked and Inspired

Assisted by the theatre company Teater Giljotin, Dilian Gurov performed one of his lectures in the course Logic for Computer Science at the old KTH reactor hall.

The aim with this experiment lecture, which took place on 29 September 2010, was both to challenge other teachers to think in other directions, and to let students experience abstract concepts in addition to rational assimilation.

"Today there is a notion that art and science have nothing to do with each other. And also that emotions play no role in education and science. But emotions do play a major role, perhaps not directly in the learning process, but for the experience and to remember," says Dilian Gurov who is Associate Professor at the Department of Theoretical Computer Science at CSC.

Teachers who make an effort and spend extra time on emotions and the aesthetics during a lesson, also get the audience to experience and remember the material better, says Dilian Gurov. And if the lecture is an experience, it will also stimulate further learning, he believes.

“If we in five years from now ask the students about the lecture that they remember best, one of them will probably be the logic lecture at the KTH reactor hall,” says Dilian Gurov.
Teaching Robots to Perceive

Professor Danica Kragic, head of the Computer Vision and Active Perception Lab (CVAP) and Centre for Autonomous Systems, is a huge fan of robots. In her research she teaches the robots to see and grip things, as well as to interact with each other and the surroundings.

In the manufacturing industry robots have been around for a long time, and ABB as a manufacturer has put Sweden on the map.

“Now robotics is more and more becoming a part of our everyday lives and can be found in everything from self-driven mowers to navigation systems in our cars,” says Danica Kragic, Professor of Computer Science.

As Head of the Computer Vision and Active Perception Lab (CVAP), as well as the Director of the Centre for Autonomous Systems (CAS), she spends her days among robots and robot nerds.

Danica's research focuses in particular on the development of robots' ability to see and grasp things, but she also studies the human behavior. Because, if robots should go from being pre-programmed and remote controlled to being able to cook and interact with us humans, well then we need to teach them how.

However, mimicking the way people process information from sight, hearing and other senses, is not easy. But with sensors and computers that sense and process the contents of the digital images it is possible to get a long way.

“With the help of video sequences of human hand movements, we can calculate which fingers are important when interacting with various objects. For example, holding a pencil or a glass involves different fingers,” says Danica.

This can be useful in the development of prosthetic and robotic hands she explains, and shows a state-of-the-art prosthesis model – a hand with five fingers looking very much as a human hand but with very limited movement capabilities. It is made by one of the leading prosthetics companies, German/Austrian Otto-Bock,
who Danica collaborates with and where one of her six graduate students is working.

- For Otto-Bock it is interesting to know about the latest research when designing the next prosthesis model.

Danica’s work has been rewarded with several international prizes. In 2007 she received the IEEE Robotics and Automation Society Early Academic Career Award, which is presented to one researcher in the world once a year. In 2008 she was designated a Future Research Leader by SSF - the Foundation for Strategic Research, and 2011 she was selected as one of the first 22 members of Sweden's newly established Young Academy of Sweden.

The research project on robotic hands is called FLEXBOT, Flexible object manipulation based on statistical learning and topological representations.

"Scientifically, we push for new way of thinking in an area that has traditionally been born from mechanics an modelling of bodies but not seeking for optimal design. Technologically, we will provide methods plausible for evaluation of new designs of robotic and prosthetic hands."

For this project Danica Kragic in spring 2011 was rewarded one of the finest grants a young researcher can get to build up their research group; the ERC Starting Grant of 13.5 million SEK over five years.

Around 40 people work at CVAP. The research is largely funded by the Foundation for Strategic Research and the Swedish Research Council. A relatively young group, both academically and in terms of age.

In her role as a leader and supervisor, Danica sees herself as a guide.

- Yes, I try to work on my students’ self-confidence and make sure that they always have the supervision they need. And they all need different types of tutoring. I think it is important for all successful leaders and supervisors to be able to be a different person. You have to listen and respect different ways of doing the work, and not try to force people to work according to the structure that I want.

During spring 2011 two of her graduate students worked at the U.S. company Willow Garage, which develops both hardware and software for robot applications. Swedish Tobii Technology, a world leader in eye tracking technology - is an example of companies that have hired a post-doc that graduated from her department.

- Close relationship between the academy and the industry is beneficial for both parties. My ambition is that several of our graduate students will chose to do their post doc in the industry when they are finished with their degrees.

Susanne Rosén

CVAP – Computational Vision and Active Perception Laboratory

CVAP performs research in computer vision and robotics, developing basic and applied methods for understanding information in images and image streams. Vision is one of the most important sensory modalities used for robot interaction with the environment.

www.kth.se/csc/forskning/cvap

CAS – Centre for Autonomous Systems

CAS is an interdisciplinary center composed of three research groups from Electrical Engineering, Applied Mathematics, and Computer Science. The centre performs research in (semi-) autonomous systems including mobile robot systems for manufacturing and domestic application.

www.cas.kth.se
He first began studying the mind and memory when he came to KTH in the 80's and then became deeply engaged in modelling of locomotor systems with neuroscientists at Karolinska Institute for twenty years.

"Yes, and we have returned to this area [mind and memory] of research over the past 5-6 years. Now we have much more detailed models and more biological data, and can also mimic the oscillations in the cerebral cortex at different states", says Anders Lansner.

The research in his group focus on using network-level dynamics to find out which properties of neurons and synapses really matter to specific cognitive functions like the macroscopic phenomenon of memory, for instance the recall from memory. Their work is amongst others performed in collaboration with neurophysiologists at the Karolinska Institute’s Department of Neuroscience and within the Stockholm Brain Institute (SBI) where Anders Lansner is director of the Computational and Modelling platform.

One current aim of the research is to understand what mechanisms at the neural level are associated with particular diseases. Future practical applications of research findings are better understanding of cortex-localized diseases like Alzheimer’s and schizophrenia as a basis for developing more efficient therapy including drugs. But with increased knowledge of how the brain works, researchers can also touch on issues adjacent to the ones philosophers are engaged in; who am I, what is consciousness and how does our thought processes work?

"Exactly, and these are questions we begin to get closer to having answers to. We can see if a human test subject discovers a partially hidden stimulus since then they show certain type of oscillations in the cerebral cortex. And these oscillations we can model, and thereby see exactly what caused it."

The work is done within several European collaborative projects, including the projects FACETS and BrainScaleS, as well as with funding from SSF, VR and Vinnova via SBI. The European projects encompass everything from cortex neuroscientists right through to

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Professor Anders Lansner and His Research Group are Trying to Solve the Mystery of Human Memory

Computational Biology is an area in which mathematical techniques, and in particular computer simulation techniques, are used to address complex biological problems. In close collaboration with biologists and neurophysiologists Professor Anders Lansner and his research group are trying to solve the mystery of human memory.

Mathematics and computer models have long been used in physics and chemistry, but have now also made its way into biological research. This is a new scientific trend and the eight research groups at the Department of Computational Biology (CB) are very much a part of that process.

Professor Anders Lansner leads the research group Lansner’s lab Computational Neuroscience and Neurocomputing at CB.

"There is clearly a paradigm shift in biology where the quantitative aspect is becoming more and more pronounced. Computer science and applied mathematics will be immensely important in biological research in the future. We see only the beginning,” he says.

The theme of the research in his group is to simulate memory and perception in the cerebral cortex and other parts of the brain of mammals. A prerequisite for the success of the simulations is the availability of powerful computers, and the new supercomputer at PDC was well wished-for. With a supercomputer like that it is possible to simulate hundreds of millions of neurons and many billions of synapses, approaching the cortex size of a small mammal.

"We work with large-scale simulations and have always thought that the computers were too weak. Nowadays we don’t feel that anymore, it's very nice because then we can let our imagination materialize much more,” says Anders Lansner.
designers of neuromorphic hardware. In between the computational neuroscientists do supercomputer brain modelling. “The idea is to integrate all of these competencies so as to build a very high-capacity simulator in hardware to replicate biological neural systems”, tells Anders Lansner.

He adds: "The EU funding has been very important in recent years for the research on brain functions like memory and perception. Furthermore, this research is linked to the development of future computing and hardware. As an example, the Human Brain Project, a proposal for a “blue-sky” moon landing project funded by the Future Emerging Technologies within EU and in which also IBM and Cray are included, aims at in 10 years being able to simulate the human brain all-out on the next-next generation of supercomputers.”

Susanne Rosén

The Department of Computational Biology

The Department of Computational Biology (CB) does research on mathematical modelling and numerical simulation of biological systems and on developing algorithms and software for simulating biological functions and analysing biological data. CB researchers have a bridging competence in biology – computer science and are actively involved in joint projects with experimental biologists.

The department consists of eight teams, five of which are working on the modelling of nervous system related processes and algorithms, the other three doing research in bioinformatics/genomics and biological physics. www.csc.kth.se/forskning/cb/
Mapping the Genome of Sweden’s Most Important Plant

Together with colleagues at UPSC and SciLifeLab, Lars Arvestad and PhD student Kristoffer Sahlin participates in a large interdisciplinary project mapping the genome of Norway spruce; Sweden’s most important plant.

In the spring of 2011 two of CB’s research teams, Jens Lagergren’s Lab and Lars Arvestad’s Lab, working in Computational Biology and Bioinformatics, moved to Science for Life Lab’s (SciLifeLab) premises at Karolinska Institute Science Park in Solna. The reason for the move was that they work a lot with the other groups within SciLifeLab, explains Associate Professor Lars Arvestad.

“I find it very stimulating and interesting to be part of this interdisciplinary environment. It is also convenient from a practical perspective, since it in our field is important to be close to the data,” he says.

Lars Arvestad’s group focuses on computational problems in evolution and genomics. In their work, they collaborate with Joakim Lundeberg, Professor at KTH Biotechnology and manager of the genomics platform at SciLifeLab. He is also one of the key researchers in a large project aiming to unravel the genome of Sweden's most important plant; Norway spruce.

This five-year spruce project started in 2010, it is coordinated by Umeå Plant Science Center (UPSC) and includes scientists at SciLifeLab as well as Canadian, Italian and Belgian scientists. A SEK 75 million grant from the Knut and Alice Wallenberg Foundation, plus matching funding from the participating universities finance it.

The Swedish researchers are in for a real challenge, being first in the world to deal with the largest amount of genetic material ever sequenced in a plant or animal species. Thanks to the fast development of new DNA sequencing technologies this large project is now possible to realize.
“It is not an easy task, since a cell of spruce has seven times as much DNA as a cell of a human. Just to handle the vast amounts of data has proven to be a practical problem. Many computer programs earlier used in order to assemble the genomes of large animals, simple bacteria and plants with smaller genomes do not work for spruce, “ tells Lars Arvestad.

One of the questions the project want to answer is why conifers have so much DNA. Is this the reason for their successful life on earth during millions of years?

"What makes it tricky to piece together the spruce genome is that it has a lot of repetition," says Lars Arvestad.

He supervises graduate student Kristoffer Sahlin, who has developed a new method to link up major pieces of DNA, "contigs", which are believed to represent pieces of spruce genome but where there is limited, or sometimes conflicting, information about how they are linked together; the order in which they come and how far apart they sit.

Normally in a genome assembly process, relatively short reads (pieces) of DNA are first identified, then using calculations and other knowledge the researchers can piece together how the genome should look like.

"Kristoffer is working with so-called scaffolding, a process that links together the small pieces of DNA to larger pieces in the best way,” says Lars Arvestad. “His solution is scalable, which is important for such a large genome as the spruce and it can also estimate the distance between contigs better than previous methods.”

Susanne Rosén

SciLifeLab is a collaboration between four universities in Stockholm and Uppsala: Stockholm University, the Karolinska Institute, KTH and Uppsala University. The centre combines advanced technical know-how and state-of-the-art equipment with a broad knowledge in translational medicine and molecular bioscience.
Investigating the Behavior of Fiber Suspensions in the Pulp Industry

The Department of Numerical Analysis is an active partner in The Swedish e-Science Research Center. In one of the projects the behavior of fiber suspensions in the pulp industry is investigated.

Since 2010 the Department of Numerical Analysis (NA), along with several other groups at CSC and KTH working in computational science and engineering, is a part of The Swedish e-Science Research Center (SeRC). It all started with The Swedish Research Council (VR) call for funding of the Government’s selected strategic research areas (SRA) two years ago, tells Professor Olof Runborg at NA.

"When the call came in 2009 we all sat down and wrote up an extensive application along with other groups that we know at KTH, Linköping University, Stockholm University and the Karolinska Institute," says Olof Runborg.

The application was granted, starting 2010, and from 2012 the full SRA funding of SEK 30 million per year is available and will be spent on novel e-Science research. Today SeRC includes about 140 researchers, including PhD-students. KTH is the leading partner and the centre is headed by Dan Henningson, Professor of fluid mechanics at the School of Engineering Sciences at KTH.

The work within SeRC is focused on the collaboration between toolmakers and tool users, and thus brings together a core of nationally leading IT research teams with expertise in e-Science method development and leading scientists in selected application areas. SeRC also includes as partners the two largest high-performance computing centers in Sweden: PDC at KTH and NSC at Linköping University.

A key feature of the research within SeRC is the formation of 10 e-Science communities, which connect application-oriented groups with relevant core e-Science groups as well as computer experts at PDC and NSC.
Olof Runborg is part of the SeRC steering group and coordinating the community working on numerical analysis. His main task is to initiate and manage the SeRC e-Science projects in this area.

A total of about 40 projects have been defined within SeRC and 13 new faculty members have been hired during the first two years.

“Things have really started to fall into place. Several doctoral student projects have been started and we have also employed lecturers and assistant lecturers in these various communities,” says Olof Runborg.

Development of numerical algorithms is critical in successful e-Science based research, often matching or outperforming improvements of hardware in terms of speed gains. In the numerical analysis community focus is on algorithm development and analysis for multiscale, multiphysics and stochastic problems related to application fields like complex and multiphase flow, high frequency wave propagation and molecular dynamics.

Olof Runborg together with Associate Professor Anna-Karin Tornberg, head of NA, and the PhD student Doghonay Arjmand runs a project about multiscale methods in fluid mechanics.

The application, explains Olof Runborg, is a particular problem within a larger class of problems in numerical analysis that are difficult to solve; “it applies to cases where you need to solve very small details, although you are not interested in those details, instead you are looking for the solution on the large scale”.

“But we still have to solve the small-scale details to see how they affect the large-scale behavior. However, there are theories that only samples of the details need to be solved and still get the right large scale behavior,” he says.

These new theories are developed and tested in the SeRC project on complex fluids in the pulp industry. But knowledge of suspensions and emulsions is important also in many other areas, says Anna-Karin Tornberg, for example in the food industry.

“A suspension is a liquid that has something in it, for example fibers in the pulp. If you want to know how the suspension behaves on a large scale you need to know how all these little fibers will affect the behavior, and that is what we want to look at in this project.”

Anna-Karin Tornberg states that the core of the NA activity is the application driven method development.

“There are many groups that do numerical calculations, but what makes us special is our focus on the methods. We develop numerical methods driven by one application, but aim to use this knowledge also in other application areas.”

In the last year NA’s activity in SeRC has been expanding into a new problem area: molecular dynamics, where one attempts to follow many individual atoms in order to understand for instance chemical reactions. The work is performed in collaboration with the Group of Theoretical Physics at KTH and the SeRC Molecular Simulation community. Two PhD students began their work on this subject in January 2012.

Susanne Rosén

The Department of Numerical Analysis

Numerical analysis is the science of methods for computer simulation of complex physical processes. Computer simulations are used in industry and in most sciences to generate new knowledge. Faster and more accurate numerical methods make it possible to solve larger and more complex problems.

The NA group is concerned with the development of numerical algorithms, their theoretical justification, and their efficient implementation on serial and parallel computers. The areas of research include multiscale, multiphysics and stochastic methods in application areas like acoustics, complex, multiphase and turbulent flow, molecular dynamics, electromagnetics, radio networks and finance.

www.csc.kth.se/na
Lindgren – an Environmentally Friendly Supercomputer

Lindgren, the new supercomputer at PDC, has the power to solve the largest computational problems, which previously could not be solved in Sweden. The computer is also environmentally friendly - the heat from Lindgren is captured and used in neighbouring buildings at KTH.

On January 19 2011 the upgraded version of the supercomputer Lindgren, run by PDC, was made publicly available.

“With this upgrade, the Swedish research community now has access to the most powerful computer in the Nordic region, offering 305 TFLOPS and the fast Gemini interconnect”, says Erwin Laure, head of the supercomputing centre PDC at KTH.

With Lindgren, large and detailed fluid dynamics problems like aircraft wings or molecular dynamics can be addressed. Just a few days after the upgrade KTH researchers managed to run calculations that involved almost all of the 36,000-processor cores. Moreover, “it was the biggest job that had ever been run on a Swedish supercomputer”, says Erwin Laure.

The upgrade provides researchers with excellent hardware resources, which in turn facilitates top-level research. As part of a concerted Swedish effort, SNIC (the Swedish National Infrastructure for Computing) and ScRC (the Swedish eScience Research Center) PDC are using Lindgren to prepare researchers at KTH and other Swedish research institutions for the next level of parallel computing resources, “The Exascale era”.

Lindgren was delivered 2010 by the US supercomputer company Cray and funded by KTH together with SNIC, the Swedish Research Council (VR), and Scania, the latter is using Lindren for scalability studies and flow calculations for truck bodies and combustion.

But Lindgren will above all play a critical role in major national research projects, and it will be used, among other things, for medical, materials and climate research.

“We can now offer more application expertise in a wide area of fields which will grow further during 2012,” says Erwin Laure.
Heat Recycling for Green Computing

With Lindgren PDC is also starting a major exercise towards green computing in Sweden, since the heat produced by the supercomputer is captured and used to heat the neighbouring building on campus at KTH.

Today, PDC is one of the largest electricity consumers at KTH. Earlier the heat from the supercomputer has been re-used via Fortum’s district cooling system. With this local system, the re-using is more direct and provides a better economical advantage.

“A computer hall like the one at PDC needs large amounts of energy. Since we paid 1 million Euro a year for electricity and cooling of the data centre, it would be a shame not to take advantage of the excess heat, and thus save quite a lot of money and at the same time be environmentally friendly“, says Daniel Ahlin, Technical director at PDC.

The heat reuse system was developed in a close cooperation between PDC, Akademiska Hus and Sweco, tells Daniel Ahlin.

“We have put heat exchangers on top of the computer that takes care of the hot air, and then transfer it to the Chemistry building via existing cooling pipes, “ he says.

Both Akademiska Hus, who owns the buildings, and the KTH management team have been very enthusiastic and supported the project from start. But as in all projects there were also some challenges.

“Yes, since we did not have a ready made solution, we had to test and look at different alternatives. Coordinating all the stakeholders was also a bit of a challenge, and have everyone wanting the same thing.”

The heat from Lindgren is enough to heat more than the Chemistry building, and more buildings will be connected in the future. 600 MWh of less used heating per year is expected, as well as 1300 MWh less used district cooling, resulting in savings of 70 000 Euro per year.

“The high energy consumption in computer halls is a big problem worldwide and energy efficiency has become one of the major concerns for the computer industry. Here, our project can serve as a good example for others, “ states Daniel Ahlin.

Susanne Rosén

Facts Lindgren:
• Cray XT6
• Dual 12core AMD Opteron CPUs 2.1 GHz, 32 GB RAM per node
• 3D torus Gemini network
• 1516 nodes, 36384 cores
• 305 TF TPP
• SNIC PRACE system
• Max 800 kW

www.pdc.kth.se
Technology-Enhanced Learning and Math Coach

Technology-enhanced learning is the overall theme of the research performed by Stefan Hrastinski, Associate Professor of Media Technology, and colleagues at several departments at CSC. In the project Math Coach Online in collaboration with the School of Education and Communication in Engineering Science (ECE), his role is to strengthen the scientific part of the work.

“There is a tremendous need for education and continuous learning in the society. Used in a smart way media technology can be a powerful tool to meet this need, providing for instance active learning and training supported by the Internet”, says Stefan Hrastinski.

Issues regarding how Media Technology can support learning is an area that researchers and groups at the CSC School has been engaged in for a long time, he points.

“Lately there has been a renewed interest at KTH in how we should relate to the Internet as a support in the education. This in turn, gave us a part of the KTH strategic funding which made it possible to employ two PhD students who will study and suggest improvements in the online learning area.”

One of the projects within the area technology-enhanced learning is the very popular and awarded e-learning project Math Coach Online. The project started the spring of 2009, and it is collaboration between the CSC School and the Department of Learning at the ECE School at KTH.

In Math Coach Online teacher students from KTH coach pupils, primarily by helping them with math homework via the chat software Windows Live Messenger. The service is open on weekday evenings for all pupils from 12 to 20 years old and adult education at upper-secondary level. Currently there is activity at four universities and seven municipalities in Sweden, including collaboration with Microsoft.

“This is an example of successful cross-disciplinary work. My role is to strengthen the scientific part in the project.”
All the conversations between the coaches and the pupils are archived which enables analysis and statistical compilation. Math Coach project leader and teacher Stefan Stenbom at ECE is as PhD student, supervised by Stefan Hrastinski, also doing research on the project.

“Our aim is to develop this concept further and the research can support this development, says Stefan Hrastinski.”

At the 17th Annual Conference on Online learning a research paper on the Math Coach project was selected by the Sloan Consortium as the 2011 "Best-in-Track” session.

“We will also look at ways to develop the concept of Math Coach Online for KTH students and more subjects, by using older students and PhD students as coaches, says Stefan Hrastinski.”

Furthermore, Stefan Hrastinski leads a research group together with Olle Bälter, Associate Professor of Human-Computer Interaction, that explore mobile learning, how to design large online courses, online assessment and feedback, and the use of social media in higher education. The group has recently been strengthened by the recruitment of Guest professor Martha Cleveland-Innes from Canada.

Better Decision Support for Gastro Surgeons

The Development collaboration Funk-IS aimed at producing products that facilitate gastro surgeons’ work. The project, funded by Vinnova, started 2008 and ended in 2011 and was a collaboration between the KTH, Karolinska Institutet and Gastro Center Surgery at Karolinska University Hospital.

- Focus of the project has been to produce results that the business can then take over and commercialize. The goal is to have products ready in 2016, says Kristina Groth, researcher at MDI.

Funk-IS dealt with technologies that will support decisions in the health care chain for severe diseases of the upper abdomen. The techniques will be used in evaluation of digital information (radiology images, medical records, lab data, etc.), for decisions about treatment, in preparation for surgery and in connection with education and training for the next step in the process.

The techniques that were explored and developed in close collaboration with surgeons and radiologists include information management, decision support, automated data storage, visualization, three-dimensional models, video-mediated communication and haptic (tactile feedback).

- We initially worked with two prototypes: one with a focus on multimodal interfaces for evaluation of the radiological information and one with focus on information visualization and accessibility. But we chose to continue with the latter as the potential for commercialization was considered to be higher, says Kristina Groth.

Parts of the prototype will now be integrated with existing information sources and evaluated in use, looking at business value and business benefits as part of an eventual commercialization.

Susanne Rosén

Media Technology and Interaction Design

"We are an interdisciplinary research team consisting of the two previous sections HCI (Human Computer Interaction) and Media Technology and Graphic Arts.

The group originated in the data and behavioral sciences, as well as graphic arts and media, and currently has a faculty that represents such anthropology and psychology, computer science and media technology, interaction design, film and literature, and media and communication studies.

Briefly, the area described as innovative design, adaptation and improvement of existing systems and processes to facilitate computing and media consumption and media production. We work with techniques and methods for supporting human communication over distances in space and time."

www.kth.se/csc/forskning/mid
A Social Robot in a Fur Cap

In the European project IURO the Speech group take part in the development of a robot that interacts socially with humans. With the help of their robotic head Furhat the robot will be able to conduct a dialogue and understand route directions.

The goal of the European project Interactive Urban Robot (IURO) is to develop a socially interactive robot, i.e. a robot that can engage in information-gathering face-to-face interactions in multi-user settings. The Speech group from the Department of Speech, Music and Hearing (TMH), participate in the project along with research groups from Germany, Switzerland, Austria and Poland.

“IURO is about building a hands-on demonstrator application, but the goal is also to go deeper into the research. In this case, we want to create a robot that can navigate in a city with the help of humans. It should not be guided by GPS or a map, but instead question their way, make contact with people and understand directions”, tells Associate Professor Jonas Beskow, who is one of the KTH researchers in the project.

The project, which started in early 2010, will run until 2013. At the Speech group three full-time researchers are working on the project. IURO follows a multi-disciplinary approach combining environment perception, communication, navigation, knowledge representation and assessment, and human factors studies as well as a novel robot platform for human-centred urban environments as a pre-industrial development.

One of the central challenges in IURO is that of interpreting the spoken route directions into a semantic formalism that is useful for the robot. The project is using a robot head for turn taking and attention signalling in multi-party dialogue. For this purpose the KTH group has developed the optical robotic head Furhat.

“We provide two main components of this multi-disciplinary project. One is the dialogue management and road description; the second is the actual robot face.”

The facial expression cues and gaze direction are im-
important parts in the interaction, explains Jonas Beskow.

"In this project we build on our previous work on facial animation, a robot head that consists of a mask that animates a human head."

He notes that the challenge of the project is about the desire to better simulate humanlike communication:

"We don’t want to create a natural-looking human, but something that obviously is a robot or virtual character, but that has as much as possible of the ways of expressions of a human being. There are elements of basic research in this that has to do with human communication and turn taking. Much of our communication is not verbal but is about gestures and speech signals such as tone of voice,” says Jonas Beskow.

In December 2011, the Speech group showcased their robot head FurHat at RobotVille Festival (part of a pan-European Robot week) at the Science Museum in London, where the 7500 visitors of the 4-day exhibition were able to talk with Furhat in a three-part dialogue setting.

Research in the Field of Emotions and Music

After two years of work with their scientific article on emotions in music, Associate professors Roberto Bresin and Anders Friberg at the Sound and Music Computing group (formerly the Music Acoustics group) at TMH were rewarded; the journal Cortex published their paper Emotion rendering in music: Range and characteristic values of seven musical variable in the October issue 2011.

"It was an important event for us. In the Cortex paper we present a large part of what the Sound and Music Computing group do in the research field of emotions and music,” says Roberto Bresin.

For many music listeners and performers the induction and communication of emotion is a central aspect. How brain activity and emotions are affected by music is also of great interest in modern neuropsychological research.

“Yes, music is a very powerful means for analysing how emotions are perceived and mapped into brain activity. We have worked for many years to develop tools that can give a better understanding of how music affects emotions,” says Roberto Bresin.

The article in Cortex describes a study in which the authors have identified seven musical parameters (tempo, sound level, articulation, phrasing, register, instrument, and attack speed) that vary between different emotions. 20 experienced musicians took part in an experiment, which was set in a studio at the CSC School. Here, the musicians could listen to four scores communicating different emotions (happiness, sadness, fear, calmness) and adjust the musical variables in real-time for communicating five different emotional expressions (neutral, happy, scary, peaceful, sad). The scores were polyphonic, selected from a battery of stimuli composed at Montreal University.

"We wanted to identify the mean values and range for these musical variables in order to obtain a better

The Department of Speech, Music and Hearing

In 2011 the Department of Speech, Music and Hearing (TMH) celebrated 60 years of continuous research on communication and interaction between humans via speech and music. Professor Gunnar Fant, one of the great pioneers in speech communication, founded his research group in 1951. Research at the department is truly multi-disciplinary including linguistics, phonetics, auditory perception, vision and experimental psychology which all support the main research themes in speech technology and sound and music computing. Rooted in an engineering modelling approach, the research forms a solid base for developing multimodal human-computer interaction systems in which speech, music, sound and gestures combine to create human-like communication. www.speech.kth.se/
control of the music stimuli thus improving ecological validity, emotional impact and optimal selection. It turned out that, especially for parameters like tempo and melody, that introduce large perceivable effects, the test subjects selected intuitively the same values to change the music to match a specific emotion”.

Setting up the technical equipment supporting the experiment was a big challenge in the project, states Roberto Bresin. The equipment consisted of a professional software sound synthesizer (Kontakt 2, using the Vienna Symphonic Library), a gesture controller that was specially designed and built for the experiment, two personal computers as well as two computer programs; Skatta, and a modified version of pDM.

“Skatta is a freely available program initially developed by four students as a project in a Software Engineering Course at CSC. It was used for the design of the test procedure, for the presentation of the stimuli, and the collection of results. pDM is a real-time computer program for expressive music performance, that we have developed in the Sound and Music Computing group earlier and now modified for this experiment.”

Although this is labelled as basic research, the results may in the future well be useful in for example game development and design of new digital instruments. Another area where the research is of great use is in studies of how children act and how they relate to certain emotions.

“Just an example, we developed a new instrument called MusicBoxes that is now used by researchers in Finland to study children’s’ personality, and we collaborate with them in this work,” says Roberto Bresin.

The study presented in the paper has been performed with support by the European BrainTuning project, which was investigating the musical brain by combining the expertise of six research groups in Europe and Canada during the years 2006–2009. The authors have also had support from the Same Project (Roberto), funded by the European Commission, and the Swedish Research Council (Anders).

Susanne Rosén
### Facts and Figures – Faculty and Staff

#### 2011

- Researchers: 56
- Graduate Students: 85
- Professors: 23
- Associate professors: 39
- Assistant professors: 3
- Lecturers: 13
- Administrators: 31
- Computer System Managers: 41
- Technical Staff: 1
- Total: 292

#### 2008

- Researchers: 39
- Graduate Students: 69
- Professors: 24
- Associate professors: 35
- Assistant professors: 4
- Lecturers: 31
- Administrators: 30
- Computer System Managers: 26
- Technical Staff: 3
- Total: 261

#### 2006

- Researchers: 38
- Graduate Students: 60
- Professors: 22
- Associate professors: 28
- Assistant professors: 7
- Lecturers: 33
- Administrators: 31
- Computer System Managers: 46
- Technical Staff: 4
- Total: 259
Facts and Figures
– Faculty and Staff

Numbers of Graduate Students Employed

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Numbers of Professors and Lecturers Employed by Year of Birth in 2008

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Numbers of Professors and Lecturers Employed by Year of Birth in 2011

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Male  Female
**Doctoral Theses**

**2011**
- Kristoffer Sjöö • Functional Understanding of Space: Representing Spatial Knowledge Using Concepts Grounded in an Agent’s Purpose
- Dag Lindbo • Spectral Accuracy in Fast Ewald Methods and Topics in Fluid Interface Simulation
- Nalin Harischandra • Computer Simulation of the Neural Control of Locomotion in the Cat and Salamander
- Javier Romero • From Human To Robot Graping
- Jeanette Bohg • Multi-Modal Scene Understanding for Robotic Graping
- Henrik Holst • Multiscale Methods for Wave Propagation Problems
- Murtazo Nazarov • Adaptive Algorithms and High Order Stabilization for Finite Element Computation of Turbulent Compressible Flow
- Andrzej Pronobis • Semantic Mapping with Mobile Robots
- Marco Fabiani • Interactive Computer-Aided Expressive Music Performance: Analysis, Control, Modification and Synthesis
- Daniel Fagerström • Spatio-Temporal Scale-Space Theory
- Gunnar Kreitz • Aspects of Secure and Efficient Streaming and Collaboration
- Preben Wik • The Virtual Language Teacher: Models and Applications for Language Learning Using Embodied Conversational Agents
- Sara Zahedi • Numerical Methods for Fluid Interface Problems
- Jens Edlund • In Search for the Conversational Homunculus
- Aymeric Fouquier d’Herouel • On Diverse Biophysical Aspects of Genetics - from the Action of Regulators to the Characterization of Transcripts
- Tommo Reti • Digital Content Networks: the Past, the Present and Decentralizing

**2010**
- Rosa Gudjonsdottir • Personas and Scenarios in Use
- Ying Ying Huang • Design and Evaluation of 3D Multimodal Virtual Environments for Visually Impaired People
- Ovidiu Sandor • Social Awareness Support for Cooperation: Design Experience and Theoretical Models
- Mikael Nilsson • From Interoperability to Harmonization in Metadata Standardization: Designing an Evolvable Framework for Metadata Harmonization
- Marcus Rehberger • Hybrid printing on fibre-based packaging: Performance, Quality and Market
- Anna Hjalmarsson • Human interaction as a model for spoken dialogue system behaviour
- Kjetil Falkenberg Hansen • The Acoustics and Performance of DJ Scratching Analysis and Modeling
- Malin Sandström • Computational Modelling of Early Olfactory Processing
- Emmi Enoksson • Toward Better Image Reproduction in Offset
- Maria Werner • Studies of Cellular Regulatory Mechanisms: from Genetic Switches to Cell Migration

**2009**
- Smith, Christian • Input Estimation for Teleoperation: Using Minimum Jerk Human Motion Models to Improve Telerobotic Performance
- Oppelstrup, Tomas • Simulation of relaxation processes in complex condensed matter systems: Algorithmic and physical aspects
- Tavakoli Targhi, Ali Reza • The Texture-Transform: An Operator for Texture Detection and Discrimination
- Westerlund, Bo • Design Space Exploration - cooperative creation of proposals for desired interactions with future artefacts
- Elenius, Måns • Computer Simulations of Simple Liquids with Tetrahedral Local Order - the Supercooled Liquid, Solids and Phase Transitions

**Licentiate Theses**

**2011**
- Fredrik Enoksson • Flexible Authoring of Metadata for Learning - Assembling Form from a Declarative Data and View Mode
- Muddassar Sindhu • Incremental Learning and Testing of Reactive Systems
- Oana Marin • Quadrature Rules for Boundary Integral Methods Applied to Stokes Flow
- Fredrik Enoksson • Flexible Authoring of Metadata for Learning
- Niclas Jansson • High performance adaptive finite element methods for turbulent fluid flow
- Fei Niu • Learning-based Software Testing using Symbolic Constraint Solving Methods

**2010**
- Rosa Gudjonsdottir • Personas and Scenarios in Use
- Qasim Ali Chaudhry • Numerical Approximation of Reaction and Diffusion Systems in Complex Cell Geometry
- Jon Häggblad • Boundary and Interface Conditions for Electromagnetic Wave Propagation using FDTD
- Marcus Pettersson • Beyond AMPA and NMDA: Slow synaptic mGlu/TRPC currents: Implications for dendritic integration
- Laura Enflo • Alternative Measures of Phonation: Collision Threshold Pressure and Electroglottographic Spectral Tilt: Extra: Perception of Swedish Accents
- Daniel Elenius • Accounting for Individual Speaker Properties in Automatic Speech Recognition
- Aymeric Fouquier d’Herouel • On Diverse Biophysical Aspects of Genetics - from the Action of Regulators to the Characterization of Transcripts
- Mattias Bratt • Teleoperation with significant dynamics
- Jenny Tigerholm • A-type Potassium Channels in Dendritic Integration Role in Epileptogenesis