Annual Report 1996

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Contents

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1.2 Personnel

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Scientific staff

Bernard Achermann; Stephan Amann; Thomas Bebie; Hans-Peter Blau; Bernhard Bühlmann; Andrey Collison; Juan Carlos Cruz; Dr. Serge Demeyer; Luca Deri; Stephane Ducasse; Matthias Günter; Dr. Tien M. Ha; Dr. Wolfgang Heinle; Alain Heuerding; Dr. Xiao-Yi Jiang; Reinhard Kahle; Guido Kaufmann; Josef Kleinle; Markus Lumpe; Willem Mallon; Urs-Viktor Marti; Dr. Theo Dirk Meijler; Marco Menna; Dr. Bruno Messmer; Simon Moser; Dr. Lorenz Müller; Tamar Richner; Rudi Scheurer; Jean-Guy Schneider; Stefan Schwendimann; Dr. Walter Senn; Michael

Seyfried; Karin Sobottka; Dr. Jürg Stiefenhofer; Thomas Strahm; Christoph Streit; Dr. Daniel Toggweiler; Dr. Werner Volken; Werner Wolff; Dr. Kuno Wyler; Keren Yu; Heinrich Zimmermann.

2 Research Group on Computational Geometry and Graphics

2.1 Personnel

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2.2 Research Projects

d-dimensional general polyhedra

These polyhedra, now normally called "Nef polyhedra", are those subsets of R^d which can be obtained by applying finitely many Boolean set operations to a finite number of linear halfspaces. The project extends the theory of Nef polyhedra, develops and analyses appropriate data structures and prepares an object-oriented implementation of the kernel of a solid modeler for working with Nef polyhedra.

Research staff: H. Bieri, W. Nef

BOOGA

BOOGA (Berne's Object-oriented Graphics Architecture) is an object-oriented framework for integrating techniques from geometric modelling, computer graphics (2D and 3D), computer vision and image processing. Primarily, it is a system to investigate new approaches in computer graphics.

Main fields of interest are the combination of various illumination models, the generation of 3D scene descriptions based on various inputs (sketches, photographs, etc.) and innovative user interaction techniques. Traditional approaches in computer graphics are generalized to achieve a common underlying model for a number of existing algorithms.

Research staff: St. Amann, P. Habegger, Ch. Streit, Th. Teuscher

BOOGA Extensions for Virtual Reality Applications

Several extensions are added to the graphics framework BOOGA to realize virtual reality applications intended to become tools for urban planning. 3D acceleration techniques are implemented on common UNIX workstations without specialized graphics hardware to allow interactive walkthroughs of large urban scenes. A parallel raytracer has been developed on the IBM SP2 parallel computer, especially for the fast computation of photorealistic images of complex 3D scenes. Specialized 3D objects are added to BOOGA to simplify the modeling of buildings and whole complexes of buildings.

Research staff: B. Bühlmann, Th. Matthey.

Graphics Database

The goal of this project is to develop a database capable of storing and retrieving various kinds of graphical objects (e.g. 2D and 3D models, L-systems, fractal objects, surfaces, textures, geometric scenes and rendered images). The system shall enable the user (typically a designer) to quickly compose new scenes by combining and modifying existing objects stored in the database. The main challenge is to find efficiently the objects relevant to the user. In order to solve this problem various content based retrieval methods are developed and tested using the BOOGA framework.

Research staff: A. Collison

SoccerMan

The goal of this project consists in generating 3D information from a motion picture sequence of a soccer game. The principal subtasks are: Locating key features of the playground in an initial frame, tracking these features in subsequent frames, calibrating the camera, locating the players in subsequent frames, computing a player's 3D location, finding a player's 2D shape, reconstructing a player's 3D body posture. A specialized method for camera calibration has been developed. This method computes the camera's position, its orientation, focus and aspect ratio from very few known features in the image sequence.

Research staff: Th. Bebie, A. Tschäppeler

2.3 Diploma Theses

- R. Bächler: Design and Implementation of a NURBS Library.
- B. Frei: An Extension of Radiosity with Textures.
- B. Grossniklaus: Design and Implementation of a CD-i Application.
- P. Habegger: A Graphical Structure Browser.
- Th. Teuscher: Shading Languages.

2.4 Further Activities

- Participation in Computer Graphics 96, Zürich (St. Amann, B. Bühlmann, Ch. Streit).
- Member of the Program Committee for CSG 96, Winchester (H. Bieri).
- Co-Organizer of the Dagstuhl Seminar 9622 on Geometric Modelling (H. Bieri).
- Participation in the Interop Tradeshow in Atlanta (B. Grossniklaus).
- Reviewing for Solid Modeling 98 (H. Bieri).

2.5 Publications

- Bieri, H: Two Basic Operations for Nef Polyhedra. In Woodwark, J. (Ed.): CSG 96 Set-theoretic Solid Modelling: Techniques and Applications, 337-356. Informations Geometers Ltd., 1996.
- Bieri, H., Schmidt, P.-M.: On the Permutations Generated by Rotational Sweeps of Planar Point Sets. In Proceedings of the 8th Canadian Conference on Computational Geometry, 179-184, Ottawa 1996.
- Bieri, H.: APL. In Hazewinkel, M. (Ed.): Encyclopaedia of Mathematics, Vol. 10, Kluwer Academic Publishers, 1996.
- Bieri, H: Representation Conversions for Nef Polyhedra. Submitted.
- Dubuis, E.: Graphical User Interfaces: Mess them up! In Proceedings of the Fourth International Conference in Central Europe on Computer Graphics and Visualization, Vol. 1, 71-78, Pilsen 1996.
- Dubuis, E.: Improved Visibility Computation for Clustering in Radiosity. Technical Report IAM-96-003.
- Amann, St., Streit, Ch., Bieri, H.: BOOGA - A Component-Oriented Framework for Computer Graphics. Technical Report IAM-96-017.

3 Research Group on Computer Vision and Artificial Intelligence

3.1 Personnel

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	Dr. B. Messmer*	until January 1996
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	K. Yu*	Tel: +41 31 631 33 23 e-mail: yu@iam.unibe.ch
Guests:	K. Shearer	November & December
	S. Campell	November & December
	Prof. J. Csirik	December
	Prof. K. Bowyer	December
	Prof. D. Goldgof	April 1996
	Prof. T. Caelli	September 1996
	J. Llados*	February 1996

* with financial support from a third party

3.2 Research Projects

Range Image Analysis

The research in range image analysis is continued by the development of new segmentation techniques and methodologies for experimentally evaluating both edge- and region-based range image segmentation algorithms. We are working on near-optimal edge detection in range images and complete segmentation based on edge detection. Earlier works on evaluating range image segmentation techniques are extended to the domain of curved surfaces.

Research staff: Dr. X.-Y. Jiang

Range Image Sequence Analysis

The purpose of this project is to develop reliable presence detection systems based on range image sequences. Due to low resolution (32x32), incompleteness and ambiguity of the data, the interpretation needs novel approaches and innovative techniques in the field of image sequence processing. As application we consider the problem of obstacle detection in traffic scenes, but there are many more areas, e.g. surveillance and security, that would benefit from the availability of such systems.

Research staff: K. Sobottka, Dr. X.-Y. Jiang

Financial Support: Swiss National Science Foundation (Schwerpunktprogramm OPTIQUE II)

Document Image Analysis and Understanding

A variety of problems occuring in the context of document image analysis are being investigated. These include the processing and recognition of both machine printed and handwritten documents. Current focus is on handwriting recognition, particularly its applications in postal check reading and general text recognition.

Research staff: Dr. T.M. Ha, G. Kaufmann, U.-V. Marti

Financial support: Swiss National Science Foundation (Schwerpunktprogramm Informatikforschung)

Efficient Graph Matching Algorithms

In this project, efficient algorithms for exact and error-tolerant attributed graph matching are developed. The basic idea in improving the efficiency of graph matching algorithms lies in suitable preprocessing procedures for prototype, or model, graphs. By means of these preprocessing procedures, the complexity of the actual matching step can be reduced.

Research Staff: Dr. B.T. Messmer, Prof. Dr. H. Bunke and external partners

Financial support: Swiss National Science Foundation (Schwerpunktprogramm Informatikforschung)

Structural and Syntactic Pattern Recognition

The key idea in structural and syntactic pattern recognition is the representation of patterns by means of symbolic data structures such as strings, trees, and graphs. In order to recognize an unknown pattern, its symbolic representation is compared with

a number of prototypes stored in a database. In this project, we aim at developing new symbolic matching and parsing algorithms for a variety of applications.

Research staff: Prof. Dr. H. Bunke

Automatic Lipreading

The basic idea in automatic lipreading is to extract significant features from sequences of lip images. These features are used for model construction and recognition of unknown words. In this project we develop robust methods and study possibilities of their combination.

Research staff: K. Yu, Dr. X.-Y. Jiang

Analysis of Human Face Images

Analysis of human faces with computers is nowadays a very active research area. Though the first activities date back to the sixties, there are still many unsolved problems (e.g., variations of illumination or different head positions). The focus of our investigations is on range images of human faces. Furthermore, we combine different methods in order to get more robust results.

Research staff: B. Achermann, X.-Y. Jiang, K. Yu

3.3 Diploma Theses

- Ammann, R.: Rekonstruktion von on-line Information in der Handschrifterkennung (Reconstruction of on-line information for cursive script recognition)
- Gonin, R.: Benutzerfreundliches Online-Korrektursystem für LaTeX-Dokumente (Userfriendly on-line correcting system for LaTeXdocuments)
- Hadorn, M.: Vorauswahl von Testmodellen beim Einsatz von Hidden Markov Modellen in der Handschriftenerkennung (Hidden Markov model preselection for handwriting recognition)
- Zimmermann, M.: Maschinelle Erkennung handgeschriebener Zahlen (Recognition of handwritten numerals)
- Marti, U.-V.: Kombination von neuronalen Netzen und Hidden Markov Modellen für die Erkennung kursiver Handschrift (Combination of neural networks and hidden Markov models for cursiv handwriting recognition)

3.4 Awards and Further Activities

Awards

- B. Messmer received the *Preis der Fächergruppe Mathematik* 1996 for his PhD thesis.
- H. Bunke has become a Fellow of the IAPR (Int. Association for Pattern Recognition).

Visits

- H. Bunke was visiting professor at the University of South Florida, Tampa, from July 1 to August 15.

Editorial Boards and Technical Committees

- Editor-in-charge of the International Journal of Pattern Recognition and Artificial Intelligence by World Scientific Publ., Singapore (H. Bunke)
- Member of the editorial board of Acta Cybernetica (H. Bunke)
- Editor-in-chief of the book series Machine Perception and Artificial Intelligence by World Scientific Publ., Singapore (H. Bunke)
- Member of the Technical Committee on Structural and Syntactic Pattern Recognition of the International Association for Pattern Recognition (IAPR) (H. Bunke)

Organization and Program Committees

- Member of Program Committee of IEEE/SICE/RSJ Int. Conference on Multisensor Fusion and Integration for Intelligent Systems, Washington, D.C., December 8-11, 1996 (X. Jiang)
- Member of Technical Program Committee of the IEEE Int. Conf. on Image Processing, Lausanne, September 16-19, 1996 (T. M. Ha)
- Finance Chair of the IEEE Int. Conference of Image Processing, Lausanne, September 16-19, 1996 (H. Bunke)
- Member of Program Committee of IAPR Workshop on Document Analysis Systems, Malvern, Pa., October 14-16, 1996 (H. Bunke)
- Member of Program Committee of Int. Conference on Pattern Recognition, Vienna, August 26-29, 1996 (H. Bunke)

- Member of Program Committee of 3rd Int. Colloquium on Grammatical Inference, Montpellier, September 25-27, 1996 (H. Bunke)
- Member of Program Committee of 3rd IEEE Workshop on Applications of Computer Vision, Sarasota, Fl, December 2-4, 1996 (H. Bunke)
- Member of Program Committee of Int. Workshop on Structural and Syntactic Pattern Recognition, Leipzig, August 20-23, 1996 (H. Bunke)
- Member of Program Committee of IAPR Workshop Machine Perception Applications, Graz, September 2-4, 1996 (H. Bunke)
- Member of Program Committee of DAGM-Symposium Mustererkennung, Heidelberg, September 11-13, 1996 (H. Bunke)

Seminar

- A Dagstuhl Seminar on "Modelling and Planning for Sensor-based Intelligent Robot Systems" was held from September 2-6, 1996. This seminar was jointly organized by R. Bolles (SRI International, Menlo Park, Ca.), H. Bunke, and H. Noltemeier (University of Würzburg)

3.5 Publications

Books

- Jiang, X., Bunke, H.: Dreidimensionales Computersehen - Gewinnung und Analyse von Tiefenbildern, Springer Verlag, 1996

Journal Papers

- Hoover, A., Jean-Baptiste, G., Jiang, X., Flynn, P., Bunke, H., Goldgof, D., Bowyer, K., Eggert, D., Fitzgibbon, A., Fisher, R.: An experimental comparison of range image segmentation algorithms, IEEE Trans. on PAMI, Vol. 18, No. 7, 1996, 673 - 689
- Jiang, X., Yu, K., Bunke, H.: Detection of rotational and involutional symmetries and congruity of polyhedra, The Visual Computer, Vol 12, No 4, 1996, 193 - 201

Refereed Papers in Conference Proceedings and Edited Books

- Robmann, R., Bunke, H.: An edge labeling scheme for polyhedra in incomplete range images, in Borgefors, G. (ed.): Theory and Applications of Image Analysis II, World Scientific, Singapore, 1995, 53 - 64

- Bunke, H.: Edit distance of regular languages, Proc. 5th Annual Symposium on Document Analysis and Information Retrieval, Las Vegas, 1996, 113 - 124
- Messmer, B. T., Bunke, H.: Automatic learning and recognition of graphical symbols in engineering drawings, in R. Kasturi, K. Tombre (eds.): Graphics Recognition, Lecture Notes in Computer Science 1072, Springer Verlag, 1996, 123 - 134
- Kaufmann, G., Bunke, H., Ha, T.M.: Recognition of cursively handwritten words using a combined normalization/perturbation approach, in Proc. 5th Int. Workshop on Frontiers in Handwriting Recognition, 1996, 17 - 22
- Jiang, X., Bunke, H.: Including geometry in graph representations: a quadratic time isomorphism algorithm and its applications, in Perner, P., Wang, P., Rosenfeld, A. (eds.): Advances in Structural and Syntactic Pattern Recognition, Springer Verlag, Lecture Notes in Computer Science 1121, 1996, 110 - 119
- Achermann, B., Bunke, H.: Combination of face classifiers for person identification, Proc. 13th Int. Conference on Pattern Recognition, 1996, Vol III, 416 - 420
- Yu. K., Jiang, X., Bunke, H.: Robust facial profile recognition, Proc. IEEE Int. Conf. on Image Processing, 1996, 491 - 494
- Kaufmann, G., Ha, T.M., Bunke, H.: Einsatz eines Perturbation-Ansatzes fuer die Erkennung handgeschriebener deutscher Grundzahlwörter, in B. Jaehne et al. (Hrsg.): Mustererkennung 1996, Springer Verlag, Informatik Aktuell, 1996, 63 - 70
- Jiang, X., Meier, U., Bunke, H.: Schnelle Segmentierung von Tiefenbildern, in B. Jähne et al. (Hrsg.): Mustererkennung 1996, Springer Verlag, Informatik Aktuell, 1996, 400 - 407
- Messmer, B.T., Bunke, H.: Clustering and error-correcting matching of graphs for learning and recognition of symbols in engineering drawings, in Proc. Workshop on Document Analysis Systems, Malvern, Pennsylvania, 1996, 282 - 296
- Messmer, B.T., Bunke, H.: Subgraph isomorphism detection in polynomial time on preprocessed model graphs, in Li, S.Z., Mital, D.P., Teoh, E.K., Wang, H.(eds.): Recent Developments in Computer Vision, Springer Verlag, Lecture Notes in Computer Science 1035, 1996, 373 - 382
- Ha, T.M., Bunke, H., Kaufmann, G.: Perturbation models: a new approach to improving handwriting recognition, Proc. MVA'96 IAPR Workshop on Machine Vision Applications, Tokyo, 1996, 151 - 159

- Jiang, X., Bunke, H.: Robust and fast edge detection and description in range images, Proc. MVA'96 IAPR Workshop on Machine Vision Applications, Tokyo, 1996, 538 - 541

- Jiang, X., Meier U., Bunke, H.: Fast range image segmentation using high-level segmentation primitives, Proc. 3rd IEEE Workshop on Applications of Computer Vision, Sarasota, Florida, 1996, 83 - 88

- Ha, T.M.: An optimum class-selective rejection rule for pattern recognition, Proc. ICPR'96, Vol. II, Aug. 25-30, 1996, Vienna, Austria, 75-80

- Ha, T.M.: On functional relation between class-selective rejection error and average number of classes, IEEE International Symposia on Intelligence and Systems, Nov. 4-5, 1996, Rockville, Maryland, U.S.A., 282-287

Technical Reports

- Bunke, H., Liviero, R.: Classification and postprocessing of documents using an error-correcting parser, Technical Report IAM-96-001, University of Bern, 1996

- Achermann, B., Bunke, H.: Combination of classifiers on the decision level for face recognition, Technical Report IAM-96-002, University of Bern, 1996

- Ha, T.M.: On functional relation between recognition error and class-selective reject, Technical Report IAM-96-007, University of Bern, 1996

- Ha, T.M.: An experimental study of the optimal class-selective rejection rule, Technical Report IAM-96-008, University of Bern, 1996

- Ha, T.M.: Application of the optimal class-selective rejection rule to the detection of abnormalities in OCR databases, Technical Report IAM-96-009, University of Bern, 1996

- Messmer, B., Bunke, H.: Fast error-correcting graph isomorphism based on model precompilation, Technical Report IAM-96-012, University of Bern, 1996

- Ha, T.M., Bunke, H.: Design, implementation, and testing of perturbation method for handwritten numeral recognition, Technical Report IAM-96-014, University of Bern, 1996

- Jiang, X., Bunke, H.: Robust edge detection in range images based on scan line approximation, technical Report IAM-96-016, University of Bern, 1996

4 Research Group on Theoretical Computer Science and Logic

4.1 Personnel

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Guests:	Prof. Dr. R. Bornat	(November)
	U. Dunker	(April)
	Dr. L. Hendriks	(May)
	Dr. I. Niemelä	(November)
	Prof. Dr. V. Sazonov	(June)

4.2 Research Projects

Logic and computation

This very general project deals with the close connections between mathematical logic and certain parts of computer science, and emphasis is put on a proof-theoretic approach to some of the central questions in this area of research. These include the development of perspicuous and feasible logical frameworks for studying typical questions in computer science like termination and correctness of functional programs, properties of distributed systems and the like.
We study applicative theories as well as strongly typed formalisms and are interested in the connections to constructive and explicit mathematics. Furthermore, we are interested in analyzing the close connections between the complexities of computations and proofs in suitable formalizations, ranging from propositional calculi up to abstract frameworks for computations (in higher types).
Some of the relevant key-words are: Proofs as computations, formulas as types, polymorphism, flexible typing, explicit and constructive mathematics, universes of types, theories of types and names, functional programming, distributed computing.

Research staff: All members of research group.

Algebraic and logical aspects of knowledge processing

In collaboration with Prof. Dr. E. Engeler, ETH Zürich.

Several research problems from the general area of knowledge representation are being investigated. They are directed toward the mathematical foundation of this area and refer to algebraic and logical questions. The work of the group in Berne emphasizes the logical basis of knowledge representation. One of the first and most important steps in a logical approach to knowledge representation is the development and analysis of adequate formal frameworks, both from a declarative and procedural point of view. Depending on the context, various logical formalisms (e.g. applicative theories, type theories, modal logics, etc.) have turned out to be extremely useful. We focus on questions involving structural properties of suitable logical formalisms, and the interplay between logic and computation.

Research staff: W. Heinle, G. Jäger, R. Kahle, Th. Strahm, V. Sazonov, H. Zimmermann.

Financial Support: Swiss National Science Foundation.

A Frame for Networked Components

In collaboration with Dr. H. Lienhard, IvyTeam, Zug.

A frame for Networked Components is part of the *Virtual Software House (VSH)* project package. The object is to develop a powerful, executable frame for network

components that can be used to assemble complex model components from elementary units. In addition to drawing up mathematically based rules of composition, this requires the development of suitable interface definitions to fit the individual parts into the frame. The point of departure is previous work (supported by the SPP IF) of the IvyTeam and our research group here in Bern concerning the component structure of BusinessSpecs 2.0, developed by IvyTeam, Zug. The biggest challenge now is to match components of different providers accessible via the VSH in the simplest possible manner, addressing the end-user (e.g. the organizer of a business process reengineering project) rather than the software engineer.
This goal demands a strictly mathematical approach to the problem, while nonetheless concealing the mathematical mechanisms from the end-user. Instead, the end-user is provided with easy-to-operate composition plans featuring intuitive semantics.

Research staff: P. Brambilla, G. Jäger

Financial support: Swiss National Science Foundation (Schwerpunktprogramm Information und Kommunikation)

Non-Deterministic Aspects of Information Refinery in Distributed Environments

In collaboration with Prof. Dr. B. Schmid, Universität St. Gallen (HSG).
Aim of this project is to investigate non-deterministic algorithms which have practical relevance for defining agents in open system environments. The project will be focused on specific non-deterministic problems occurring in searching, collecting, and integrating information, especially quantitative information, within open system environments.
More specifically, the question is to define the behaviour of a information refinery process or agent that acts in a distributed, open environment and delegates specific subtasks to other available information processing agents. In this sense, such an agent can be considered as an information vendour/arbitrageur. Since in an open system environment there is no centralised control, such a cooperation has to deal with non-deterministic behaviour of other agents. This interaction can be seen as coordinated by market forces — a perspective taken on from the Competence Center "Electronic Markets" at HSG (IWI4) whose overall research goal is the introduction of market mechanisms into information processing. Practical applications arise in the fields of information management, information refinery, and data mining.
The project is based on research results achieved in cooperation between the University Bern (Prof. Jäger) and HSG (Prof. Schmid) within the SNF project *Representation and automatic evaluation of empirical, especially quantitative knowledge* (No. 5003-34372).

Research staff: G. Jäger, W. Th. Wolff

Financial support: Swiss National Science Foundation

Distributed propositional proof systems
The Logics Workbench LWB

The research project *distributed propositional proof systems* is centered around the concept of distribution in a logical context and comprises a theoretical as well as a practical component. In the theoretical part we study the structure of logical algorithms modulo a distributed environment. Special emphasis is put on questions concerning non-classical deductive systems and (distributed) proof search in those, and in developing new and more powerful methods, which form the basis of our practical work.
On the practical side we produce an extension of our present Logics Workbench LWB, which improves its performance by making advantage of available techniques of distributed computing. We make use of existing tools (e.g. PVM), such that we can concentrate on the logical and foundational aspects.
An important aspect is to shift the emphasis from worst-case behaviour to some realistic form of average case behaviour in the field of distributed logical environments.
The Logics Workbench LWB is currently ported to the Macintosh operating system. While most of the basic algorithms can be reused, the graphical user interface has to be completely rewritten. This is done using object oriented techniques in conjunction with an Macintosh specific object oriented GUI library.
At the same time, it was necessary to adjust and modify our implementation details, in order to be able to use the same base algorithms for Macintosh and for Solaris versions.

Research staff: P. Balsiger, R. Bornat, U. Dunker, R. Goré, L. Hendriks, A. Heuerding, G. Jäger, I. Niemelä, S. Schwendimann, M. Seyfried

Financial support: Swiss National Science Foundation

4.3 Diploma Thesis

- P. Brambilla. Sequent Calculus Proof Representation.

4.4 Ph.D. Thesis

- Th. Strahm. On the Proof Theory of Applicative Theories.

4.5 Further Activities

Editorial Board and Technical Committees

- Member of the editorial board of *Theoretical Computer Science* (G. Jäger).
- Member of the editorial board of *Journal of Symbolic Logic* (G. Jäger).

- Member of the *CICUS (Commission pour l'informatique, conférence universitaire suisse)* (G. Jäger).

Program Committees

- Member of the program committee of *Computer Science Logic CSL '96* (G. Jäger).
- Member of the program committee of *Extensions of Logic Programming ELP '96* (G. Jäger).
- Member of the program committee of the *Swiss Computer Science Society* (G. Jäger, Th. Strahm).

Conferences and Workshops

- *Theoretische Informatik in der Schweiz.* Workshop auf Schloß Münchenwiler (E. Engeler, G. Jäger).
- *Workshop on Applicative Theories and Explicit Mathematics, WATEM '96* in Bern (G. Jäger, Th. Strahm)
- *Deduktive Aspekte von Beweistheorie und Informatik* in Bern (G. Jäger, H. Schwichtenberg)
- *Logik und Informatik.* Workshop im Centro Stefano Franscini, Monte Veriá, Ascona (E. Engeler, G. Jäger).
- *Deduktive Aspekte von Beweistheorie und Informatik* in München (G. Jäger, H. Schwichtenberg)

4.6 Publications

- S. Feferman, G. Jäger. Systems of explicit mathematics with non-constructive μ-operator, Part II. *Annals of Pure and Applied Logic*, 79, 1996.
- Th. Glass, Th. Strahm. Systems of explicit mathematics with non-constructive μ operator and join. *Annals of Pure and Applied Logic*, 82, 1996.
- R. Goré, W. Heinle, A. Heuerding. Relations between propositional normal modal logics: an overview. *Journal of Logic and Computation.* To appear.
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- G. Jäger, Th. Strahm. Some theories with positive induction of ordinal strength $\varphi\omega 0$. *Journal of Symbolic Logic*, 61(3), 1996.
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- R. Kahle. Frege structures for partial applicative theories. Technical Report IAM-96-013, Institut für Informatik und angewandte Mathematik, Universität Bern, 1996.
- M. Marzetta, Th. Strahm. The μ quantification operator in explicit mathematics with universes and iterated fixed point theories with ordinals. Submitted.
- H. Schlingloff, W. Heinle. Relation Algebra and Modal Logics. Chapter 5 in C. Brink, W. Kahl, G. Schmidt, editors, *Relational Methods in Computer Science*. Springer Verlag, 1996.
- B. Schmid, G. Geyer, W. Wolff, R. Schmid, K. Stanoevska-Slabeva. Representation and Automatic Evaluation of Empirical, especially Quantitative Knowledge. Technical Report HSG/IWI/SNF-5003-34372/8, Institut für Wirtschaftsinformatik, Universität St. Gallen, 1996.
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5 Research Group on Neurocomputing

5.1 Personnel

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* financial support from a third party.
§ from 1.11.96-31.4.97 W. Senn is visiting scientist at the Dept. of Neurobiology of the Hebrew University, Israel.

5.2 Research Projects

BRAINTOOL - A computer supported model of the basic spinal motor control system

BRAINTOOL is an interdisciplinary and interuniversitary neuroscience research project within the priority programme Biotechnology (SPP Biotech, module: Neuroinformatics). The research work is executed by a collaboration group between the IAM, the Departments of Physiology (PHY) of the University of Bern and Freiburg, and the Institute of Mathematics at the University of Freiburg. The goal of the

project is to achieve new knowledge about the biological information processing and to transfer this knowledge into new, more powerful technical systems (direct knowledge transfer to FOVEA project at the IAM). The experimental work is focused on the basic spinal motor control.
The obtained results provide the input to define a canonical motoneuron model as a tool for further computational neuroscience research and as a building block for new more neuromorphic artificial networks. With the canonical neuron model we can study intrinsic properties in biological networks but also the potential of neuromorphic networks in technical applications (FOVEA Project). In order to understand the muscular control we further need a characterization of movements at the level of canonical networks in the motoneuronal pool (motoneurons controlling one muscle) and at the higher integrated motor control systems. The BRAINTOOL research may also provide the necessary knowledge to progress on these questions.
The research at the IAM is focused on three levels of modeling: (1) synaptical level (diffusion of neuro-transmitter across the synaptical cleft), (2) cell level (information processing in the dendritic apparatus, reduction of modeling complexity by using a fuzzy rule approach), (3) network level (mathematical analysis of size principle in motor unit recruitment, oscillation in excitatory randomly connected neural networks). Another aim of the project is to develop an integrated workbench which supports rapid prototyping in neuronal modeling and provides an extensive set of analysis instruments. We have already implemented a program NeuroTrace in Java, which facilitates computer aided tracing for the morphological reconstruction of nerve cells, a toolbox for computational neuroscience, NeuroToolbox, based on Matlab/Simulink systems to generate computer simulations of reconstructed cells. Currently we are developing a parallelized solver for Simulink systems based on PVM and NAG libraries on the IBM SP2 owned by the university of Bern to accelerate our simulations.

Research staff:

IAM:	H. Mey, J. Kleinle, L. Müller, W. Senn, K. Wyler, N. Buchs, N. Iselin, M. Jakob
PHY:	H.-R. Lüscher, M. Larkum, J. Streit, K. Vogt, T. Wannier
Freiburg:	D. Rüegg, J.-P. Gabriel, L. Studer, T. Kakebeeke, R. Nussbaumer

Financial support: Swiss National Science Foundation (SPP Biotech, module: Neuroinformatics)

For further details, see: `http://iamwww.unibe.ch/~brainwww`

FOVEA - Focused Operating View Evaluation Architecture

Multisensor foveal perception for target detection and tracking using neuromorphic network architectures and dynamic binding

The FOVEA project is an extended feasibility study for the development of a biology inspired neuromorphic perception system for target detection, selective feature extraction and tracking in a predefined background scenario. The study includes the construction of a prototype system with realized lower level perception and selective attention steering functionality which shall be tested for specific technical applications.
The use of biology inspired ideas and methods for real time target detection and tracking in a natural environment may improve many automatic supervision systems in defense and in civil applications. Such ideas are (a) the combination and sensotopic fusion of information from several sensor channels (colliculus inspired space representing maps for the different sensor channels), (b) the situation dependent scanning of the perception space with a inhomogeneous (foveal) sensor resolution, (c) the structuring of the perception process in an novelty detection, a characterization (selective attention) and a evaluation (context dependent classification and tracking) stream and (d) the context dependent evaluation and binding of signal features in the different processing pathways. Special emphasis goes to the problem of dynamic binding mechanisms capable to solve the selective attention steering and the sensor fusion tasks.
The project work will be done in two steps. The first is devoted to a feasibility and usability study where a certain number of biology inspired ideas will be implemented, tested and evaluated in functional components and in prototype subsystems. The prototype system consist of a sensor front end (using conventional video and audio sensors in combination with fast data acquisition and preprocessing devices), a laboratory scenario generator and a set of (partially off line) perception analysis tools. In a second step we will use the obtained test results and the gained knowledge of the initial project phase to design and realize a complete perception system which integrates all necessary components for target detection, characterization and tracking in a fixed background environment.

Research staff: L. Müller, M. Kientsch, H. Zimmermann, E. Mousset (replaces J. Stiefenhofer), M. Heuer (GR)

Financial support: Swiss National Science Foundation, Swiss Defence Technology and Procurement Agency (GR)

MMC - A fast Algorithm for Electron Beam Dose Calculations

The macro Monte Carlo (MMC) method is a fast algorithm suitable for electron beam dose calculations in clinical radiotherapy treatment planning. MMC has been developed to improve the speed of traditional Monte Carlo (MC) electron transport calculations without significant loss in accuracy at energies up to 20 MeV. The MMC algorithm uses results derived from conventional MC simulations of electron transport through macroscopic spheres of various radii and consisting of a variety

of media. Based on these results, electrons are transported in macroscopic steps through the absorber. The absorber geometry is represented by a three dimensional (3D) density matrix typically derived from computer tomographic (CT) data. Energy lost by the electrons along their path through the absorber is scored in a 3D dose matrix. Transport of secondary electrons and bremsstrahlung photons are taken into account.

Research staff: W. Volken, P. Schwab (TNTech), H. Neuenschwander (AMS, Unispital Bern), C. Cris (AMS)

Financial support: This project is founded by BBW contract No. 94.0079 (EU-project AIM-A 2024 and EUREKA No. 3023.1)

5.3 Ph.D. Thesis

Kaspar Vogt, Chemical Transmission of single synaptic contacts in the central nervous system (thesis completed within the interdisciplinary MD PhD programme; neuroscience)

5.4 Further Activities

Editorial Boards

- Swiss Union of Commerce and Industry, Research comittee (H. Mey, member)

Associations

- Assoc. Swiss Machinery Manufacturers, Research committee (H. Mey, president)
- Assoc. Techno Park Bern (H. Mey, president)

Committees

- Swiss Federal Commission for Higher Education (H. Mey, president)
- NDIT/FPIT, an interregional society for postgraduate studies in Telecommunications and Informatics (H. Mey, president, L. Müller, director)
- FORMITT, a COMETT project on education in Telecommunications and Informatics on a European level (H. Mey, president)
- Member of the Swiss Science Council (H. Mey)
- Member of the Academic Committee University of Bern (H. Mey)

5.5 Courses presented at other institutions

- Postgraduate teaching activities (NDIT/FPIT courses): Neural Networks and Genetic Algorithms (L. Müller, K. Wyler), Operating-System Tools (J. Stiefenhofer), Information Security and Cryptology (L. Müller), Mathematical Repetitorium (P. Schwab(ISBE), L. Müller (IAM), R. Müller (ISBE), Ch. Meier (ISBE))
- Teaching activities at ISBE: Cryptology (L. Müller), Neural Networks (L. Müller), UNIX Introduction (J. Stiefenhofer), Image Processing (J. Stiefenhofer)
- Teaching activities at SWS: Neural Networks (L. Müller)
- Teaching activities at the 'Swiss Programs for Management Education' (H. Mey)

5.6 Publications

Journal Articles

- W. Senn, K. Wyler, J. Streit, M. Larkum, H.-R. Lüscher, H. Mey, L. Müller, D. Stainhauser, K. Vogt, Th. Wannier (1996). Dynamics of a random neural network with synaptic depression. *Neural Networks.* **9**(4): 575-588.
- J. Kleinle, K. Vogt, H.-R. Lüscher, L. Müller, W. Senn, K. Wyler, J. Streit (1996). Transmitter concentration profiles in the synaptic cleft: An analytical model of release and diffusion. *Biophys. J.* **71**: 2413-2426.
- A. Balogh, R. Best, D. Stainhauser, K. Wyler, H. Boddeke (1996). From neuron to network: measurement, analysis and modeling - Part 1: Biological and theoretical review of neuronal properties. *tm-Technisches Messen* **63**, No. 7/8: 296-304.
- H. Boddeke, R. Best, D. Stainhauser, K. Wyler (1996). From neuron to network: measurement, analysis and modeling - Part 2: Biological neuronal networks. *tm-Technisches Messen* **63**, No. 9: 337-344.

Proceeding Articles

- A fuzzy logic approach to neuronal modeling; W. Senn, M. Jakob, K. Wyler, J. Kleinle, H.-R. Lüscher, H. Mey, L. Müller (1996). In *Proceedings of the Swiss Computer Science Conference 1996* SCSC'96

Preprints

- W. Senn, K. Wyler, H. P. Clamann, J. Kleinle, H.-R. Lüscher, L. Müller. Size principle and information theory. Accepted for publication in *Biol. Cybern.* **76.**

- Phase-locking of two oscillating random neural networks; W. Senn, K. Wyler, T. Wannier and BRAINTOOL. Submitted to *Neural Computation.*

- Multisensor foveal perception for target detection and tracking; L. Müller, J. Kleinle, W.Senn, J. Stiefenhofer, K. Wyler; Fovea project proposal; (7.1996) preprint

- R. Best, H. Boddeke, D. Stainhauser, K. Wyler. From neuron to network: measurement, analysis and modeling - Part 3: Data acquisition, filtering and digital signal processing. To be published in *tm-Technisches Messen* **64**, No. 1.

- R. Best, H. Boddeke, D. Stainhauser, K. Wyler. From neuron to network: measurement, analysis and modeling - Part 4: Time-frequency analysis and digital image processing. To be published in *tm-Technisches Messen* **64**, No. 2.

- K. Wyler, D. Stainhauser, R. Best, H. Boddeke. From neuron to network: measurement, analysis and modeling - Part 5: Models and simulation tools of biological neurons and networks. To be published in *tm-Technisches Messen* **64**, No. 3.

- K. Wyler, D. Stainhauser, R. Best, H. Boddeke. From neuron to network: measurement, analysis and modeling - Part 6: Braintool – An integrated workbench for neuronal modeling and for rapid prototyping. To be published in *tm-Technisches Messen* **64**, No. 5.

Published Abstracts

- J. Kleinle, K. Vogt, J. Streit (1996). Estimating transmitter concentration profiles in synaptic clefts. *European Journal of Physiology (Pflügers Archiv).* **431**(6): P-73.

- M. Larkum, J. Kleinle, T. Launey, A. Dityatev, H-R. Lüscher (1996). Attenuation of dendritic EPSPs measured using multisite recordings. *Abstract Book, p. 29* Workshop on Neural Networks: from Biology to Hardware Implementation Chia (Cagliari), September 23-27, 1996

- J. Kleinle, K. Vogt, J. Streit (1996). Transmitter concentration profiles in the synaptic cleft. *European Journal of Physiology (Pflügers Archiv).* **433**(R1-R4): 4.

- J. Kleinle, K. Vogt, J. Streit (1996). Transmitter Concentration Profiles in the Synaptic Cleft. *Society for Neuroscience, Abstracts.* Nr. 687.4. 26th Annual Meeting, Washington D. C., Nov. 16-21.

Poster Exhibitions

- J. Kleinle, K. Vogt, J. Streit (1996). Estimating transmitter concentration profiles in synaptic clefts. Joint Congress of the Swiss and German Physiological Societies. Zürich/Switzerland, March 24-27.

- M. Larkum, J. Kleinle, T. Launey, A. Dityatev, H-R. Lüscher (1996). Attenuation of dendritic EPSPs measured using multisite recordings. Workshop on Neural Networks: from Biology to Hardware Implementation. Chia (Cagliari), September 23-27.

- C. Lüscher, P. Lipp, H.-R. Lüscher, J. Kleinle, E. Niggli (1996). Focal photolysis of caged Ca using two-photon excitation. Society for Neuroscience, Abstract 316.1, Washington D. C., Nov. 16-21.

- J. Kleinle, K. Vogt, J. Streit (1996). Transmitter concentration profiles in the synaptic cleft. Society for Neuroscience, Abstract 687.4, Washington D. C., Nov. 16-21.

6 Research Group on Software Composition

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* financial support from a third party.

6.2 Research Projects

The Software Composition Group conducts research into tools, techniques and methods for constructing flexible software systems from components.
Our research can be divided into four related activities:

1. *Composition Models and Languages:* Here we try to answer the question, "What kinds of formal models and languages are suitable for specifying software components, architectures and applications built from components?"

2. *Tools and Environments:* A rigorous approach to the construction of flexible software systems requires an infrastructure to support the development, maintenance and use of software components. Here we are investigating suitable meta-models, repositories, and visual presentation techniques.

3. *Component Frameworks:* Requirements for flexible, evolving systems are difficult to capture because they are non-functional requirements stemming from the software process itself. We are trying to understand these requirements better by building experimental frameworks in various application domains where flexibility and change are critical issues. This activity is crucial for providing requirements to the other research tracks, and, we hope, it will be able to benefit from the tools and techniques that they develop.

4. *Methods:* Current development methods typically introduce component reuse too late in the software life cycle, when detailed design is already complete. Furthermore, most methods say little or nothing about how to develop general, reusable components. We are investigating (i) techniques for driving the development process from component frameworks, and (ii) techniques for iteratively developing component frameworks from existing and legacy software.

For further details, see: `http://iamwww.unibe.ch/~scg/Research/`

Composing Active Objects

Research staff: Prof. Dr. M. Barrio, J. C. Cruz, M. Lumpe, W. Mallon, Dr. T. D. Meijler, J.-G. Schneider.

Duration: 10.94 - 9.96

Financial support: Swiss National Science Foundation, grant Nr. 21-40610.94

The project "Composing Active Objects" has addressed the problem of how to build flexible, open applications from distributed software components. Both formal and practical results have been achieved: (1) a formal model of composable concurrent objects has been developed using PICT, an executable formal language for specifying processes, (2) a technique has been elaborated for specifying components as composable, "black-box" classes, (3) an environment for visual software composition, based on this technique, has been prototyped, (4) an architecture for open network management applications has been specified and used in an experimental prototype, and (5) first steps have been made in the development of a framework of software components for coordinating distributed applications.

Infrastructure for Software Component Frameworks

Research staff: J. C. Cruz, Dr. S. Demeyer, S. Ducasse, M. Lumpe, Dr. T. D. Meijler, J.-G. Schneider.

Duration: 10.96 - 9.98

Financial support: Swiss National Science Foundation, grant Nr. 2000-46947.96

Infrastructure for Software Component Frameworks is a Swiss National Science Foundation research project (NFS project no. 2000-46947.96) investigating fundamental models and tools for building software frameworks.
One of the key problems in the development of modern software systems is planning for change: open systems must be flexible in that they must be easy to adapt to new and changing requirements. Increasingly systems developers have come to the consensus that the best way of dealing with open requirements is to build systems out of reusable components conforming to a "plug-in architecture". The functionality of an open system can then be changed or extended by substituting components or plugging in new components.
Quite recently, interest in software reuse has shifted from the reuse of single components (procedures, functions, classes), to whole abstract system designs or architectures. A software system that may be reused at this level for creating complete applications is called a framework. The idea is that it should be relatively easy to produce a range of specific systems within a certain domain starting from the framework software.
Unfortunately this is not so easy to realize, mainly because (object-oriented) programming languages don't provide specific abstractions and support for building frameworks. We identify especially (a) a lack of abstractions for building and adapting class-like components in a framework or domain specific way, (b) a lack of abstractions for defining cooperation patterns, and (c) a lack of support for checking the correctness of compositions.
This project proposes basic research to improve the infrastructure for building frameworks. We therefore plan to do the following work:

1. A composition language will be designed and implemented which supports the definition of new abstractions based on a rigorous formal semantics. This semantics will be based on a formal model of objects and components being developed in the ongoing research project "Composing Active Objects" (NFS 2100-040610.94).

2. The meta-modelling technique will be developed in the context of a visual composition environment. The environment and technique will support component designers by providing concepts for representing and manipulating software abstractions. The semantics of abstractions is based on (meta-level) interpretation.

3. An experimental coordination framework will be developed consisting of composable software abstractions for coordinating software components in multi-agent systems.

For further details, see: `http://iamwww.unibe.ch/~scg/Research/iscf.html`

FAMOOS

Research staff: Dr. S. Demeyer, S. Ducasse, Dr. T. D. Meijler, R. Nebbe, T. Richner.

Duration: 9.96 - 8.99

Financial support: Swiss National Science Foundation, ESPRIT project 21975.

FAMOOS is an industrial ESPRIT Project (No. 21975) in the IT Programme of the Fourth ESPRIT Framework Programme. FAMOOS is an acronym for "Framework-based Approach for Mastering Object-Oriented Software Evolution". The goal of FAMOOS is to support the evolution of first generation object-oriented software towards flexible software frameworks. The partners are Nokia Corporation (Finland), Daimler-Benz (Germany), Forschungszentrum Informatik (Germany), Sema Group (Spain), TakeFive Software (Austria), and The Software Composition Group (Switzerland).
Methods and tools will be developed to analyse and detect design problems with respect to flexibility in object-oriented legacy systems and to transform these systems efficiently into frameworks based on flexible architectures.
For further details, see: `http://iamwww.unibe.ch/~famoos/`

6.3 Ph.D. Thesis

- Simon Moser, *Measurement and Estimation of Software and Software Processes*, December 1996.

6.4 Diploma Thesis

- Pierre Viret, *Viewing C++ Objects as Communicating Processes* (co-supervised with Prof. Claude Petitpierre, Laboratoire de Téléinformatique, EPFL), March 1996.

6.5 Further Activities

Editorial Boards

- Object Oriented Systems, Chapman & Hall (O. Nierstrasz)
- L'OBJET – Logiciel, réseaux, bases de données (O. Nierstrasz)

- Annals of Software Engineering (O. Nierstrasz)

Associations

- CHOOSE – Swiss group for Object-Oriented Systems and Environments (Chairman 1992-1996, O. Nierstrasz)
- AITO – Association Internationale pour les Technologies Objets (Secretary, O. Nierstrasz)

Conference Chair

- Tenth European Conference on Object-Oriented Programming - Linz, Austria, July 8-12, 1996. (O. Nierstrasz, Conference Co-chair with Peter Wegner)

Program Committees

- First IFIP International Workshop on Formal Methods for Open Object-Based Distributed Systems - Paris, March 4-6, 1996 (PC member, O. Nierstrasz)
- International Symposium on Object Technologies for Advanced Software - Kanazawa, Japan, March 11-15, 1996 (PC member, O. Nierstrasz)
- Coordination 96 – Cesena, Italy, April 15-17, 1996 (PC member, O. Nierstrasz)
- European Symposium on Programming – Linköping, April 22-26, 1996 (PC member, O. Nierstrasz)
- Very Large Data Bases - Bombay, Sept. 3-6, 1996 (PC member, O. Nierstrasz)
- SIGSOFT 96 - San Francisco, Oct. 16-18, 1996 (PC member, O. Nierstrasz)
- OOPSLA 96 - San Josè, Oct. 6-10, 1996 (PC member, O. Nierstrasz)
- Langages et Modèles à Objets - Leysin, Oct. 17-18, 1996 (PC member, O. Nierstrasz)

6.6 Publications

Journal and Conference Publications

- Luca Deri, "Network Management for the 90s," *ECOOP'96 Workshop on 'OO Technologies For Network and Service Management' Proceedings*, July 1996.
- Luca Deri, "Surfin' Network Resources Across the Web," *2nd International IEEE Workshop on Systems Management Proceedings*, June 1996, pp. 158-167.

- Franck Barillaud, Luca Deri and Metin Feridun, "Network Management using Internet Technologies," *Integrated Network Management: Management in a Virtual World*, May 1996, (to appear).

- Markus Lumpe, Jean-Guy Schneider and Oscar Nierstrasz, "Using Metaobjects to Model Concurrent Objects with PICT," *Proceedings of Langages et Modèles à Objects*, Leysin, October 1996, pp. 1-12.

- Theo Dirk Meijler and Robert Engel, "Making Design Patterns Explicit in FACE, a Framework Adaptive Composition Environment," *EuroPLoP preliminary Conference Proceedings*, July 1996.

- Theo Dirk Meijler, Serge Demeyer and Robert Engel, "Class Composition in FACE, a Framework Adaptive Composition Environment," *Special Issues in Object-Oriented Programming*, Max Muehlhauser (Ed.), to appear.

- Simon Moser and Oscar Nierstrasz, "The Effect of Object-Oriented Frameworks on Developer Productivity," *IEEE Computer*, Sept. 1996, pp. 45-51.

- Oscar Nierstrasz, Jean-Guy Schneider and Markus Lumpe, "Formalizing Composable Software Systems – A Research Agenda," *Proceedings 1st IFIP Workshop on Formal Methods for Open Object-based Distributed Systems FMOODS '96*, Chapmann and Hall, 1996, pp. 271-282.

Technical Reports

- Jean-Guy Schneider and Markus Lumpe, "Modelling Objects in PICT," Technical Report, no. IAM-96-004, University of Bern, Institute of Computer Science and Applied Mathematics, January 1996.

A Teaching Activities

Winter semester 1995/96:

H. Bieri	Datenstrukturen und Algorithmen
	Geometrisches Modellieren
	Seminar Computergeometrie: Graphical User Interfaces
	Seminar für DiplomandInnen und DoktorandInnen
H.P. Blau:	Programmierung 1
	Informatik 1C
H. Bunke:	Automaten und formale Sprachen
	Bildanalyse
	Künstliche Intelligenz
	Seminar für DiplomandInnen und DoktorandInnen
A. Heuerding,	
S. Schwendimann:	Logiksysteme in der Informatik
D. Hogrefe:	Informatik 1B
	Computernetze
	Praktikum Rechnernetze
	Seminar für DiplomandInnen und DoktorandInnen
G. Jäger:	Blockseminar Bern und Zürich: Logik und Informatik
G. Jäger, W. Heinle,	
T. Strahm,	
H. Zimmermann:	Seminar für DiplomandInnen und DoktorandInnen
H.-R. Lüscher, J. Streit,	
W. Senn, L. Müller,	
K. Wyler:	Neuronale Netze 1
M. Marzetta, T. Strahm:	Logik und Informatik
H. Mey:	Informatik 1A
R. Oppliger:	Informations- und Kommunikationssystem-Sicherheit
O. Nierstrasz:	Datenbanken
	Semantics of Concurrency
	Seminar: Software Engineering
	Seminar für DiplomandInnen und DoktorandInnen
S. Schwendimann,	
H.Zimmermann:	Praktikum Symbolisches Rechnen

Summer semester 1996:

H. Bieri:	Computergrafik
	3D-Grafik
H. Bieri, Th. Bebie, A. Collison:	Praktikum in Computergrafik
	Seminar für DiplomandInnen und DoktorandInnen
H.P. Blau:	Informatik 2C
H. Bunke:	Compilerbau
	Strukturelle Methoden der Mustererkennung
	Seminar für DiplomandInnen und DoktorandInnen
H. Bunke, X.-Y. Jiang:	Seminar: Verarbeitung und Interpretation von Tiefenbildern
G. Jäger:	Applikative Theorien und explizite Mathematik
	Einführung in die theoretische Informatik
	Blockseminar Bern und Zürich: Logik und Informatik
	Seminar: Logiklabor
	Seminar für DiplomandInnen und DoktorandInnen
H. Mey:	Informatik 2B
H.-H. Nägeli:	Betriebssysteme
O. Nierstrasz:	Informatik 2A
	Praktikum in Software Engineering
	Programmiersprachen
	Programmierung 2
	Seminar für DiplomandInnen und DoktorandInnen

Winter semester 1996/97:

H. Bieri:	Algorithmische Geometrie
	Datenstrukturen und Algorithmen
	Digitale Bilder
	Seminar: Virtual Reality
H.P. Blau:	Programmierung 1
	Informatik 1C
H. Bunke:	Automaten und formale Sprachen
	Künstliche Intelligenz
	Praktikum Bildanalyse
	Seminar für DiplomandInnen und DoktorandInnen
K. Decker:	Parallele Computersysteme: Architektur und Programmierung
H. Hügli:	Informatik 1B
G. Jäger:	Komplexitätstheorie
	Logik und Informatik

	Praktikum Symbolisches Rechnen
	Blockseminar Bern und Zürich: Logik und Informatik.
	Seminar: Logik in Philosophie und Informatik
	Seminar für DiplomandInnen und DoktorandInnen
J. Kohlas:	Eine mathematische Theorie der Informationssysteme, Teil 1
H. Mey:	Informatik 1A
O. Nierstrasz:	Datenbanken
	Programmiersprachen
	Seminar: Design Patterns and Frameworks
	Seminar für DiplomandInnen und DoktorandInnen
J. Streit, L. Müller, K. Wyler:	Neuroinformatik

B Institute Events

07.03.96	Visit organized by BETECH.
11.01.96	Inauguration of the center "Universität Engehalde".
11.02.96	"Open house".