Monday, March 14

10:00-10:15	**Registration for Ph.D. students** (at Carolina Rediviva)
10:15-15:00	**PhD day** (incl. lunch)
14:45-15:15	**Registration (at Norrlands nation) + Coffee**
15:15-15:30	**Welcoming words**
15:30-16:30	**Invited talk** *Chair: Robin Strand, Uppsala University* ***Learning approaches in medical image analysis*** **Marleen de Bruijne,** University Medical Center Rotterdam, The Netherlands and University of Copenhagen, Denmark
16:30-17:30	**Invited talk** *Chair: Ingela Nyström, Uppsala University* ***Data-Driven Methods in Defect Detection in Textile Images*** **Aysin Ertuzun,** Bogazici University, Turkey This talk is sponsored by the Centre for Image Analysis.
17:30-18:30	**SSBA 40th anniversary special program**
18:30-21:00	**SSBA 40th anniversary reception**

Tuesday, March 15

8:30-8:50	**Registration** (at ITC/Aula)
8:50-9:00	**Opening of the Symposium**
9:00-10:00 **ITC/Aula**	**Invited talk** *Chair: Magnus Borga, Linköping University* ***Microstructure imaging of the human brain using diffusion MRI*** **Carl-Fredrik Westin,** Harvard Medical School in Boston, USA This talk is sponsored by the Centre for Interdisciplinary Mathematics, and is open also for non-registered participants.

10:00-10:30 **Coffee break + exhibition time**

10:30-12:10 **Regular papers presentation**

ITC/Aula **Session 1a: Medical Image Processing 1 – MRI**
Chair: Matilda Landgren, Lund University

1. ***Holistic whole-body MRI image analysis***
Robin Strand[1 2], Filip Malmberg[1 2], Lars Johansson[1], Lars Lind[3], Magnus Sundbom[4], Håkan Ahlström[1], Joel Kullberg[1]
[1]Division of Radiology, Dept. of Surgical Sciences, Uppsala University
[2]Centre for Image Analysis, Dept of Information Technology, Uppsala University
[3]Dept. of Medical Sciences, Uppsala University
[4]Dept. of Surgical Sciences, Uppsala University

2. ***Simulation of Diffusion MRI Processes using Iterated Complex Matrix Multiplication***
Hans Knutsson[1], Magnus Herberthson[1], Carl-Fredrik Westin[1 2]
[1]Biomedical Engineering, CMIV, Linköping University
[2]Brigham and Women's Hospital, Harvard Medical School, USA

3. ***Clustering of tensor votes for inference of fibre orientations in DTI data***
Daniel Jörgens, Örjan Smedby, Rodrigo Moreno
School of Technology and Health, KTH Royal Institute of Technology

4. ***Time-resolved tracking of the cardiac valve movement by normalized cross correlation and principal component analysis in cardiovascular magnetic resonance imaging***
Felicia Seemann[1 2], Ulrika Pahlm[1], Katarina Steding-Ehrenborg[1 3], Håkan Arheden[1], Einar Heinberg[1 4]
[1]Lund University, Department of Clinical Sciences Lund, Clinical Physiology, Skåne University Hospital
[2]Department of Numerical Analysis, Faculty of Engineering, Lund University
[3]Department of Heath Sciences, Lund University
[4]Department of Biomedical Engineering, Faculty of Engineering, Lund University

5. ***An approach to model diffusion tensor distributions using Generalized Wishart processes***
Snehlata Shakya, Hans Knutsson
Department of Biomedical Engineering, Linköping University

10:30-12:10 **Session 1b: Image Analysis**
ITC/6140 *Chair: Mårten Wadenbäck, Lund University*

1. ***Periocular Biometrics: Databases, Algorithms and Directions***
Fernando Alonso-Fernandez, Josef Bigun
Halmstad University

2. ***Estimating manuscript production dates using both image and language data***
Fredrik Wahlberg[1], Lasse Mårtensson[2], Anders Brun[1]
[1]Department of Information Technology, Uppsala University
[2]Department of Business Studies, University of Gävle

3. ***From Sensor Data to Piracy Threat Classification for Merchant Shipping***
   K-G Stenborg, Maria Andersson, Jonas Allvar, Ronnie Johansson, Niclas Wadströmer
   Swedish Defence Research Agency (FOI)

4. ***Histology cell counting: from academic sandbox to clinical wilderness***
   Erik Sjöblom[1], Jesper Molin[1 2], Claes Lundström[1 2]
   [1]Sectra AB
   [2]Center for Medical Image Science and Visualization (CMIV), Linköping University

5. ***Cilia Detection using Template Matching in Low Magnification Electron Microscopy Images***
   Amit Suveer[1], Nataša Sladoje[1 2], Joakim Lindblad[1 2], Anca Dragomir[3], Ida-Maria Sintorn[1]
   [1] Centre for Image Analysis, Department of Information Technology, Uppsala University
   [2]Mathematical Institute, Serbian Academy of Sciences and Arts
   [3] Surgical Pathology, Department of Immunology, Uppsala University Hospital

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12:10-13:30   **Lunch**

13:30-14:30   **Invited talk**
ITC/Aula   *Chair: Per-Erik Forssén, Linköping University*

   Vision, you can drive my car
   Uwe Franke,
   Daimler Research and Development, Germany

14:30-15:15   **Industrial presentations**
ITC/Aula   *Chair: Anders Åström*

1. ***Improving mammography with photon counting technology at Philips***
   Philips Digital Mammography

2. ***Time-of-flight and structured light 3D cameras in industrial applications***
   Fotonic

3. ***Developing a consumer eye tracking device***
   Tobii

15:15-15:45   **Coffee break + exhibition time**

15:45-17:25   **Regular papers presentation**

ITC/6140   **Session 2a: Medical Image Processing 2**
   Chair: Olivier Cros, Linköping University

1. ***Good Features for Reliable Registration in Multi-Atlas Segmentation***
   Matilda Landgren[1], Frida Fejne[2], Jennifer Alvén[2], Johannes Ulén[1], Johan Fredriksson[1], Viktor Larsson[1], Olof Enqvist[2], Fredrik Kahl[1 2]
   [1]Centre for Mathematical Sciences, Lund University
   [2]Department of Signals and Systems, Chalmers University of Technology

2. ***Shape-Aware Multi - Atlas Segmentation***
   Jennifer Alvén[1], Fredrik Kahl[1 2], Matilda Landgren[2], Viktor Larsson[2], Johannes Ulén[2]
   [1] Department of Signals and Systems, Chalmers University of Technology
   [2] Centre for Mathematical Sciences, Lund University

3. ***Non-linear spatial normalization for fMRI based group studies: Does it make a difference?***
   Anders Eklund[1 2 3], Cameron Craddock[4], Hans Knutsson [1 3]
   [1] Department of Biomedical Engineering, Linköping University
   [2] Department of Computer and Information Science, Linköping University
   [3] Center for Medical Image Science and Visualization (CMIV), Linköping University
   [4] Child Mind Institute, New York, USA

4. ***A Toolbox for Non-parametric Deformable Registration of Volume Images***
   Filip Malmberg[1 2], Robin Strand[1 2], Håkan Ahlström[2], Joel Kullberg[2]
   [1] Centre for Image Analysis, Department of Information Technology, Uppsala University
   [2] Section of Radiology, Department of Surgical Sciences, Uppsala University

5. ***Repeated tractography of a single subject – how high is the variance?***
   Xuan Gu, Anders Eklund, Hans Knutsson
   Department of Biomedical Engineering, Linköping University

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15:45-17:25   **Session 2b: Computer Vision**

ITC/Aula   *Chair: Måns Larsson, Chalmers University of Technology*

1. ***Hand Detection and Gesture Recognition Using Symmetric Patterns***
   Hassan Nemati, Yuantao Fan, Fernando Alonso-Fernandez
   Center for Applied Intelligent Systems Research (CAISR), Halmstad University

2. ***Ground Truth for Rolling Shutter Visual-Inertial SLAM and Camera-IMU Calibration***
   Hannes Ovrén, Per-Erik Forssén
   Linköping University

3. ***Metric scale with non-overlapping cameras the 5+1 point method***
   Mikael Persson, Andreas Robinson
   Computer Vision Laboratory, Linköping University

4. ***Recovering Planar Motion from Homographies Obtained using a 2.5-Point Solver for a polynomial System***
   Mårten Wadenbäck, Kalle Åström, Anders Heyden
   Centre for Mathematical Sciences, Lund University

5. ***Indoor Positioning and Mapping Using Inertial Data and Depth Images***
   Joakim Rydell, Erika Bilock, Håkan Larsson
   Swedish Defence Research Agency (FOI)

17:30-18:30   **Annual SSBA meeting** (ITC/Aula)

19:00-   **Symposium Dinner at Eklundshof**

Wednesday, March 16

8:40-10:00   **Regular papers presentation**

ITC/Aula   **Session 3a: Medical image processing 3 – CT**

Chair: Mikael Persson, Linköping University

1. ***Quantitative dual-energy computed tomography using the base material decomposition in projection and image space***
   Maria Magnusson[1 2 3], David Ballestero Gómez[1], Michael Sandborg[2 3], Gudrun Alm Carlsson[2 3], Alexandr Malusek [2 3]
   [1]Computer Vision Laboratory, Department of Electrical Engineering, Linköping University
   [2]Medical Radiation Physics, Department of Medical and Health Sciences, Linköping University
   [3]Center for Medical Image Science and Visualization (CMIV), Linköping University

2. ***DeepSeg: Abdominal Organ Segmentation Using Deep Convolutional Neural Networks***
   Måns Larsson[1], Yuhang Zhang[1], Fredrik Kahl[1 2]
   [1] Chalmers University of Technology, Göteborg
   [2] Lund University

3. ***BoneSplit – A 3D Painting Tool for Interactive Bone Segmentation in CT Images***
   Johan Nysjö, Filip Malmberg, Ida-Maria Sintorn, Ingela Nyström
   Centre for Image Analysis, Department of Information Technology, Uppsala University

4. ***Signed Distance Fields for Modeling Surgical Guides and Plates from CT Images***
   Fredrik Nysjö, Pontus Olsson, Filip Malmberg, Ingrid B. Carlbom, Ingela Nyström
   Centre for Image Analysis, Uppsala University

8:40-10:00   **Session 3b: Image processing**

ITC/6140   *Chair: Omer Ishaq, Uppsala University*

1. ***Adaptive enhancement of micro-channels within the human mastoid bone based on local structure tensor analysis***
   Olivier Cros[1 2 4], Anders Eklund[1 3], Michael Gaihede[4 5], Hans Knutsson[1 2]
   [1] Department of Biomedical Engineering, Linköping University
   [2]Centre of Medical Imaging and Visualization, Linköping university hospital
   [3]Department of Computer and Information Science, Linköping university
   [4]Department of Otolaryngology, Head & Neck Surgery, Aalborg University Hospital, Denmark
   [5]Department of Clinical Medicine, Aalborg University, Denmark

2. ***Blind deconvolution of images degraded with mixed Poisson-Gaussian noise with application in Transmission Electron Microscopy***
   Buda Bajić[1], Joakim Lindblad[2 3], Nataša Sladoje[2 3]
   [1] Faculty of Technical Sciences, University of Novi Sad, Serbia
   [2] Centre for Image Analysis, Department of Information Technology, Uppsala University
   [3] Mathematical Institute, Serbian Academy of Sciences and Arts, Belgrade, Serbia

3. ***On the Equivalence of the Taut String Algorithm to the Rudin-Osher-Fatemi Denoising Model***
   Niels Chr Overgaard
   Centre for Mathematical Sciences, Lund University

4. ***Spectral Dimensionality Reduction using Autoencoder***
   Niclas Wadströmer, David Gustafsson
   Swedish Defence Research Agency (FOI)

10:00-10:30	**Coffee break + exhibition time**

10:30-12:00 **ITC/Aula**	**Invited talks: Perspectives on image processing** *Chair: Nataša Sladoje, Uppsala University*

Computer vision, perspectives from machine learning
Thomas Schön,
Division of Systems and Control, Dept. of Information Technology, Uppsala University

Image processing, perspectives from human-computer interaction
Mats Lind,
Division of Visual Information and Interaction, Dept. of Information Technology, Uppsala University

Image processing, perspectives from radiation therapy
Stina Svensson,
RaySearch Laboratories

12:00-13:15	**Lunch**

13:15-14:30 **ITC/Aula**	**Industrial presentations** *Chair: Erik Ringaby*

1. ***Industrial Machine Vision for Real-Time Applications – Examples and Technology***
   Combitech

2. ***Vision for automotive safety***
   Autoliv

3. ***Thermal cameras vs. pirates***
   Termisk Systemteknik

4. ***Deep learning in medical imaging from an industrial perspective***
   ContextVision

5. ***Face tracking and analysis***
   Visage Technologies

14:30-14:50	**Coffee break**

14:50-16:10	**Regular papers presentation**

ITC/Aula   **Session 4a: Image Segmentation**

Chair: Jennifer Alvén, Chalmers University of Technology

1. ***Optimal Cell Reconstruction of 3D Foam Images***
   André E. Liebscher, Claudia Redenbach
   Department of Mathematics, University of Kaiserslautern, Germany

2. ***Word segmentation in Historical Documents using Convolutional Neural Networks***
   Tomas Wilkinson, Anders Brun
   Department of Information Technology, Uppsala University

3. ***Global And Local Adaptive Gray-level Thresholding Based on Object Features***
   Petter Ranefall, Sajith Kecheril Sadanandan, Carolina Wählby
   Centre for Image Analysis and SciLifeLab, Uppsala University

4. ***Analysis of corneal endothelium using fast robust stochastic segmentation***
   Bettina Selig
   Centre for Image Analysis, Uppsala University

14:50-15:50   **Session 4b: Imaging**

ITC/6140   *Chair: Xuan Gu, Linköping University*

1. ***Detectors and Descriptors for IR Images***
   Johan Johansson[1], Atsuto Maki[1], Martin Solli[2]
   [1]KTH Royal Institute of Technology,
   [2]FLIR Systems AB

2. ***An Overview of the Thermal Infrared Visual Object Tracking VOT-TIR2015 Challenge***
   Amanda Berg[1,2], Michael Felsberg[1], Gustav Häger[1], Jörgen Ahlberg[1,2]
   [1] Computer Vision Laboratory, Dept. of Electrical Engineering, Linköping University
   [2] Termisk Systemteknik AB

3. ***Extended Dynamic Range and Suppression of Intense Lasers with a Digital Micromirror Device***
   Carl Brännlund, David Gustafsson
   Swedish Defence Research Agency (FOI)

16:10-16:15	**SSBA Symposium Closing**

Industrial presentations

Improving mammography with photon counting technology at Philips

Philips

Abstract:

In Sweden, breast cancer is the most common cancer decease for women, with an incidence that reached almost 10,000 cases in 2014. At Philips Mammography Solutions, we use the unique MicroDose technology to improve sensitivity and specificity in X-ray mammography, which is currently the best tool for breast cancer screening. Philips Mammography Solutions has a global R&D-organization, and the site in Solna, Sweden, is leading the research and advanced development of technology improvements and new mammography applications. MicroDose is a photon counting technology where the signal from each X-ray photon is analyzed. It also provides the only slot-scanning system present on the market, presently installed in 53 countries. These two features enable high image quality at a very low level of radiation dose to the tissue. They also create unique opportunities for future development, such as collection of 3D-information and spectral-imaging using measured photon energy for tissue separation, both achieved with a single exposure and thereby removing or minimizing the impact on patient work-flow and radiation dose. There is currently a transition from 2D to tomosynthesis which has in clinical studies shown potential to significantly improve the screening-performance. In Philips, there is ongoing work to develop tomosynthesis units based on the MicroDose technology and the development of image reconstruction algorithms, adapted to the specific features of the MicroDose technology, is a vital part of this work. Spectral imaging is employed to calculate breast glandularity content, which is an important indicator of cancer risk, but future development include full integration of the spectral information into the image reconstruction and the following image processing, thereby enhancing the diagnostic value of the images and also enabling specific advanced applications, e.g. lesion characterization and contrast enhanced imaging.

Time-of-flight and structured light 3D cameras in industrial applications

Fotonic

Abstract:

Fotonic develops and manufactures 3D cameras for industrial applications based on two different measurement principles: time of flight (TOF) and structured light triangulation.

 These technologies are suitable for different applications and both have their respective advantages and image data characteristics requiring special handling in application algorithms.

 In addition to 3D point cloud data, the TOF camera also outputs intensity information for every pixel and the structured light camera has an integrated RGB-camera. This allows for multi modal processing where both shape and texture is analyzed.

 Examples of applications based on Fotonic cameras are dimension measurement of goods, body fat measurement of cows, pallet detection, and obstacle detection for fork lifts.

Developing a consumer eye tracking device

Tobii

Abstract:

Eye tracking is a sensor technology that enables a device to know exactly where your eyes are focused.

To develop a simple eye tracker that works in controlled environments is not very difficult. To make a system that works for everyone, always, is enormously challenging. But for eye tracking to become a widespread technology within its respective application areas, this is a basic requirement.

To achieve this, machine learning approaches are used to make the algorithm data-driven and easy to adapt, and mathematical models are developed to approximate the complicated anatomy and physiology of the eye. Another essential part is to build up a tool chain which includes data collection, annotation, training, algorithm evaluation, result data analysis in a loop that facilitates research and development. This is essential to pinpoint problematic areas, and to direct time and effort to the right thing. In this talk, we will explain basics of eye tracking and give examples of simple but powerful practice in developing successful algorithms in an industrial setting.

Industrial Machine Vision for Real-Time Applications – Examples and Technology

Combitech

Abstract:

Combitech is one of the largest Scandinavian consultancy operators towards high technology industry. We are a competence partner to our customers, driven by the power of strong and often unusual combinations of skill, technology and personal resources.

In the field of Machine Vision, Combitech possesses such a strong combination in our team of engineers and our IP. Our consultants active in the Machine Vision field are all highly skilled in one of Combitech's core areas, software and systems engineering for embedded real-time systems. In addition, the team carries a strong body of knowledge in multidimensional signal processing. We have an SDK styled IP set, named Combitech Machine Vision, that enable fast prototyping as well as forming a basis for product grade development projects.

In our presentation at SSBA 2016, we will delve deeper into actual projects and success stories. There will be an emphasis on solutions for robust real-time implementations, as well as key algorithm aspects enabling unique customer specific solutions.

Vision for automotive safety

Autoliv

Abstract:

To save more lives and make the roads safer it is not sufficient to only use passive safety products, e.g., airbags and safety belts. It is also necessary to prevent accidents before they occur, using active safety technology. Modern cars will need to automatically brake when there is a risk of collision with a pedestrian or another vehicle. Furthermore, they must be able to prevent unintentional lane departures and understand road signs. In the future, this technology can be used for autonomous driving.

 In this presentation we will show some state-of-the-art techniques for vision-based active safety products. Central parts of these techniques are machine learning and computer vision. The algorithms must be able to run in real-time on limited hardware and handle challenging driving scenarios.

Thermal Cameras vs Pirates

Termisk Systemteknik

Abstract:

Termisk Systemteknik is involved in the anti-piracy project IPATCH, a European project developing a sensor system, a decision support system and a countermeasure manual for helping merchant vessels avoid pirate attacks. The talk will describe the project, how fun it is to play pirates, and the computer vision we apply to counter piracy on the high seas.

Deep learning in medical imaging from an industrial perspective

ContextVision

Abstract:

Deep learning is increasingly being used to develop automated systems for recognition of data patterns or features, e.g. facial recognition. The technology is however still in an early phase in medical imaging. Recently, ContextVision announced the ambition to grow their research team and broaden the technology platform to include artificial intelligence, in particular deep learning. We will present some of our initial research efforts on deep learning in medical image processing and imaging.

Face tracking and analysis

Visage Technologies

Abstract:

Visage Technologies will soon release the 8th generation of its SDK for face tracking and analysis. The talk will introduce the problems of face tracking and alignment, how the topic has involved the last decade and what is so much better now than before.

Exhibition

The industry exhibition will take place outside the Aula during all coffee and lunch breaks on Tuesday and Wednesday, March 15-16.

Take the chance to visit the companies listed below and learn more about their image analysis related activities, as well as their business in general.

Visage Technologies	
Combitech AB	
Fotonic	
Autoliv	
Tobii	
Philips – Digital Mammography	
Mapillary	
Unibap	
Vironova	