News

ELLIIIT publication in Nature.
Working at the Department of Automatic Control in Lund, and supported by ELLIIIT via professor Bo Bernhardsson, the supervisor of Jacob Bergstedt, the PhD student Jacob Bergstedt has worked with modeling and statistical analysis of the human immune system. The project has been a cooperation with the Pasteur Institute in Paris that needed help with statistical analysis of huge data sets recently made available in the so called Milieu Interieur project, see http://www.milieuinterieur.fr/en/project/project-overview. The resulting paper, entitled ”Natural variation in the parameters of innate immune cells is preferentially driven by genetic factors” has been published in Nature Immunology, see https://www.nature.com/articles/s41590-018-0049-7, and has also been given some attention in popular media, for instance in Vetenskapsradion at Sveriges Radio. For a popularized description in Swedish see https://www.lu.se/article/detta-paverkar-vart-immunforsvar-allra-mest.

WASP initiative on AI
The Knut and Alice Wallenberg Foundation has granted an additional billion Swedish kronor to extend the Wallenberg Autonomous Systems and Software Program (WASP), with a broad investment into artificial intelligence. As a result of this the name of WASP will change to the Wallenberg Artificial Intelligence, Autonomous Systems and Software Program (WASP)
The initiative in artificial intelligence will follow two pathways. The larger of these involves an investment into machine learning, deep learning and the explainable AI. The second pathway deals with increasing our understanding of the mathematical principles behind AI.

SSF’s Cybersecurity Call
ELLIIIT researchers were successful in SSF’s call for cybersecurity projects. Out of the 10 granted applications two were led by Lund researchers. Professor Christian Gehrmann from EI/Lund University and SICS received 30 MSEK for the project “Cyber Security for Next Generation Factory”
and Martin Hell, also from EIT, received 22 MSEK for the project “Secure Software Update Deployment for the Smart City”. In addition to this Professor Thomas Johansson (EIT/LU) and Professor Erik G Larsson (ISY(LiU) are co-applicants in the project “Secure and Private Connectivity in Smart Environments” led by Professor Panagiotis Papadimitratos at KTH that received 33 MSEK.

**Nordic Industrial Hub on Industrial IoT**
Karl-Erik Årzén (AC/LU), Flavius Gruian (CS/LU), and Erik Larsson (EIT/LU) represent Lund in the new Nordforsk Nordic Hub on Industrial Internet of Things (HI2OT). The total approved budget is 18 MNOK over three years. The additional partners are DTU, KTH, Aalto University, and NTNU. The coordinator is Paul Pop at DTU.

**Joint User Activity and Non-Coherent Data Detection in mMTC-Enabled Massive MIMO Using Machine Learning Algorithms**
Machine-type communication (MTC) services are expected to be an integral part of the future cellular systems. A key challenge of MTC, especially for the massive MTC (mMTC), is the detection of active devices among a large number of devices. The sparse characteristics of mMTC makes compressed sensing (CS) approaches a promising solution to the device detection problem. CS-based techniques are shown to outperform conventional device detection approaches. However, utilizing CS-based approaches for device detection along with channel estimation and using the acquired estimates for coherent data transmission may not be the optimal approach especially for the cases where the goal is to convey only a few bits of data. In this work, we propose a non-coherent transmission technique for the mMTC uplink and compare its performance with coherent transmission. Furthermore, we demonstrate that it is possible to obtain more accurate channel state information by combining the conventional estimators with CS-based techniques. Further details: [K. Senel and E. G. Larsson, ITG Workshop on Smart Antennas, 2018]

**Massive MIMO Has Unlimited Capacity**
Cellular communications with large-antenna arrays at the base stations and spatial multiplexing of many users per cell is known as Massive MIMO. Since its inception, the pilot contamination, caused by the necessary reuse of pilot sequences for channel estimation in multiple cells, has been viewed as a fundamental limitation for Massive MIMO. In particular, pilot contamination has been believed to be create a finite channel capacity limit, as the number of antennas goes to infinity. In this paper, we prove that this is incorrect and an artifact from using simplistic channel models and suboptimal precoding/combining schemes when evaluating the performance. We show that with a certain type of precoding/combining and a tiny amount of spatial channel correlation or large-scale fading variations over the array, the capacity increases without bound as the number of antennas increases, even in the presence of pilot contamination. This new result contradicts previous “wisdom” and shows that there are no limits to how spectrally efficient the network can become. For example, consider a network with any finite number of UEs that each have a finite-valued data rate requirement. The main result implies that we can always satisfy these requirements by deploying sufficiently many antennas. Further details: [Emil Björnson, Jakob Hoydis, Luca Sanguinetti, IEEE Transactions on Wireless Communications, vol. 17, no. 1, pp. 574-590, Jan. 2018]
LiU/ISY/Communication systems launches YouTube channel
See this link https://www.youtube.com/channel/UCOrjRoYJPqGiR1SZvU3xcYQ

Cross disciplinary program on Working and Organizing in the Digital age
Elizabeth Bjarnason participated in a cross disciplinary program on Working and Organizing in the Digital age, at the Lund University Pufendorf institute 2016/17. The final report was released Jan 29, 2018: Working and Organizing in the Digital Age, Stephan Schaefer, Magnus Andersson, Elizabeth Bjarnason, Kristofer Hansson (editors), The Pufendorf Institute for Advanced Studies, Lund University, Sweden, ISBN 9789198439410

Synergies open innovation project
The VR funded ICT framework program Synergies on open innovation concluded by the end of 2017. Significant progress is made in understanding how open software can provide business value. Selected results in highly ranked journals:


Some Publications
• Morteza Mohaqeqi, Mitra Nasri, Yang Xu, Anton Cervin, Karl-Erik Årzén: “Optimal Harmonic Period Assignment: Complexity Results and Approximation Analysis”, Real-Time Systems Journal, 2018 (Accepted for publication)
• Yang Xu, Anton Cervin, Karl-Erik Årzén: ”Jitter-Robust LQG Control and Real-Time Scheduling Co-Design”, American Control Conference, Milwaukee, WI, 2018
• Tommi Nylander, Cristian Klein, Martina Maggio, Karl-Erik Årzén: ”BrownoutCC: Cascaded Control for Bounding the Response Times of Cloud Applications”, American Control Conference, Milwaukee, WI, 2018
• Nauman bin Ali, Muhammad Usman: Reliability of search in systematic reviews: towards a quality assessment framework for the automated-search strategy. Information and Software Technology (Accepted for publication in 2018)
- Yuxin Zhao, Carsten Fritsche, Feng Yin, Fredrik Gunnarsson, Fredrik Gustafsson, “Sequential Monte Carlo Methods and Theoretical Bounds for Proximity Report Based Indoor Positioning”, IEEE Transactions on Vehicular Technology, 2018
- Yuxin Zhao, Carsten Fritsche, Feng Yin, Fredrik Gunnarsson, Fredrik Gustafsson, “Sequential Monte Carlo Methods and Theoretical Bounds for Proximity Report Based Indoor Positioning”, IEEE Transactions on Vehicular Technology, 2018
- "Approximative Coding Methods for Channel Representations" by K. Öfjäll and M. Felsberg (joint first authorship) was accepted at Journal of Mathematical Imaging and Vision.
- " Binary Patterns Encoded Convolutional Neural Networks for Texture Recognition and Remote Sensing Scene Classification” was accepted at ISPRS Journal of Photogrammetry and Remote Sensing.
- Juan-Diego Sanchez, Avendal, J., Adnan Bibic & Buon Kiong Lau, Radiative MRI coil design using parasitic scatterers: MRI Yagi, 2018 mar, IEEE Transactions on Antennas and Propagation. 66, 3, s. 1570-1575
- Dahman, G., Jose Flordelis & Fredrik Tufvesson, Cross-Correlation of Large-Scale Parameters in Multi-Link Systems: Analysis using the Box-Cox Transformation, 2018 jan 24, IEEE Access.

Keynotes and Invited Talks:
• Emil Björnson (LiU/ISY/Communication systems) gave the IEEE 5G webinars: “Massive MIMO for 5G below 6 GHz: Achieving Spectral Efficiency, Link Reliability, and Low-Power Operation” (January 17, 2018) and “Massive MIMO for 5G: How Big Can it Get?” (November 9, 2017). Recordings are available online.
• Per Runeson gave a keynote on Industry-Academia Communication in Empirical Software Engineering at the 11th ACM / IEEE International Symposium on Empirical Software Engineering and Measurement in Toronto, Canada in November. He used the Berlin wall as a metaphor for the divide between industry and academia, and asked both practitioners and researchers to “tear down that wall”. Presentation available at https://www.slideshare.net/PerRuneson/industryacademia-communication-in-empirical-software-engineering
• Fredrik Tufvesson gave a IEEE Communications Society webinar, "Maximising spectrum efficiency with massive MIMO in the 3 GHz band", Nov 2017
• Fredrik Tufvesson gave a Key note, workshop at PIMRC, "Channel characteristics for cooperative ITS and positioning” Oct. 2017
• C. Wohlin: Software Engineering Research with and in Industry, Keynote at the yearly research seminar at Lero - The Irish Software Research Center, Athlone, Ireland.
• C. Wohlin: Can we trust the evidence?, Keynote at the upcoming the 22nd International Conference on Evaluation and Assessment in Software Engineering in Christchurch, New Zealand, June 2018.
Isak Nielsen and Daniel Axehill. Low-rank modifications of Riccati factorizations for model predictive control. Accepted for publication in IEEE Transactions on Automatic Control, July 2017.


Q. He, D. Yuan, and A. Ephremides. Optimal link scheduling for age minimization in wireless systems. IEEE Transactions on Information Theory. (Accepted)


V. Angelakis, “Age and Value of Information in IoT systems”, 4th tutorial at the 2017 Open Internet of Things Summer School, 4-8 Sep. 2017, Galway City, Ireland.

Anders Hansson gave an invited talk on “Distributed Robustness Analysis” at the LCCC Focus Period on Large-Scale and Distributed Optimization in Lund, June 16, 2017.

Michael Felsberg is invited as keynote speaker at CVCS 2018.

Awards and Appointments:


N. Pappas IEEE WiMob 2017 Workshops co-chair.

N. Pappas co-chair for the IEEE SPAWC 2018 Special session "Low Latency Communications in Cooperative Networks”.

The paper Gradient-Based Recursive Maximum Likelihood Identification of Jump Markov Non-Linear Systems by Andre R. Braga, Carsten Fritsche, Fredrik Gustafsson, and Marcelo Bruno was second runner-up for the ISIF 2017 Tammy Blair Best Student Paper Award at the Fusion 2017 conference.

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Program chairs and Editorships:

- Nauman bin Ali serves as one of the guest-editors for a special issue on empirical software engineering in Journal of Systems and Software.
- Mario Garrido is appointed associate editor for Journal of Signal Processing Systems

PhD theses:

- Christopher Mollen (LiU/ISY/Communication systems) successfully defended his Ph.D. thesis "High-End Performance with Low-End Hardware: Analysis of Massive MIMO Base Station Transceivers", Jan. 2018
- Wadenbäck, M., Homography-Based Positioning and Planar Motion Recovery, 2017, Lund,
- Efficient Software Implementation of Stream Programs, Gustav Cedersjö, 2017, Lund
- Computer Vision Based Analysis of Animal Behavior, Palmér, T., 2017 feb 9, 1 red. Lund
- Modeling and Estimation Topics in Robotics, Fredrik Bagge Carlson, 2017 mar 10, Department of Automatic Control, Lund
- Inverted GUI Development for IoT with Applications in E-Health, Johnsson, B. A., 2017 apr 11, Department of Computer Science, Lund
- Applications of Machine Learning on Natural Language Processing and Biomedical Data, Dennis Medved, 2017 Lund
- Automatic Controller Tuning using Relay-based Model Identification, Berner, J., 2017, Lund
- LQG-Based Real-Time Scheduling and Control Codesign, Xu, Y., 2017, Lund

Conferences and workshops:
- OpenModelica Annual Workshop 2018
  Linköping University, February 5, 2018
- 12th MODPROD Workshop on Model-Based Cyber-Physical Product Development
  Linköping University, February 6-7, 2018

Personell

- Dr. Christoph Reichenbach was recruited as senior lecturer in software technology in August 2017. He is recruited within the WASP program.
- Dr. Elizabeth Bjarnason was promoted to senior lecturer in software engineering, in December 2017.
- Sergio Rico from Colombia started Feb 1 as a PhD student in software engineering, co-supervised by ELLIIT post doc Emelie Engström. The focus is on developing methods for evaluating software test processes and proposing adequate and evidence-based improvements to them
- Vi Tran has been employed as a Ph.D. student since January 2018 at Blekinge Institute of Technology (January 2018).
- V. Angelakis – promoted to biträdande professor (Reader (UK) / Assoc. Prof. (US)) from 1 Dec. 2017 at Department of Science and Technology (ITN), LiU,
- Hamed Haghshenas has been recruited as a PhD student in the project Scalable Optimization for Control Systems at ISY, LiU
- Dr Shang Xiang from Shanghai Jiao Tong University (SJTU) will begin his two year postdoctoral employment at Lund University with Buon Kiong Lau (LU/EIT) in March 2018, funded by a Marie Skłodowska-Curie Actions (MSCA) Individual Fellowship. His project concerns several theoretical extensions of a computational electromagnetics technique called Characteristic Mode Analysis and using them to solve practical antenna design problems.

Research Grants

- New ITEA3 EMPHYSIS project at LiU (https://itea3.org/project/emphysis.html).
- New SSF project in cyber security https://strategiska.se/pressmeddelande/300-miljoner-till-cybersakerhet-en-strategisk-injektion/
  - Martin Hell (LU/EIT) has received an SSF grant for the project "Secure Software Update Deployment for the Smart City" in the call "Cybersecurity and Information Security". Co-applicants are Christian Gehrmann (LU/EIT) and Boris Magnusson (LU/CS). The awarded amount is 22 MSEK.
  - Christian Gehrmann (LU/EIT) has received an SSF grant for the project "Cyber Security for Next Generation Factory" in the call "Cybersecurity and Information Security". Co-
applicants are Martin Hell (LU/EIT), Maria Kihl (LU/EIT), Thomas Thelin (RISE SICS) and Ludwig Seitz (RISE SICS). The awarded amount is 30 MSEK.

- **BTH: SHADE** — En värdeorienterad strategi för hantering av degradering av mjukvarutillgångar, Funded by The Knowledge Foundation, Duration: April 1, 2018 – March 31, 2021. Total budget: 10.5MSEK.

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- **N. Pappas**, "Low Latency Communications for Wireless Networks: Exploiting Traffic Characteristics", funded by the LiU Center for Industrial Information Technology (CENIIT).

- **A. Ephremides**, "Using message properties and structure to control latency in information systems ", funded by VR.

- **Buon Kiong Lau** (LU/EIT) received an SSF Mobility Grant to spend 50% of his time at nok9 AB for 1.5 years. nok9 is the official test equipment provider for the Qi standard of wireless charging, and wireless communication solutions are critical to the Qi charging solution.

- **The Competence Center LINK-SIC** (Linköping Center for Sensor Informatics and Control) has been approved by VINNOVA. The funding from VINNOVA is 32 MSEK over five years. The center involves the Divisions of Automatic Control and Vehicular Systems at Linköping University and some of Sweden’s largest system-building industries.