1 Doctorate degree - Dec 17, **1982**

Discipline: Computer and Information Science. Thesis title: *Filtering and Reconstruction in Image Processing*, Supervisor: Gsta Granlund, Linkping University, Sweden

2 Postdoctoral fellow - **1984 -1985**

The Rockefeller University, Laboratory of Neurobiology, New York, USA. (Headed by Nobel Laureate Torsten Wiesel.)

3 Docent degree - Oct, **1992**

Computer Vision, Linkping University, Sweden

4 Present Employment

Professor, July 2000 - present, Linkping University, Department of Biomedical Engineering, Division of Medical Informatics.

5 Previous Employment

Associate Professor, January 1986 - June 2000, Linkping University, Department of Electrical Engineering, Division of Computer Vision.

Visiting Professor, September 1998 - December 1998, Technical University of Denmark, Department of Mathematical Modeling, Section for Image Analysis.

Acting Professor, July 1990 - July 1991, Department of Electrical Engineering, Division of Computer Vision.

Postdoctoral Fellow, September 1984 - December 1985, The Rockefeller University, Laboratory of Neurobiology (Headed by Nobel Laureate Torsten Wiesel), New York.

Research Assistant, January 1976 - September 1984, Linkping University, Department of Electrical Engineering, Division of Computer Vision.

Image Processing Consultant (50% employment), January 1984 - September 1984 and January 1986 - April 1986, Context Vision AB, Linkping. (50% leave of absence from Linkping University.)

7 Research Log

Development of a new 3D radiological reconstruction method termed '**Ectomography**', [79].

Development of a theoretic framework for adaptive image filtering and analysis, [80] and [81]. The image processing company '*Context Vision*' was founded based on these results, see section 9.

Was invited by Nobel Laureate Torsten Wiesel to join The Rockefeller University in New York as Postdoctoral Fellow. Developed a new, surface charge based, model for ion flow through visual receptor cells which resulted in a publication in *Science*, [82].

Developed a novel method of representation and estimation of local structure of multi-dimensional signals using tensors and **tensor fields**,[2]. The use of tensor representations for local signal features, e.g. orientation and velocity, has had far reaching consequences for the continuance of the research of the group. The fundamentals of the methods developed has been published as a textbook that has more than 800 citations, [1]. A continuation of the work resulted in a method for high resolution local frequency and bandwidth estimation. The method was cited in *Science* as the best available tool for local wave-length estimation in MR elastography, [83].

Developed a method for handling irregularly sampled and uncertain data. The method was termed **Normalized Convolution** and is based on a filtering technique using a local signal space metric, [3]. The method has recently been extended to handle the real valued sample coordinates case, [84].

Advanced spatio-temporal filtering, registration and segmentation techniques are currently the main targets of research. The list of invited talks shows that the interest in the ideas brought forward by the group is high, see section 8. A good example is given by the introduction of **Canonical Correlation** based fMRI analysis, [21, 85].

Examples of more recent important results are: MR reconstruction of beating heart-sequences new approaches to image volume registration, [65] , a real-time fMRI brain-computer interface,[59] , denoising of 4D data sets using GPU:s, [16] , statistical evaluation of the SPM fMRI analysis software using 1484 rest data sets, [13], spine modeling, [11, 12], a matrix representation of local multidimensional phase, [24], generation of pseudo-CT from MR scans [9], optimization of sparse convolution networks [8] and a new framework for diffusion MRI [6].

8 Recent Invited Seminars

Finding optimal sets of acquisition sequences for dMRI of tissue micro-structure Harvard Medical School, Boston 2016.

Point charges and charged containers: A tool for distributing q-space samples
Harvard Medical School, Boston 2013.

What Defines Uniform Sampling of 3D orientations?
Harvard Medical School, Boston 2012.

HOPE: Higher Order Phase Estimation
Leibniz-Center for Informatics, Dagstuhl, Germany, December 2011.

Out of our Heads – *Real-time fMRI, DTI, Multi- dimensional Signal Processing and More*
IFM, LiU, December 2011.

Real Time fMRI
Norrkping Visualization Center, October 2010.

Towards Closure on Structure Tensor Estimation: Introducing Monomial Quadrature Filter Sets
Leibniz-Center for Informatics, Dagstuhl, Germany, July 2009.

9 Entrepreneurial achievements

Participated in the launching of the image processing company **Context Vision** AB in Linkping. Three important hardware designs were patented and tied to the company, e.g [86, 86, 87] The algorithms developed are still the core of many of the products currently supplied by the company.

Algorithms developed in the *Spatio-temporal Subtraction Angiography* project have been implemented as part of a commercial product by **SECTRA Imtec**. The core of the developed methods have been patented,[88]. Other patents due to my ideas concern visual analysis of ear drums, [89] and volume visualization, [90].

Perhaps the most important recent event, were I had a key role, is the launching of the **Center for Medical Image Science and Visualization** (CMIV) at Linkping University in 2003. The center presently involves more than 70 persons and brings together technical and medical researchers, industry and clinicians in a very creative environment. CMIV convinced Linkping University, Hospital and County to declare Medical Image Science and Visualization a strategic area granting substantial financial support.

10 Short list of Professional Activities

Member of the stergtland City Council delegation to Brussels in October 2011. Member of the scientific board of **CMIV** - Center for Medical Image Science and Visualization. Member of the program committee for the 3:rd tensor processing and visualization, Dagstuhl 2013. Evaluation of scientific qualifications for national and international professor appointments. Member of the review committee for national and international PhD theses. Reviewer for a number of international journals.

11 Research Grants

Listed below are major research grants covering 2016 and onwards. **Learning dMRI Sequence Sets for Optimal Tissue Microstructure Imaging**
- VR/Nt, total 2.550 kSEK, 2015-2017, Main applicant Hans Knutsson.

Seeing Organ Function
- KAW total 24.500 kSEK, 2014-2019, Main applicant Anders Ynnerman, My groups share $\approx$ 4.000 kSEK.

BENEFIT
- VINNOVA/ITEA3, 5.025 kSEK, 2014-2017 Main applicant Bjrn Andersson, ELEKTA, My groups share 3.573 kSEK.

Multidimensional Diffusion-MRI
- SSF (Applied mathematics), total 20.000 kSEK, 2014-2019, Main applicant Carl-Fredrik Westin, My groups share $\approx$ 8.000 kSEK.

Advanced MRI Methods for Functional and Stereotactic Neurosurgery
- VR (Industrial PhD-student program), 539 kSEK/year, 2013-2016, Main applicant ELEKTA. My groups share 539 kSEK/year.

Linkoping University Contract 2.000 kSEK/year, 2009-2018.

CADICS - Control, Autonomy, and Decision-making in Complex Systems - VR/LiU Linneaus research environment, 7.500 kSEK/year. Main applicant Lennart Ljung, My groups share 500 kSEK/year, 2008-2017.

12 Doctorate Student Supervision

Supervised fourteen PhD students to completion. The most recent to finish was Anders Eklund who successfully finished his PhD studies in April 2012. I am currently main supervisor for four PhD students.

13 Under graduate education

Participating in the development and lecturing for the new course *Medical Images* at LiU. Responsible for lecturing, course material, development and coordination of the course *Medical Image Analysis* at LiU. MRI lectures in the course *Biomedical Modelling and Simulation* at LiU.

14 Publications

The full list has more than 300 publications of which one text book, eight patents and more than 200 full papers in international journals, books or fully reviewed international conference proceedings. A total of 6182 citations and H-index = 35 (from Google Scholar March 31 2016).

Listed below are:

The five most cited publications, [1] - [5] Refereed journal papers since 2008, [6] - [22] Book chapters since 2008, [23] - [31]. Refereed international conference papers since 2007, [32] - [77]. Software since 2008, [78]. The remaining publications referred to in the text of my CV, [79] - [89].

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