

Curriculum Vitae  
Friedrich T. Sommer

**Current Address:**

Redwood Neuroscience Institute  
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**Current Position:**

2002-present Principal investigator, Redwood Neuroscience Institute, Menlo Park, CA  
2002-present Faculty member (Privatdozent), Computer Science Department, University of Ulm  
2004-present Visiting Scholar, University of Berkeley

**Education:**

***Degrees***

2002 Habilitation, Computer Science, University of Ulm  
  
1993 Ph.D., Physics, University of Düsseldorf  
  
1987 Diploma in Physics, University of Tübingen

***Postdoctoral Fellowships***

1994-1995 Section of Experimental Magnetic Resonance of the Central Nervous System,  
University of Tübingen  
  
1993-1994 Department of Neural Information Processing, University of Ulm

**Professional Experience:**

2002-2005 Principal Investigator, Redwood Neuroscience Institute, Menlo Park, CA, USA  
  
1996-2002 Assistant Professor, Computer Science Department, University of Ulm, Germany  
  
1999 Visiting scholar, Brain & Cognitive Science Department, MIT, Boston, USA  
  
1995-1996 Staff Scientist, Institute of Medical Psychology and Behavioral Neurobiology,  
University of Tübingen, Germany  
  
1988-1993 Research Assistant, Vogt-Institute of Brain Research and Neuroanatomy,  
University of Düsseldorf, Germany

## **Funding Support:**

### ***Intramural Awards***

1999-2001 Ph.D. student salary, University of Ulm

1997-1998 Ph.D. student salary, University of Tübingen

### ***Extramural Awards***

1999-2002 German governmental research award (funds 1 PI and 1 Postdoc position)  
Principal Investigator

1999-2000 Ph.D. student salary, German Society of Endomitriosis

1996-1999 Habilitation-Fellowship of the German Research Foundation (DFG)

## **Teaching Experience:**

### ***Lecture Courses***

2005 *Statistics of natural stimuli, a potential key to brain function*  
(University of Ulm), Lecturer

2003 *Computational Neuroscience (MCB262/PSYCH290P)*, University of California Berkeley, One of 4 Lecturers

2002 *Information Retrieval and Associative Memories*, University of Ulm, Lecturer

2001 *Computational Neuroscience*, University of Ulm, Lecturer

2000 *Theoretical Methods for the Interpretation of Medical Functional Imaging Data* University of Ulm, Lecturer

1998 & 2000 *Information Retrieval*, University of Ulm, Lecturer

1997 & 1998 *Associative Memories: Conventional and Neural*, University of Ulm, Lecturer

1997 *Neural Cell Assemblies*, University of Ulm, One of 2 Lecturers

### ***Ph.D. Students (co-adviser)***

2003-2005 Martin Rehn, doctoral candidate, Royal Institute of Technology, Stockholm

2003-2005 Xin Wang, doctoral candidate, University of Southern California

1999-2004 Andreas Knoblauch, Ph. D. 2004, University of Ulm

1997-2002 Axel Baune, Ph. D. 2002, University of Ulm

1994-1997 Wolfgang Kopold, Ph. D. 1997, University of Ulm

***Diploma/Master Students in Computer Science (advisor)***

- 2000-2002 Volker Schmitt, Diploma Thesis 2002, University of Ulm
- 1997-1999 Urs Vollmer, Diploma Thesis 1999, University of Ulm
- 1997-1999 Thomas Gunsch, Diploma Thesis 1999, University of Ulm

***Post Graduate Fellows***

- 2003-2005 Kilian Koepsell, Ph. D. Redwood Neuroscience Institute
- 1999-2003 Andrzej Wichert, Ph.D., University of Ulm

**University and Public Service:**

***Doctoral Committees***

- 2005 Christopher Tengrove, University of Technology, Sydney, Australia
- 2004 Dr. Andreas Knoblauch, University of Ulm, Germany
- 2004 Dr. Anders Sandberg, Royal Institute of Technology, Stockholm, Sweden
- 2001 Dr. Usha Sreedevi Sridar, University of Sydney, Australia
- 2000 Dr. Gracia Del Rosario, Saybrook Research Center, San Francisco, USA

***Miscellaneous***

- 2000 Imaging Center Development, University of Ulm, Planning Committee
- 1996-1999 Interdisciplinary seminar series on Theoretical Neuroscience at the Universities of Tübingen and Ulm, Organizer
- 1994 Exhibit of neural hardware for information retrieval, CeBit, Hannover, Germany, Presenter
- 1989-1991 Interdisciplinary seminar series on “Brain and Mind”, University of Düsseldorf, Organizer

**Other Professional activities:**

***Journal Reviews***

Biological Cybernetics

International Journal of Neural Systems

Journal of Theoretical Medicine

Neural Networks

Neural Computation

Neurocomputing

NeuroImage

NMR in Biomedicine

Public Library of Science – Biology

IEEE Signal Processing Letters

IEEE Transactions on Neural Networks

IT-Information Technology

Theory in Biosciences

### ***Conferences***

2005 Neural Information Processing (NIPS), Program Chair

2002 European Conference on Artificial Intelligence (ECAI), Lyon, France, Reviewer

2001 Annual Conference of the Cognitive Science Society, Edinburgh, UK, Reviewer

2000 International Joint Conference on Neural Networks (IJCNN), Como, Italy, Reviewer

1999 Fest-Symposium for Guenther Palm, University of Ulm, Germany, Organizer

1998 “Local and global information processing in the cortex” Schloss Reisenburg,  
Guenzburg, Germany, Planning Committee

### ***Workshops***

2003 Inference and prediction in neocortical circuits, American Institute of Mathematics, Palo Alto,  
Planning Committee

2002 Neural assemblies: development in theory and experiment, Computational Neuroscience Conference (CNS), Chicago, IL, 2002 (Proceedings published in Theory in Biosciences), Workshop Organizer

2000 Explorative analysis and data modeling in functional neuroimaging. Neural Information Processing Conference (NIPS), (Proceedings published by the MIT Press), Workshop Organizer

### ***National and international lectures***

- Testing cell assemblies with fMRI. Computational Neuroimaging Workshop, Organizers: B. Wandell and K. Grill-Spector, Stanford University, Palo Alto, USA, 7/2004
- Cortical inference with sparse associative memories. Workshop of the Canadian Institute of Advanced Research, Organizer: Geoffrey Hinton, Vancouver, Canada, 12/2003
- Associative memory with spiking neurons. Workshop “Inference and prediction in the cortex” American Institute of Mathematics, Palo Alto, USA, 9/2003
- Cell assemblies and associative memories. Department of Biomedical Engineering, University of Southern California, Los Angeles, USA, 11/2002
- Associative memory in neuronal networks: spatial and temporal coding. Workshop at the Computational Neuroscience Conference. Chicago, IL, USA, 7/2002
- Exploratory data analysis in event-related fMRI: Application on working memory. Department of Diagnostic Radiology and Applied Physics, Yale University, New Haven, CT, USA 7/2001
- Exploratory data analysis in functional neuroimaging. (Invited Lecture) 3rd Tutorial on Neuro-fMRI, Tuebingen, Germany 3/2001
- Dynamical cluster analysis for fMRI. Workshop at the Neural Information Processing Systems (NIPS) Conference, Denver, CO, USA 12/2000
- Analysis and Bayesian foundation of associative memory models. Max Planck Institute of Mathematics in the Sciences, Leipzig, Germany 7/2000
- Activation processes and information processing in the brain. University of Aachen, Germany, 5/1999
- Adaptive cluster analysis of functional magnetic resonance data. University of Düsseldorf, Germany 3/1999
- Improved retrieval in associative memories. Division of System & Circuit Technology, Heinz Nixdorf Institute, University of Paderborn, Germany 11/1998
- Cell assemblies and associative memory. Department of Brain and Cognitive Science, MIT, Boston, MA, USA 5/1998
- Neural associative memories: Models derived from probabilistic reasoning. Center for Biological and Computational Learning, MIT, Boston, MA, USA 3/1998

Simulation of a cortical network using anatomical data. (Invited Talk) Workshop on Information Processing in Cells and Tissues, IPCAT96, Düsseldorf, Germany 10/1996

Cell assemblies, associative memory and back. Max Planck Institute of Psychological Research, Munich, Germany, 3/1996

Neural information processing with local synaptic learning rules. Department of Psychology, University of Tübingen, Germany 11/1995

Iterative retrieval in associative memory. Computer Science Faculty, Technical University Munich, Germany, 11/1994

Neural associative memories as modules for information processing systems. Workshop "Neuronales Lernen", CoWAN '94, Technical University Cottbus, Germany, 10/1994

Iterative Retrieval of Sparsely Coded Associative Memory Patterns. NeuroNet '93 Conference, Prague, Czech Republic, 9/1993

Definitions and results of information capacity for associative memories. Symposium on Physics of Neural Networks, Bad Honnef, Germany, 2/1992

## **Publications:**

### ***Books***

1. Sommer F. T., Wichert A., Editors (2003) Exploratory analysis and data modeling in functional neuroimaging. MIT Press, Cambridge, MA, ISBN 0-262-19481-3
2. Sommer F. T. (1994) Theorie neuronaler Assoziativspeicher – Lokales Lernen und iteratives Retrieval von Information. Hänsel-Hohenhausen, Egelsbach, ISBN 3-89349-901-6

### ***Journal articles***

1. Rehn, M., Sommer, F. T. (2005) Early sensory representation in cortex optimizes information content in sparse sets of neurons. *in preparation*
2. Sommer, F. T., Wennekers T. (2005) Synfire chains with conductance-based neurons: internal timing and coordination with timed input. *Neurocomputing* 65-66:449-454
3. George, D., Sommer, F. T. (2005) Computing with inter-spike interval codes in networks of integrate and fire neurons. *Neurocomputing* 65-66:414-420

4. Martinez, J. M., Wang, Q., Reid, R. C., Pillai, C., Alonso, J.-M., Sommer F. T., Hirsch, J.A. (2005) Receptive field structure varies with layer in the primary visual cortex. *Nature Neuroscience* 8: 372 - 379
5. Knoblauch A., Sommer F. T. (2004) Spike-timing dependent plasticity can form “zero-lag” links for cortical oscillations. *Neurocomputing* 58-60:185-190
6. Glatting, G., Mottaghy, F. M., Karitzky, J., Baune, A., Sommer, F. T., Landwehrmeyer, G. B., Reske, S. N. (2004) Improving binding potential analysis in [11C]raclopride PET studies using cluster analysis. *Medical Physics* 31: 902-906
7. Hirsch, J.A., Martinez, J.M., Pillai, C., Alonso, J.-M., Wang, Q., Sommer F. T. (2003) Functionally distinct inhibitory neurons at the first stage of visual cortical processing. *Nature Neuroscience* 6 : 1300-1308
8. Knoblauch A., Sommer F. T. (2003) Synaptic plasticity, conduction delays and inter-areal phase relations of spike activity in a model of reciprocally connected areas. *Neurocomputing* 52-54:301-306
9. Sommer F. T., Wennekers T. (2003) Models of distributed associative memory networks in the brain *Theory in Biosciences* 122: 70-86
10. Knoblauch A., Wennekers T., Sommer F. T. (2002) Is voltage dependent synaptic transmission in NMDA receptors a robust mechanism for working memory? *Neurocomputing* 44-46:19-24
11. Sommer F. T., Wennekers T. (2001) Associative memory in networks of spiking neurons. *Neural Networks* 14: 825-834
12. Vollmer U., Sommer F. T. (2000) Coexistence of short and long term memory in a network of realistic neurons. *Neurocomputing* 38-40: 1031-1036
13. Sommer F. T., Wennekers T. (2000a) Modeling studies on the computational function of fast temporal structure in cortical circuit activity. *Journal of Physiology, Paris* 94: 473-488
14. Sommer F. T., Wennekers T. (2000b) Associative memory in a pair of cortical groups with reciprocal connections. *Neurocomputing* 38-40: 1575-1580
15. Sommer F. T. (2000) On cell assemblies in a cortical column. *Neurocomputing* 32-33: 517-522
16. Kötter R., Sommer F. T. (2000) Global relationship between anatomical connectivity and activity propagation in the cerebral cortex. *Philosophical Transactions of the Royal Society: Biological Sciences* 355: 127-134
17. Wennekers T., Sommer F. T. (1999) Gamma-oscillations support optimal retrieval in associative memories of Pinsky-Rinzel neurons. *Neurocomputing* 26-27: 573-578
18. Baune A., Sommer F. T., Erb M., Wildgruber D., Kardatzki B., Palm G., Grodd W. (1999) Dynamical cluster analysis of cortical fMRI activation. *NeuroImage* 6: 477-489

19. Sommer F. T., Palm G. (1999) Improved bidirectional retrieval of sparse patterns stored by Hebbian learning. *Neural Networks* 12: 281-297
20. Sommer F. T., Dayan P. (1998) Bayesian retrieval in associative memories with storage errors. *IEEE Trans. Neural Networks* 9: 705-713
21. Schwenker F., Sommer F. T., Palm G. (1996) Iterative retrieval of sparsely coded associative memory patterns. *Neural Networks* 9: 445-455
22. Palm G., Sommer F. T. (1992) Information capacity in recurrent McCulloch-Pitts networks with sparsely coded memory states. *Network* 3: 177-186
23. Frodl P., Sommer F. T., Hau K., Wahl F. (1990) On the effective interaction of two hydrogen centres in niobium. *Z. f. Naturforsch.* 43a: 857-866
24. Hau K., Frodl P., Gnirß M., Sommer F. T., Wahl F. (1989) A microscopic theory of a  $\alpha$ -phase hydrogen in niobium. *Z. f. physikalische Chemie* 163: 549-554
25. Hau K., Frodl P., Sommer F. T., Wahl F. (1988) A microscopic theory of a single hydrogen centre in niobium. *Z. f. Naturforsch.* 43a: 914-922
26. Sommer, F. T., Hau, K., Wahl F. (1988) Calculation of the excitation energies of a hydrogen impurity in niobium. *Z. f. Naturforsch.* 43a: 923-929

### **Book chapters**

1. Sommer F. T., Hirsch, J.A., Wichert A. (2003) Theories, data analysis, and simulation models in neuroimaging—An overview. To appear in *Exploratory analysis and data modeling in functional neuroimaging*, Eds. F. T. Sommer, A. Wichert, MIT Press, Cambridge, MA
2. Wichert A., Walter H., Grothe, J., Abler, B., Sommer F. T. (2003) Detection of task-related activity during working memory using event-related fMRI. To appear in *Exploratory analysis and data modeling in functional neuroimaging*, Eds. F. T. Sommer, A. Wichert, MIT Press, Cambridge, MA
3. Kötter R., Nielsen, P., Dyhrfeld, J., Sommer, F.T., Northoff, G. (2002) Multi-level integration of quantitative neuroanatomical data. *Computational Neuroanatomy: Principles and Methods*. Ed.: G. Ascoli, Humana Press Inc., Totowa, NJ
4. Baune, A., Wichert, A., Glatting, G., Sommer, F.T. (2001) Dynamical cluster analysis for the detection of microglia activation. *Artificial Neural Nets and Genetic Algorithms*. Eds. V. Kurkova, N. C. Stelle, R. Neruda, M. Karny. Springer, Wien 442 - 445

5. Wichert A., Baune A. Grothe J., Grön G., Walter H., Sommer F. T. (2001a) Interpretation of event-related fMRI using cluster analysis. *Artificial Neural Nets and Genetic Algorithms*. Eds. V. Kurkova, N. C. Stelle, R. Neruda, M. Karny. Springer, Wien 446 - 448
6. Wichert, A., Kestler, H., Walter, H., Groen, G., Baune, A., Grothe, J., Wunderlich, A., Sommer, F.T. (2001b) Explorative detection of delay activity during a working memory task. *Proceedings 4th International Conference on Neural Networks and Expert Systems in Healthcare*. Ed. G. M. Papadourakis. Technological Educational Institute of Crete, Heraklion 266 - 271
7. Sommer F. T., Wennekers T., Palm G. (1998) Bidirectional completion of cell assemblies in the cortex. In *Computational Neuroscience: Trends in Research 1998*, Plenum Press, New York
8. Sommer F. T., Palm G. (1998) Bidirectional retrieval from associative memory. In *Advances in Neural Information Processing Systems 10*, MIT Press, Cambridge, MA, USA, pp. 675 - 681
9. Sommer F. T., Kötter R. (1997) Simulating a network of cortical areas using anatomical connection data in the cat. In *Computational Neuroscience: Trends in Research 1997*, Plenum Press, New York, pp. 511-517
10. Palm G., Schwenker F., Sommer F. T., Strey A. (1997) Neural associative memory. In *Associative Processing and Processors*, Eds. A. Krikelis, C. C. Weems. IEEE CS Press, Los Alamitos, CA, USA, pp. 307-326
11. Sommer F. T., Schwenker F., Palm G. (1995) Assoziative Speicher als Module in informationsverarbeitenden Systemen. In *Contributions to the workshop Aspekte Neuronalen Lernens*, Eds. L. Cromme, J. Wille, T. Kolb. TU Cottbus Press, 109-122
12. Wennekers T., Sommer, F. T., Palm G. (1995) Iterative retrieval in associative memories by threshold control of different neural models. In *Supercomputers in Brain Research: From Tomography to Neural Networks*, Eds. H. J. Herrmann, D. E. Wolff, E. Pöppel. World Scientific, Singapore, pp. 301-319
13. Palm G., Sommer F. T. (1995) Associative data storage and retrieval in neural nets. In *Models of Neural Networks III*, Eds. E. Domany, J. L. van Hemmen, K. Schulten. Springer, New York, pp. 79-118
14. Palm G., Sommer F. T. (1994) Associative memory and sparse similarity preserving codes. In *From Statistics to Neural Networks: Theory and Pattern Recognition Applications*, Ed. V. Cherkassky. Springer NATO ASI Series F, New York, pp. 282-302
15. Palm G., Sommer F. T. (1991) Information and pattern capacities in neural associative memories with feedback for sparse memory patterns. In *Neural Network Dynamics*, Eds. J. G. Taylor, E. R. Caianello, R. M. J. Cotterill, J. W. Clark. Springer, New York, pp. 3-18

***Selected recent abstracts***

- Koepsell, K., Wei, Y., Wang, Q., Wang, X., Hirsch, J. A., Sommer F.T. (2004) Spike timing in thalamic relay cells during natural stimuli. Soc. Neurosci. Abstr.
- Wang, X., Wang, Q., Wei, Y., Koepsell, K., Sommer F.T. Hirsch, J. A. (2004) Retinal and local contributions to the thalamic receptive field. Soc. Neurosci. Abstr.
- Wichert, A., Walter, H., Groen, G., Baune, A., Grothe, J., Wunderlich, A., Sommer F.T. (2001d) Interpretation of event-related fMRI using cluster analysis. Neuroimage (13) (2001) 282
- Ruckgaber, J., Glatting, G., Karitzky, J., Baune, A., Sommer, F.T., Neumaier, B., Reske, S.N. (2001) Clusteranalyse in der Positronen-Emissions-Tomographie des Hirns mit C-11-PK11195. Nuklearmedizin (40) (2001) A95
- Baune, A., Erb, M., Sommer, F.T., Wildgruber, D., Klose, U., Grodd, W. (1997) Evaluation of fast fMRI measurements in motorcortex: comparing a new cluster analysis with z-mapping. Experimental Brain Research, Vol. 117, Suppl. 50