

Annual Report 1999

IAM-99-006

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1 Institute of Computer Science and Applied Mathematics (IAM)

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1.2 Personnel

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Prof. Dr. Hanspeter Bieri; Prof. Dr. Torsten Braun; Prof. Dr. Horst Bunke;
Prof. Dr. Gerhard Jäger; Prof. Dr. Oscar Nierstrasz.

Professors

Prof. Dr. Hanspeter Bieri; Prof. Dr. Torsten Braun; Prof. Dr. Horst Bunke;
Prof. Dr. Gerhard Jäger; Prof. Dr. Hansjürg Mey; Prof. Dr. Oscar Nierstrasz.

Acting chairman

Prof. Dr. Hanspeter Bieri (until August), Prof. Dr. Gerhard Jäger (since September).

Administration

René Berliat (since July); Daniela Heiniger (until July); Isabelle Huber;
Sylvia Schaad; Susanne Thüler.

Librarian

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Neurocomputing

At the end of 1998 the scientific activities of the research group Neurocomputing were shifted from the Institute of Computer Science and Applied Mathematics to the Institute of Physiology of the University of Bern in order to optimize them in an environment of more broadly oriented interdisciplinary research activities. As a result the annual report is published in this new setting as of 1999.

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 half spaces. 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

Evaluations and enhancements of multicast routing algorithms

Internet services use many different multicast protocols, e.g. DVMRP, MOSPF, PIM, and RSVP. Most of these protocols do not make any quality-of-service assumptions. In this project, a new abstraction is developed that describes common network topologies as special digraphs and offers a possibility to evaluate and compare such protocols in a consistent way. This abstraction shall also make it possible to introduce new extensions to the strategies belonging to these protocols, in particular with regard to quality-of-service aspects, and to analyse the corresponding algorithms. The IETF workgroup diffserv has proposed a new architecture which gives users access to a whole range of network services which are differentiated on grounds of

performance. One goal of this project consists in developing new multicast routing algorithms suitable for this architecture.

Research staff: P. Habegger

A database system for 3D-graphics

This project continues previous research done by A. Collison (GSCOPE - a component-based system for storing and manipulating graphics objects of different representations). The database system is intended to support the following features: persistency for hierarchically structured 3D-objects and textures, content-based object retrieval, integration of different file formats, integration of various kinds of 3D-graphics functionality, Web integration.

Research staff: L. Ammon

Real-time visualization of complex 3D-scenes on a Web client

The use of today's technologies, like VRML or Java3D, limits the size of 3D-scenes that can be rendered in real time on a standard Web client. There exist already some techniques that can compensate the limited bandwidth of the Internet: level-of-detail management, 3D-geometry compression, incremental streaming of geometric data, and area-of-interest management. The goal of this project is to provide a flexible framework that integrates these techniques and can easily be extended for new ones. In order to prove that complex 3D-scenes can indeed be visualized in real time by means of this framework, a number of characteristic applications will be implemented.

Research staff: Th. Wenger

BalanceIK: A 3D Studio Max plug-in for inverse kinematics

Inverse kinematics (IK) plays an important role in today's computer animation and can be found in most professional 3D graphics software systems. Kinetix's 3D Studio Max is such a system that provides developers with an additional software development kit for writing plug-ins to add new features. IK lets the user specify tasks for articulations, and the computer takes on the tedious task of finding the proper parameters to satisfy them. BalanceIK is an IK-engine in form of a plug-in for 3D Studio Max which enhances

the standard IK-algorithms. It is based on research performed at the Computer Graphics Lab of the Swiss Federal Institute of Technology in Lausanne (LIG/EPFL).

Research staff: M. Bürki

A computer-based visualization of the Pulfrich phenomenon

The Pulfrich phenomenon leads often to wrong depth analysis of moving objects because image processing - i.e. visual motion analysis and stereoscopic depth perception - in the brain isn't done with the same velocity for both eyes. This effect can be simulated using computer graphics by vertically dividing a screen into its two halves, each one being shown to only one eye of the viewer. One half displays the actual state of a scene, the other half displays a delayed state (1ms - 15ms). By setting appropriate parameters, it can be tested if and how much the viewer's perception discloses the Pulfrich phenomenon. This work is done in collaboration with the Department of Neuroophthalmology of the Kantonsspital St. Gallen.

Research staff: Th. Oexl, D. Mojon

The computer game Serphillion

The main goal of this project is to develop a 3D jump-and-run game, called Serphillion. This game shall be a reference implementation for illustrating three important aspects of modern computer graphics: real-time rendering, physical simulation and artificial agents. The essence of Serphillion shall represent the foundation of a virtual world simulator. Its interface will give the user the possibility to experiment and interact with the underlying system in a playful and animating way.

Research staff: J. Hutchison, Ph. Robert, S. Wyssmann

Robust watermarking of digital images

Digital watermarking techniques can be used to protect the copyright of multimedia data. In the case of digital images this is done by introducing small changes that are imperceptible to the human eye but easily recoverable by a computer program. To be of practical use, it should be difficult or, ideally, impossible to remove a watermark without destroying the image itself. Because of the various possible alternations of marked images, such as blurring,

lossy compression and geometrical transformations, this is very difficult to achieve. In this project a watermarking framework is being developed. Several methods based on spread-spectrum communications will be implemented and evaluated under the aspect of robustness.

Research staff: Th. Buchberger

Voice mapping

VoiceMapper is a PC-based system that transforms a human voice into another. First, the source speaker and the target speaker create a profile of their voices. These profiles are then used to map speech signals from the source speaker to signals that simulate the voice of the target speaker. The main idea consists in replacing the voiced parts of the source signal by voiced parts of the profile of the target speaker.

Research staff: B. Rigazzi

2.3 Ph.D. Theses

- Th. Bebie: SOCCERMAN - Ein System zur videobasierten 3D-Rekonstruktion von Fussballspielen
- A. Collison: GSCOPE - Ein auf Wiederverwendbarkeit basierendes Grafikdatenbanksystem

2.4 Further Activities

- January 15-16, Upper-Rhine-Region Algorithms Workshop, organized by H. Bieri.
- March 18, Inauguration of the new Bern Show at the altes Tramdepot. Bern. Computer animations by B. Bühlmann.
- May 14, Seminar of the 3ème Cycle Romand d'Informatique on Programming Approaches to Geometric Modelling, organized by H. Bieri. Speakers: Dr. Adrian Bowyer (University of Bath) and Prof. Alberto Paoluzzi (University of Rome 3).
- May 16-21, Dagstuhl-Seminar 99201 on Geometric Modelling, organized by H. Bieri, G. Brunnett (Kaiserslautern) and G. Farin (Arizona State University).

- June 24, Inauguration of the exhibition "Ferdinand Hodler - Aufstieg und Absturz" at the Schweizerisches Alpines Museum, Bern. Computer graphics by P. Schnellmann and L. Ammon.
- Computer Aided Geometric Design 16(1999): Special issue dedicated to Paul de Faget de Casteljaou. Guest editors: H. Bieri, H. Prautzsch (Karlsruhe).
- Reviewing for Computer Graphics International 2000 (H. Bieri).
- Member of the Program Committee for Eurographics 2000 (H. Bieri).

2.5 Publications

- Collison, A., Bieri, H.: A component-based system for storing and manipulating graphics objects of different representations. To appear in IEEE Transactions on Visualization and Computer Graphics.
- Bühlmann, B.: BOOGA - vom Grundrissplan zur 3D-Stadt. Schweizerische Technische Zeitschrift, Nr. 9/99, 14-15 (1999).
- Rigazzi, B., Bieri, H.: VOICEMAPPER: a PC-based system for mapping human voices. Submitted.
- Bebie, Th., Bieri, H.: A video-based 3D-reconstruction of soccer games. Submitted.

3 Research Group on Computer Networks and Distributed Systems

3.1 Personnel

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Scientific Staff:	F. Baumgartner * H. Einsiedler (until June 1999) * M. Günter* M. Kasumi (until August 1999) * I. Khalil * L. Liu (since September 1999) * G. Stattenberger *	Tel.: +41 31 631 8646 email: baumgart@iam.unibe.ch email: einsiedl@iam.unibe.ch Tel.: +41 31 631 8691 email: mguenter@iam.unibe.ch email: kasumi@iam.unibe.ch Tel.: +41 31 631 8692 email: ibrahim@iam.unibe.ch Tel.: +41 31 631 8668 email: liu@iam.unibe.ch Tel.: +41 31 631 3404 email: stattenb@iam.unibe.ch
Guests:	Dr. Jayati Ghoshal	North Dakota State University June - August 1999

* with financial support from a third party

3.2 Research Projects

Charging and Accounting Technologies for the Internet (CATI)

CATI is a CNEC (Competence Network Electronic Commerce) project within the Swiss Priority Program for Information and Communications Structures (SPP ICS) of the Swiss National Science Foundation (SNF). The main goal of the CATI project is the design, evaluation and implementation of charging and accounting mechanisms for value-added Internet services such as Integrated Services, Differentiated Services and Virtual Private Networks (VPNs). Project partners are the ETH Zürich, the Universities of Zürich and Geneva, SWITCH, and IBM Research Zürich. The RVS group focuses on the development of a flexible VPN service system including Quality-of-Service (QoS) support by resource reservation. The user can set up, modify

and tear down VPN connections on-line and choose from security features for the VPN service as well as QoS features similar to the Differentiated Services proposed by the Internet Engineering Task Force (IETF). Nevertheless, complexity which is inherent in security technology, is hidden from the user. To support Integrated Services applications, a gateway has been designed and implemented in order to map Integrated Services to Differentiated Services reservations. The implementation also handles accounting of VPN connections considering bandwidth, duration of the reservation, time of day, security parameters etc. The implementation is an instance of a generic control architecture for multi-provider network services. In order to evaluate our results, we simulated aspects of the control architecture, analyzed its security and performed local and wide area tests of our implementation between Bern and Geneva.

Research staff: Roland Balmer, Florian Baumgartner, Manuel Günter, Mevlyde Kasumi, Ibrahim Khalil, Linqing Liu

Financial support: Swiss National Science Foundation Projects No. 5003-054559/1 and 5003-054560/1

Differentiated Services over ATM

Within this project an implementation of Differentiated Services (DiffServ) has been performed on a Linux-based router platform. The implementation of Premium and Assured Services is compliant with the IETF's definition of Expedited and Assured Forwarding and aims to support easy DiffServ router configuration. Initial performance tests show that the implementation can protect higher priority flows from other aggressive flows which is a common situation in the Internet. Another part of the project focussed on the implementation of Differentiated Services over ATM. In particular, we want to take advantage of the facilities (e.g. shaping, policing, and cell discards based on cell loss priorities) that ATM network equipment can provide. Both, Premium and Assured Services have been implemented over ATM. This allows to offload functionality from the Differentiated Services implementation to the ATM hardware. The implementation of a Differentiated Services router can, therefore, be kept simpler in ATM networks than in other networks.

Research staff: Arik Dasen, Hans Einsiedler, Jayati Ghoshal, Matthias Scheidegger, Günther Stattenberger

Financial support: NEC Europe Ltd.

IP/ATM Gateway

Although the number of Internet capable computers is growing, there are still scenarios with pure ATM capable hosts, e.g. servers in the core network or in Digital Subscriber Line (DSL) access networks. A gateway has been developed and implemented in order to interconnect ATM and IP end systems. The gateway maps UDP/IP data flows to ATM connections (PVCs) and vice versa. The implementation has been successfully demonstrated at the world telecommunications exhibition (TELECOM99) at Geneva using an audio tool (for both ATM and IP end systems) which has also been developed at IAM.

Research staff: Florian Baumgartner, Thomas Rytz

Financial support: Telscom AG

Mobile IP Telephony (MIPTel) and Mobile IP Quality-of-Service (MobiQoS)

The Mobile IP Telephony (MIPTel) project started in October 1999 and is being funded by SNF. The project aims to develop adaptive telephony applications over DiffServ IP networks. The audio applications shall take advantage of DiffServ services in order to decrease packet loss and delay in mobile and wireless network environments. The project is directly linked with a research activity called Mobile IP Quality-of-Service (MobiQoS) which is performed in collaboration with INRIA Rhône Alpes and ENST (Ecole Nationale Supérieure de Telecommunication) Bretagne. Several workshops have been held to discuss and exchange the research results of the different partners in the area of integrating mobile communication environments and QoS-enabling Internet technologies such as Differentiated and Integrated Services. Problems with the integration of Differentiated Services and Mobile IP have been analysed. This analysis forms a basis for common future research work.

Research staff: Günther Stattenberger, Matthias Scheidegger

Financial support: Swiss National Science Foundation Project No. 2100-057077. 99/1, Institut National de Recherche en Informatique et en Automatique (INRIA)

QoS Support for the Internet based on Intelligent Network Elements

Active Networking (AN) is a promising technology for flexible and powerful service provisioning in future telecommunications and computer networks. The project on QoS support in the Internet based on AN includes a collaboration with a research group at Purdue University that already gained experience with Active Networking. AN technology shall be applied for management related tasks, i.e. so-called AN capsules (packets carrying programs that can be executed in network nodes such as IP routers) are used to reconfigure routers in order to provide QoS for specific flows in the Internet. This includes topics like traffic conditioning components (especially for Differentiated Services), signaling, QoS routing and the development of appropriate multimedia applications, capable to exploit the AN technology benefits. In a first step a prototypical Active Networking system and a special hybrid network simulator have been designed and implemented, allowing to emulate larger Active Networks and to study their behaviour using real applications simultaneously.

Research staff: Florian Baumgartner

Financial support: Swiss National Science Foundation Project no. 2100-055789.
98/1

Simulation and Evaluation of Differentiated Services

The project evaluates the performance and facilities of the IETF's Differentiated Services approach by simulations. Initial work has been done using Berkeley's Network Simulator (ns) for evaluation of the Assured Service and related fairness issues. More recent work includes simulations of several scheduling and queuing mechanisms using the Opnet network simulator. In addition, the impacts of Differentiated Services in ATM-based IP networks have been investigated.

Research staff: Florian Baumgartner, Alexander Dobreff

Testbed for Mobile and Internet Communications

An experimental test network has been set up for the implementation tasks of the various research projects mentioned above. The network consists of

UNIX-based servers, Linux-based and commercial routers, ATM switches, LAN switches as well as a variety of multimedia end systems. The testbed has been extended by Virtual Private Network (VPN) routers and wireless LAN equipment such as base stations and wireless/portable end systems. A separate domain with name, web, and file services has been set up. This allows to perform experiments without any impact to other university networks.

Research staff: Florian Baumgartner, Ibrahim Khalil, Günther Stattenberger

Financial support: Swiss National Science Foundation R'Equip Project No. 2160-053299.98/1, Stiftung zur Förderung der wissenschaftlichen Forschung an der Universität Bern, NEC Europe Ltd.

3.3 Diploma Theses

- Balmer, R.: Integration von Integrated und Differentiated Services, November 1999
- Dobreff, A.: Vergleich zwischen Simulation und realer Funktionalität für die Abbildung von Differentiated Services auf ATM, November 1999

3.4 Further Activities

Conference Program Committee Memberships

- 10th IEEE Workshop on Local and Metropolitan Area Networks, Sydney, November 21-24, 1999 (Torsten Braun)
- 24th IEEE Annual Conference on Local Computer Networks (LCN), Lowell/Massachusetts, October 18-20, 1998 (Torsten Braun)
- Kommunikation in Verteilten Systemen (KiVS'99), Darmstadt, March 2-5, 1999 (Torsten Braun)
- European Conference on Multimedia Applications, Services and Techniques (ECMAST'99), Madrid, May 25-28, 1999 (Torsten Braun)
- GI-Workshop Multicast-Protokolle und Anwendungen, Braunschweig, May 19-21, 1999 (Torsten Braun)
- 2nd International Conference on New Learning Technologies, University of Bern, August 30-31, 1999 (Torsten Braun, Chair)

Technical Committees

- SWITCH Stiftungsrat (Torsten Braun)
- SPEEDUP Society Committee (Torsten Braun)

Reviewing Activities

- Photonic Network Communications, Kluwer Academic Publishers (Torsten Braun)
- Computer Networks, Elsevier (Torsten Braun)
- Journal of Computer Aided Engineering, Wiley-Interscience (Torsten Braun)
- IEEE/ACM Transactions on Networking (Torsten Braun)
- dpunkt.verlag (Torsten Braun)
- Schweizerischer Nationalfonds (Torsten Braun)
- International Zürich Seminar (Torsten Braun)

Invited Talks

- Manuel Günter: "Charging Differentiated Services and VPNs: the Approach of the CATI Project", Invited Talk at IBM Research Yorktown, NY, October 27, 1999
- Manuel Günter: "Problems of the Inter-Domain Control Architecture for Value Added Internet Services", Invited Talk at Lucent Technologies Holmdel, NJ, October 29, 1999
- Torsten Braun: "Quality-of-Service in Virtual Private Networks", Seminar "One Voice to Cisco", London, May 21, 1999

Organized Events

- SNF Site Visit of the CATI project, IAM, July 9, 1999
- 2nd International Conference on New Learning Technologies, University of Bern, August 30-31, 1999
- Seminar "Universelle Verkabelungssysteme und drahtlose Übermittlungssysteme", IAM, September 2, 1999

3.5 Publications

Books

- Torsten Braun: "IPnG: Neue Internet-Dienste und virtuelle Netze", dpunkt.verlag, March 1999, ISBN 3-920993-98-5
- Frederico Flückiger, Torsten Braun, and Andreas Ninck (eds.): "2nd International Conference on New Learning Technologies", Bern, August 30-31, 1999

Journal and Conference Papers

- Florian Baumgartner and Torsten Braun: "Evaluation of Assured Service", in R. Steinmetz (ed.): "Kommunikation in Verteilten Systemen (KiVS)",; Informatik aktuell, Springer-Verlag, March 2-5, 1999, pp.72-85, ISBN 3-540-65597-2 (presentation by Florian Baumgartner)
- Torsten Braun and Manuel Günter: "Virtuell aber real - Virtuelle Private Netze und deren Basistechnologien", NET 4/99, Hüthig-Verlag, ISSN 0947-4765

- Torsten Braun, Claude Castelluccia, and Günther Stattenberger: "An Analysis of the DiffServ Approach in Mobile Environments", 1st Workshop on IP Quality of Service for Wireless and Mobile Networks (IQWiM99) Aachen, Germany, April 8-9, 1999 (presentation by Torsten Braun)
- Burkhard Stiller, Torsten Braun, Manuel Günter, and Bernhard Plattner: "The CATI Project: Charging and Accounting Technology for the Internet", in H. Leopold, N. Garcia (eds.): "Multimedia Applications, Services and Techniques; - ECMAST'99", Lecture Notes in Computer Science 1629, Springer, pp. 281-296, Madrid, May 25-28, 1999, ISBN 3-540-66082-8. (presentation by Manuel Günter)
- Hans Joachim Einsiedler, Paul Hurley, Burkhard Stiller, and Torsten Braun: "Charging Multicast Communications Based on a Tree Metric", in Proceedings of GI-Workshop "Multicast-Protokolle und Anwendungen", Braunschweig, May 20-21, 1999 (presentation by Hans Einsiedler)
- Florian Baumgartner, Torsten Braun, and Christian Siebel: Fairness of Assured Service, in: H. Szerbicka (ed.): "Modelling and Simulation: A Tool for the Next Millennium, 13th European Simulation Conference 1999, Warsaw, June 1999, Vol. 1, pp. 390-397, SCS Publication, ISBN 1-56555-171-0 (presentation by Florian Baumgartner)
- Florian Baumgartner, Torsten Braun, Hans Einsiedler, and Ibrahim Khalil: "Differentiated Internet Services", in G. Cooperman, E. Jessen, G. Michler (eds.): "Workshop on Wide Area Networks and High Performance Computing", Lecture Notes in Control and Information Sciences 249, Springer, June 1999, pp. 37-60, ISBN 1-85233-642-0
- Torsten Braun: "Kommunikation ohne Tricks - IPv6 - das Internet-Protokoll der nächsten Generation (Teil 1)", NET 10/99, pp. 62-65, Hüthig-Verlag, ISSN 0947-4765
- Manuel Günter, Torsten Braun, and Ibrahim Khalil: "An Architecture for Managing QoS-enabled VPNs over the Internet", in Proceedings of the 24th Conference on Local Computer Networks LCN'99, IEEE Computer Society, pp.122-131, Lowell/Boston, October 1999, ISBN 0-7695-0311-X. (presentation by Manuel Günter)
- Manuel Günter and Torsten Braun: "Evaluation of Bandwidth Broker Signaling", in Proceedings of the International Conference on Network Protocols ICNP'99, IEEE Computer Society, p.145-152, November 1999, ISBN 0-7695-0412-4 (presentation by Manuel Günter)

- Torsten Braun: "Kommunikation ohne Tricks - IPv6 - das Internet-Protokoll der nächsten Generation (Teil 2)", NET 11/99, S. 60-63, Hüthig-Verlag, ISSN 0947-4765

Technical Reports

- Torsten Braun, Manuel Günter, Mevlyde Kasumi, and Ibrahim Khalil: "Virtual Private Network Architecture", Technical Report, IAM-99-001, April 1999
- Manuel Günter and Torsten Braun: "Evaluation of Bandwidth Broker Signaling", Technical Report, IAM-99-002, May 1999
- Roland Balmer, Florian Baumgartner, Torsten Braun, Manuel Günter, and Ibrahim Khalil: "Virtual Private Network and QoS Management Implementation", Technical Report, IAM-99-003, July 1999
- Torsten Braun, Hans Einsiedler, Matthias Scheidegger, and Karl Jonas: "DiffServ Implementation Report", NEC Internal Technical Report NPDLE-HD-IR-1999-02, July 1999

This publication list does not include publications which have been submitted in 1999 and are to be published in 2000.

4 Research Group on Computer Vision and Artificial Intelligence

4.1 Personnel

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	M. Zimmermann*	Tel: +41 31 631 49 02 email: zimmerma@iam.unibe.ch
Guests:	Dr. K. Bowyer	University of South Florida, Tampa December
	Dr. A. Kandel	University of South Florida, Tampa June – July
	Dr. M. Krätzl	DSTO Salisbury, Australia September
	Dr. M. Lazarescu	Curtin University, Perth, Australia October – December
	Dr. J. Schmid	Ingenieurschule Burgdorf, Switzerland March – September

* with financial support from a third party

4.2 Research Projects

Range Image Analysis

The research in range image analysis is continued by the development of new segmentation and surface representation techniques. We are working on qualitatively decomposing a range image into convex parts and efficient least-square methods for surface approximation.

Research staff: PD Dr. X. Jiang

Range Image Sequence Analysis

The purpose of the MINORA project is to develop reliable presence detection systems based on range image sequences. Due to low resolution (16x64), 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 and tracking 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

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

Document Image Analysis and Understanding

A variety of problems occurring 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 on general text recognition and the use of natural language processing techniques.

Research staff: U.-V. Marti, M. Zimmermann

Financial support: Swiss National Science Foundation

Graph Matching Algorithms and Applications

Graphs are a flexible and powerful representation mechanism that has been successfully applied in computer vision, pattern recognition and related areas. When graphs are used to represent objects of a particular domain, the recognition problem turns into the task of graph matching. In this project we study a variety of issues, including efficient algorithms for graph matching,

the adaption of concepts and techniques based on vector representations to the domain of graphs, and special classes of graphs that allow matching with polynomial complexity.

Research staff: PD Dr. X. Jiang, Prof. Dr. H. Bunke and external partners

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

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, PD Dr. X. 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: Dr. B. Achermann, PD Dr. X. Jiang

Automatic Diatom Identification and Classification

The ADIAC project is a pilot study concerning the application of image processing and pattern recognition tools to the automation of diatom identification by computer processing. The project is divided into several subtasks which are solved by different European institutes. At the IAM a solution is searched to identify the shapes in a first step based on their valve outline, and

in a second step based on the valve ornamentation. Several image processing techniques will be implemented and their performance will be evaluated in order to obtain robust algorithms to identify unknown diatoms.

Research staff: S. Fischer

Similarity-based retrieval of objects from 3D image databases

The aim of this project is to develop methods and techniques to support the retrieval of free-form objects from 3D image databases. A content-based representation of information in the database together with a corresponding retrieval-algorithm build the core of such an intelligent database. In particular, the user is allowed to formulate queries by giving examples. Scope of this project is to develop methods allowing to retrieve image information that is essentially 3D. The most challenging aspect in this context is the similarity-based search for objects which is closely tied to 3D-object recognition and its difficulties. Concretely, we defined our task to be the retrieval of so-called free form objects, especially those gained from a sensory process like range images. Efficiency in processing and storing these three-dimensional datasets and the the representation of an object in a high-dimensional feature space address techniques from vector quantization and dimensionality reduction. We are focussing on range-images because of the availability of a structured light stripe range sensor in the Computer Vision and Artificial Intelligence Group (FKI). Current research focusses on view-based representations of objects and unsupervised learning techniques.

Research staff: Markus Volkmer

Financial support: Swiss National Science Foundation

4.3 Diploma Theses

- Hofer, S.: Segmentierung von Tiefenbildsequenzen
- Zuber, P.: Verfolgen von Objekten in Tiefenbildsequenzen basierend auf Template Matching mit relativem Tiefentemplate
- Schiffmann, L.: Ähnlichkeit dreidimensionaler Kurven
- Hegyi, G.: Matching in Tiefenbildern
- Peleg, R.: Rauchdetektion in Autobahntunnels

- Binkert, M.: Konturbasierte Klassifikation von Diatomeen
- Wymann, D.: Texterkennung auf Pass Codes mit Hidden Markov Modellen
- Perroud, T.: Clustering Algorithmen für die farbbasierte Dokumentanalyse

4.4 Ph.D. Theses

- Yu, K.: Methods for lipreading: classification of isolated words, sentence recognition, and classifier combination

4.5 Further Activities

Editorial Boards and Committees

- 1st Vice President of the Int. Association for Pattern Recognition, IAPR (H. Bunke)
- 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 the International Journal on Document Analysis and Recognition (H. Bunke)
- Member of the editorial board of Pattern Analysis and Applications (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)

Program Committees

- 8th Spanish National Symposium on Pattern Recognition and Image Analysis, May 12 - 14, 1999, Bilbao (H. Bunke)
- First Int. Workshop on Document Image Analysis and Understanding for Document Databases, Florence, Aug 30 - Sept 3, 1999 (H. Bunke)
- 10th Int. Conference on Image Analysis and Processing, Venice, Sept 22 - 29, 1999 (H. Bunke)

- 2nd Int. Conference on Multimodal Interface, Hong Kong, Jan 5 - 7, 1999 (H. Bunke)
- 5th Int. Conference on Document Analysis and Recognition, Bangalore, Sept 20 - 22, 1999 (H. Bunke)
- 3rd IAPR Int. Workshop on Graphics Recognition, Jaipur, India, Sep 26 - 27, 1999 (H. Bunke)
- Workshop on Document Layout Interpretation and Its Application, Bangalore, Sept 19, 1999 (H. Bunke)
- 2nd IAPR TC-15 Workshop on Graph-based Representations, Castle Haindorf, Austria, May 10 - 12, 1999 (H. Bunke)
- Int. Workshop and Symposium AGTIVE - Applications of Graph Transformation with Industrial Relevance, Castle Rolduc, Kerkrade, The Netherlands, Sep 1 - 3, 1999 (H. Bunke)
- Symposium Advanced Concepts for Intelligent Vision Systems, Baden-Baden, August 2 - 7, 1999 (H. Bunke)
- Int. Workshop on Document Analysis, Speech and Natural Language Processing, Indian Statistical Institute, Calcutta, December 23 - 24, 1999 (H. Bunke)

4.6 Publications

Books

- Christensen, H., Bunke, H., Noltemeier, H. (eds.): Sensor Based Intelligent Robots, Lecture Notes in Artificial Intelligence 1724, Springer Verlag, 1999

Journal Publications

- Bunke, H.: Error correcting graph matching: On the influence of the underlying cost function, IEEE Trans. Pattern Analysis and Machine Intelligence, Vol. 21, No. 9, 1999, 917 - 922
- Jiang, X., Bunke, H.: Edge detection in range images based on scan line approximation, Computer Vision and Image Understanding, Vol. 73, No. 2, 1999, 183 - 199

- Jiang, X., Bunke, H.: Optimal quadratic-time isomorphism of ordered graphs, *Pattern Recognition*, Vol. 32, 1999, 1273 - 1283
- Bunke, H., Zumbühl, M.: Acquisition of 2D shape models from scenes with overlapping objects using string matching, *Pattern Analysis and Applications* Vol. 2, No. 1, 1999, 2 - 9
- Yu, K., Jiang, X., Bunke, H.: Lipreading using signal analysis over time, *Signal Processing*, Vol. 77, No. 2, 1999, 195 - 208
- Messmer, B., Bunke, H.: A decision tree approach to graph and sub-graph isomorphism detection, *Pattern Recognition*, Vol. 32, 1999, 1979 - 1998
- Rodriguez, W., Teodorescu, H.-N., Kandel, A., Bunke, H.: A fuzzy information space approach to movement nonlinear analysis, *Int. Journal of Chaos Theory and Applications*, Vol. 3, Nos. 1 - 2, 1999, 29 - 37
- Zimmermann, M., Mao, J.: Lexicon reduction using key characters in cursive handwritten words, *Pattern Recognition Letters*, Vol. 20, Nos. 11-13, 1999, 1297 - 1304
- Bunke, H., Münger, A., Jiang, X.: Combinatorial search versus genetic algorithms: a case study based on the generalized mean graph problem, *Pattern Recognition Letters*, Vol. 20, Nos. 11 - 13, 1999, 1271 - 1277

Refereed Conference Proceedings and Edited Books

- Yu, K., Jiang, X., Bunke, H.: Automatic lipreading of sentences combining hidden Markov models and grammars, *Proc. 2nd Int. Conference on Audio- and Video-based Biometric Person Identification*, Washington D.C., 1999, 90 - 95
- Shoubridge, P., Kraetzl, M., Bunke, H., Wallis, W.: Approaches to measuring network change, in *Proc. Defence Applications of Signal Processing*, DASP'99, Illinois, 1999
- Sobottka, K., Bunke, H.: Detection of road boundaries in range image sequences, *Proc. 32nd ISATA*, Vienna, 1999, 129 - 136
- Sobottka, K., Zuber, P., Bunke, H.: Shape based template matching for robust obstacle tracking in low-resolution range image sequences, in Blanc-Talon, J., Popescu, D. (eds.): *Advanced Concepts for Intelligent Vision Systems*, The Int. Inst. for Advanced Studies in Systems Research and Cybernetics, 1999, 110 - 115

- Jiang, X., Münger, A., Bunke, H.: Synthesis of representative symbols by computing generalized median graph, Proc. of the 3rd Int. Workshop on Graphics Recognition, GREC'99, Jaipur, 1999, 187 - 194
- Sobottka, K., Bunke, H., Kronenberg, H.: Identification of text on colored book and journal covers, Proc. 5th Int. Conference on Document Analysis and Recognition, ICDAR'99, Bangalore, 57 - 62
- Bunke, H., von Siebenthal, T., Yamasaki, T., Schenkel, M.: Online handwriting data acquisition using a video camera, Proc. 5th Int. Conference on Document Analysis and Recognition, ICDAR'99, Bangalore, 1999, 573 - 576
- Jiang, X., Bunke, H., Widmer-Kljajo, D.: Skew correction of document images by focused nearest-neighbor clustering, Proc. 5th Int. Conference on Document Analysis and Recognition, ICDAR'99, Bangalore, 1999, 629 - 632
- Marti, U., Bunke, H.: A full English sentence database for off-line handwriting recognition, Proc. 5th Int. Conference on Document Analysis and Recognition, ICDAR'99. Bangalore, 705 - 708
- Kaufmann, G., Bunke, H.: Error localization and correction in check processing, in S.-W. Lee (ed.): Advances in Handwriting Recognition, World Scientific, 1999, 111 - 120
- Marti, U.-V., Bunke, H.: Towards general cursive script recognition, in S.-W. Lee (ed.): Advances in Handwriting Recognition, World Scientific, 1999, 203 - 212
- Jiang, X., Hofer, S., Stahs, T., Ahrns, I., Bunke, H.: Extraction and tracking of surfaces in range image sequences, Proc. 2nd Int. Conf. on 3-D Digital Imaging and Modeling, Ottawa, 1999, 252 - 260
- Sobottka, K., Bunke, H.: Anytime behavior for obstacle tracking, Proc. Int. Conf. on Intelligent Transportation Systems, Tokyo, 1999, 368 - 373
- Du Buf, H., Bayer, M., Droop, S., Head, R., Juggins, S., Fischer, S., Bunke, H., Wilkinson, M., Roerdink, J., Pech-Pacheco, J., Cristobal, G., Shahbazkia, H., Ciobanu, A.: Diatom identification: a double challenge called ADIAC, Proc. 10th Int. Conference on Image Analysis and Processing, Venice, Italy, Sept 27-29, 1999, 734-739.

- Kaufmann, G., Bunke, H.: A system for the automated reading of check amounts - Some key ideas, in Lee, S.-W., Nakano, Y.(eds.): Document Analysis Systems: Theory and Practice, Springer Verlag, 1999, 188 - 200
- Sobottka, K., Meier, E., Ade, F., Bunke, H.: Towards smarter cars, in Christensen, H., Bunke, H., Noltemeier, H.: Sensor Based Intelligent Robots, Lecture Notes in Art. Intell. 1724, Springer Verlag, 1999, 120 - 139
- Jiang, X.: Recent advances in range image segmentation, in Christensen, H., Bunke, H., Noltemeier, H.: Sensor Based Intelligent Robots, Lecture Notes in Art. Intell. 1724, Springer Verlag, 1999, 272 - 286

5 Research Group on Theoretical Computer Science and Logic

5.1 Personnel

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* with financial support from a third party

Guests:	Dr. R. Goré	(July – August)
	Dr. W. Heinle	(February – March)
	Dr. A. Setzer	(May – June)
	Prof. Dr. V. Rybakov	(October – November)

5.2 Research Projects

Logic and Computation

This very general project deals with 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 the research group.

Algebraic and Logical Aspects of Knowledge Processing

Several research problems from the general area of knowledge representation are being investigated. They are directed toward the mathematical foundations of this area and refer to algebraic and logical questions. The work of the group in Bern 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: G. Jäger, D. Probst, Ch. Rüede, Th. Strahm, Th. Studer, S. Tupailo, M. Wirz.

Financial support: Swiss National Science Foundation.

The Logics Workbench LWB

The Logics Workbench LWB is a powerful computer logic system. It offers the possibility to work in a user-friendly way in classical and non-classical propositional logics, including nonmonotonic approaches. The LWB provides

a sophisticated user interface to handle logical formulas for the different logics. Formulas can be simplified, transformed into a normal form, or tested for provability. It is also possible to use embeddings, generate random formulas, or to manipulate strings, among other things.

Another powerful feature of the LWB is its programming language. It allows the user to combine all available functions into own programs. It is even possible to write own functions that can then be used just like a built-in function.

The Logics Workbench has a graphical user interface featuring multiple regions for input, output and comments. It has menus to control program behavior and allows to adjust the various configuration values. It supports different fonts, including fonts with logical operators. The LWB is available for Solaris (Sparc), Linux (Intel), and MacOS (PowerPC). Each of these versions features a native graphical user interface and installation method.

One important research aspect of our group in context with the LWB deals with distributed propositional proof systems, 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 behavior to some realistic form of average case behavior in the field of distributed logical environments.

Research staff: P. Balsiger, P. Brambilla.

Financial support: Swiss National Science Foundation

Inference and Deduction: An Approach Integrating Logic and Probability

In collaboration with Prof. Dr. J. Kohlas, University of Freiburg and Prof. Dr. R. Stärk, ETHZ.

Inference in its general setting subsumes reasoning under uncertainty. This is a domain of great importance in the actual development of information tech-

nology. Correspondingly big and growing interest in this field and impressive progress can be observed. Different, symbolic and numerical formalisms for inference under uncertainty have been elaborated. Among symbolic approaches nonmonotonic logics of different kinds play a predominant role. Probability theory, belief functions and fuzzy systems are the best known representations of numerical approaches to uncertainty.

Inference is closely related to deduction. Inference under uncertainty involves an appreciation of the reliability of the deductions. This points to a close interaction of logic (for deduction) and probability (for reliability). Several propositions have been made so far as how to combine logic with probability. The project presented here proposes to study a particular way to do this, which is different to the other formalism presented in the literature: it is a theory of the reliability of deduction with probable (not fully reliable) arguments and can be labeled as probabilistic argumentation.

The project proposes to study three themes: the first is a comparison of inference and deduction mechanisms for dealing with uncertainty, partial and distributed information. This will help to situate our proposed approach of probabilistic argumentation systems in terms of descriptive power and computational efficiency with respect to other formalisms of nonmonotonic logic, probabilistic logic, Bayesian networks, belief functions, etc. The second theme concerns the inference architecture of probabilistic argumentation and treats basic questions such as modularity, focusing of deduction, distributed reasoning and reasoning with temporal information. The third subject finally is computational logic. This is the basic ingredient for the deductive part of inference under uncertainty.

Research staff: L. Alberucci, P. Balsiger, P. Brambilla, G. Jäger.

Financial support: Swiss National Science Foundation

5.3 Diploma Theses

- A. Danaei Boroumand. Logics Workbench für Window System.
- J. Brignoni. Konstruktion von Gegenmodellen intuitionistisch unweisbarer Sequenzen.
- I. Bucher. Extensions of the modal system KT4.
- D. Probst. Dependent choice in explicit mathematics.

- M. Wirz. Charakterisierung kleiner Komplexitätsklassen mittels geschichteter N-Prädikate.

5.4 Further Activities

Editorials Board and Technical Committees

- Member of the editorial board of *Theoretical Computer Science* (G. Jäger).
- Member of the editorial board of *The Journal of Symbolic Logic* (G. Jäger).
- Member of the *CICUS (Commission pour l'informatique, conférence universitaire suisse)* (G. Jäger).
- Member of the *Scientific Council of the European Association for Computer Science Logic* (G. Jäger).

Program Committees

- Swiss Computer Science Society (G. Jäger, Th. Strahm).
- International Symposium on Operations, Sets and Types (G. Jäger).

Organized Events

- Workshop Deduktive Aspekte von Beweistheorie und Informatik, Munich, January 1999, (G. Jäger und H. Schwichtenberg)
- Workshop Deduktive Aspekte von Beweistheorie und Informatik, Bern, June 1999, (G. Jäger und H. Schwichtenberg)
- Seminar of the 3ème Cycle Romand d'Informatique, Automated Inference and Deduction, Schloss Münchenwiler, November 1999, (G. Jäger and J. Kohlas)

5.5 Publications

- P. Balsiger, A. Heuerding, and S. Schwendimann. A benchmark method for the propositional modal logics K, KT, S4. To appear.
- G. Jäger. First order theories for nonmonotone inductive definitions: recursively inaccessible and Mahlo, *Journal of Symbolic Logic*. To appear.

- G. Jäger, R. Kahle, A. Setzer, and Th. Strahm. The proof-theoretic analysis of transfinitely iterated fixed point theories, *Journal of Symbolic Logic* 64, 1999.
- G. Jäger, R. Kahle, and Th. Strahm. On applicative theories. In A. Cantini, E. Casari and P.L. Minari (eds.), *Logic in Florence '95*, Kluwer.
- G. Jäger, R. Kahle and Th. Studer. Universes in explicit mathematics. Submitted.
- G. Jäger, Th. Strahm. Bar induction and ω model reflection. *Annals of Pure and Applied Logic* 97, 1999.
- G. Jäger, Th. Strahm. The proof-theoretic analysis of the Suslin operator in applicative theories. Submitted.
- G. Jäger, Th. Strahm. Upper bounds for metapredicative Mahlo in explicit mathematics and admissible set theory. *Journal of Symbolic Logic*. To appear.
- G. Jäger, Th. Studer. Extending the system T_0 of explicit mathematics: the limit and Mahlo case. Submitted.
- R. Kahle. Frege structures for partial applicative theories. *Journal of Logic and Computation* 9, 1999.
- G. Mints, S. Tupailo. Epsilon-substitution method for the ramified language and Δ_1^1 -comprehension rule. In A. Cantini, E. Casari and P.L. Minari (eds.), *Logic and Foundations of Mathematics*, 1999.
- Th. Strahm. First steps into metapredicativity in explicit mathematics. In B. Cooper and J. Truss (eds.), *Sets and Proofs*, Cambridge University Press, 1999.
- Th. Strahm. The non-constructive μ operator, fixed point theories with ordinals, and the bar rule, *Annals of Pure and Applied Logic*. To appear.
- Th. Strahm. Autonomous fixed point progressions and fixed point transfinite recursion. In S. Buss, P. Hajek, P. Pudlak (eds.), *Logic Colloquium '98*, ASL Lecture Notes in Logic. To appear.
- Th. Studer. A semantics for $\lambda_{str.}^{\Omega}$: a calculus with overloading and late-binding. Technical Report IAM-99-004, Institut für Informatik und angewandte Mathematik, Universität Bern, 1999.

- S. Tupailo. Finitary reductions for local predicativity, I: recursively regular ordinals. In S. Buss, P. Hajek, P. Pudlak (eds.), *Logic Colloquium '98*, ASL Lecture Notes in Logic. To appear.
- S. Tupailo. Realization of analysis into explicit mathematics. Submitted.
- M. Wirz. Characterizing the Grzegorzcyk hierarchy by safe recursion. Technical Report IAM-99-005, Institut für Informatik und angewandte Mathematik, Universität Bern, 1999.

6 Research Group on Software Composition

6.1 Personnel

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* financial support from a third party.

6.2 Research Projects

The Software Composition Group conducts research into languages, tools and methods for constructing flexible software systems from components.

The SCG is involved in three federally funded projects:

- “A framework approach to composing heterogeneous applications” (NFS No. 20-53711.98) investigates the application of framework technology to the composition of heterogeneous applications.

- FAMOOS (“Framework-based Approach for Mastering Object-Oriented Software Evolution”) is a European industrial project (Esprit 21975) concerned with reengineering of object-oriented legacy applications.
- COORDINA is an Esprit Working Group (Esprit 25412) on technology for coordinating distributed agents.

For further details, see: <http://www.iam.unibe.ch/~scg/Research/>

A Framework Approach to Composing Heterogeneous Applications

“A framework approach to composing heterogeneous applications” addresses the problem of building systems from heterogeneous applications. On the one hand it focuses on the problems related to the formal aspects of composition by proposing a Form-based calculus that serves as a glue specification between the applications. On the other hand it focuses on concrete experiences in composing applications. Two prototypes of languages, Piccola and CoLaS, have been implemented and are currently being further developed, and guidelines for composing software have been documented.

Piccola: Piccola is a general purpose composition language. It supports the definition of different architectural styles in which components can be scripted. Piccola’s formal semantics is given in terms of the piL-calculus. We have also developed a type system for the calculus. We have used the formalism of the piL-calculus to define a metamodel for object-based programming.

CoLaS: In the CoLaS model we integrate coordination into an object-oriented programming language itself. In CoLaS the coordination is based on the notion of Coordination Groups. We are extending the CoLaS model in the context of distributed object-oriented programming environments.

Coordination Framework: We defined a series of guidelines for developing component frameworks in which coordination is an issue. We worked on a coordination medium for distributed application that extends the notion of *tuple spaces* to *form spaces*, with corresponding advantages for flexibility and extensibility.

Research staff: F. Achermann, J. C. Cruz, Dr. S. Demeyer, Dr. S. Ducasse, Dr. M. Lumpe, Dr. J.-G. Schneider, T. Richner.

Duration: 1998-10-01 - 2000-09-30

Financial support: Swiss National Science Foundation, grant Nr. 20-53711.98

FAMOOS

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).

We are developing methods and tools 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.

In addition to the organisation of international workshops on re-engineering, we are currently working on: analysis of dependencies, detection of duplicated code, reorganization of code based on patterns, and use of prototypes for software architecture recovery.

For further details, see: <http://www.iam.unibe.ch/~famoos/>

Research staff: Dr. S. Demeyer, Dr. S. Ducasse, M. Lanza R. Nebbe, T. Richner, M. Rieger, S. Tichelaar.

Duration: 1996-09-01 - 1999-08-30

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

COORDINA

So-called “coordination languages” make it possible to specify how multiple, distributed agents should coordinate their activities to achieve a common goal. Coordination, then, is a form of composition (or configuration) for distributed agent systems.

The goal of the COORDINA Working Group is to establish European leadership in such a critical field, by joining theoreticians and practitioners in a collaborative assessment of diverse problems and approaches, with a view towards consolidating the foundational work and identifying promising technological avenues worth exploring in more focused ESPRIT projects.

For further details, see: <http://www.iam.unibe.ch/~coordina/>

Research staff: J. C. Cruz, Dr. S. Ducasse, S. Tichelaar

Duration: 08.97-08.2000

Financial support: Swiss National Science Foundation, Working Group ESPRIT 24512

6.3 Diploma Theses

- Fredi Frank. *An Associative Documentation Model*. Diploma thesis, University of Bern, October 1999.
- Michael Held. *Scripting für CORBA*. Diploma thesis, University of Bern, March 1999.
- Michele Lanza. *Combining Metrics and Graphs for Object-Oriented Reverse Engineering*. Diploma thesis, University of Bern, October 1999.
- Tobias Röthlisberger. *Compiler Framework for the Java Virtual Machine*. Diploma thesis, University of Bern, May 1999.

6.4 Ph.D. Theses

- Markus Lumpe. *A Pi-Calculus Based Approach to Software Composition*. Ph.D. thesis, University of Bern, Institute of Computer Science and Applied Mathematics, January 1999.
- Jean-Guy Schneider. *Components, Scripts, and Glue: A conceptual framework for software composition*. Ph.D. thesis, University of Bern, Institute of Computer Science and Applied Mathematics, October 1999.

6.5 Further Activities

Editorial Boards and Associations

- IEEE Computer Society – Computer Science Engineering Practice Board (O. Nierstrasz)
- Object-Oriented Systems, Chapman & Hall (O. Nierstrasz)
- L'OBJET – Logiciel, réseaux, bases de données (O. Nierstrasz)

- Annals of Software Engineering (O. Nierstrasz)
- Technique et Sciences Informatiques – Numéro spécial Réutilisation (S. Ducasse)
- CHOOSE – Swiss group for Object-Oriented Systems and Environments (Executive Board member, O. Nierstrasz)
- AITO – Association Internationale pour les Technologies Objets (Manager, O. Nierstrasz)
- ESEC, the European Software Engineering Conference (Member of Steering Committee, O. Nierstrasz)
- ESUG (European Smalltalk User Group) (Member of Steering Committee, S. Ducasse)
- SSUG (Swiss Smalltalk User Group) (Member of Steering Committee, S. Ducasse)

Program Committees

- ECOOP'99 (European Conference on Object-Oriented Programming) (PC member, O. Nierstrasz)
- ESEC/FSE'99 (European Software Engineering Conference) (PC Chair, O. Nierstrasz)
- ESOP'98 (European Symposium on Programming) (PC member, O. Nierstrasz)
- Coordination'99 (PC member, O. Nierstrasz)
- LMO'00 (Langages et Modèles à Objets) (PC member, S. Ducasse)
- OORaSE' 99 (OOPSLA'99 Workshop on Reflection and Software Engineering) (S. Demeyer and S. Ducasse)
- ECOOP'00 (European Conference on Object-Oriented Programming) (PC member, S. Demeyer)
- OOPSLA'00 (ACM SIGPLAN Object-Oriented Programming Systems, Languages and Applications) (PC member, O. Nierstrasz)
- ICSE'00 (The 22d International Conference on Software Engineering) (PC member, O. Nierstrasz)

- XP'00 (International Conference on eXtreme Programming and Flexible Processes in Software Engineering) (PC member, S. Ducasse)
- International Workshop on Object-Oriented Architectural Evolution (S. Demeyer)
- Third International Workshop on Experiences in Object-Oriented Reengineering (S. Ducasse)
- ROOM 3 (The Third Workshop on Rigorous Object-Oriented Methods) (PC member, S. Demeyer)
- GCSE'99 (Generative and Component-Based Software Engineering Symposium) (PC member, S. Demeyer)
- ESEC/FSE'99 Workshop on Object-Oriented Reengineering (PC member, S. Demeyer)

Conference Tutorials

- “Scripting: Higher-Level Programming for Component-Based Systems” presented at OOPSLA'98 and ECOOP'99 (J.-G. Schneider and O. Nierstrasz)
- “Reengineering Object-Oriented Systems” presented at ECOOP'99 and OOPSLA'99 (S. Demeyer, S. Ducasse, and O. Nierstrasz)

6.6 Publications

Proceedings

- Isabelle Borne, Serge Demeyer, and Galal Hassan Galal. Proceedings of the ECOOP'99 workshop on object-oriented architectural evolution, June 1999.
- Stéphane Ducasse and Oliver Ciupke, editors. *Proceedings of the ECOOP'99 Workshop on Experiences in Object-Oriented Re-Engineering*. Forschungszentrum Informatik, Karlsruhe, Germany, June 1999.
- Serge Demeyer and Harald Gall, editors. *Proceedings of the ESEC/FSE'99 Workshop on Object-Oriented Re-engineering (WOOR'99)*. TUV-1841-99-13. Technical University of Vienna - Information Systems Institute - Distributed Systems Group, September 1999.

- Ana Moreira and Serge Demeyer, editors. *Object-Oriented Technology (ECOOP'99 Workshop Reader)*. LNCS. Springer-Verlag, Kaiserslautern, Germany, December 1999.
- Oscar Nierstrasz and Michel Lemoine, editors. *Proceedings ESEC/FSE'99*. LNCS 1687. Springer-Verlag, Toulouse, France, September 1999.

Journal and Conference Publications

- Juan-Carlos Cruz and Stéphane Ducasse. A group based approach for coordinating active objects. In *Proceedings of Coordination'99, LNCS 1594*, pages 355–371, 1999.
- Serge Demeyer and Stéphane Ducasse. Metrics, do they really help? In Jacques Malenfant, editor, *Proceedings LMO'99 (Languages et Modèles à Objets)*, pages 69–82. HERMES Science Publications, Paris, 1999.
- Serge Demeyer, Stéphane Ducasse, and Michele Lanza. A hybrid reverse engineering platform combining metrics and program visualization. In Françoise Balmas, Mike Blaha, and Spencer Rugaber, editors, *WCRE'99 Proceedings (6th Working Conference on Reverse Engineering)*. IEEE, October 1999.
- Serge Demeyer, Stéphane Ducasse, and Sander Tichelaar. Why unified is not universal. UML shortcomings for coping with round-trip engineering. In Robert France and Bernhard Rumpe, editor, *Proceedings UML'99 (The Second International Conference on The Unified Modeling Language)*, LNCS 1723, Kaiserslautern, Germany, October 1999. Springer-Verlag.
- Stéphane Ducasse, Matthias Rieger, and Serge Demeyer. A language independent approach for detecting duplicated code. In Hongji Yang and Lee White, editors, *Proceedings ICSM'99 (International Conference on Software Maintenance)*, pages 109–118. IEEE, September 1999.
- Stéphane Ducasse, Tamar Richner, and Robb Nebbe. Type-check elimination: Two object-oriented reengineering patterns. In Françoise Balmas, Mike Blaha, and Spencer Rugaber, editors, *WCRE'99 Proceedings (6th Working Conference on Reverse Engineering)*. IEEE, October 1999.
- Stéphane Ducasse. Evaluating message passing control techniques in smalltalk. *Journal of Object-Oriented Programming (JOOP)*, 12(6):39–44, June 1999.

- Jean-Guy Schneider and Oscar Nierstrasz. Components, Scripts and Glue, In *Software Architectures – Advances and Applications* Editors Leonor Barroca, Jon Hall and Patrick Hall, pages 13-25, Published Springer, ISBN 1-85233-636-6
- Tamar Richner and Stéphane Ducasse. Recovering high-level views of object-oriented applications from static and dynamic information. In Hongji Yang and Lee White, editors, *Proceedings ICSM'99 (International Conference on Software Maintenance)*, pages 13–22. IEEE, September 1999.

Workshop Publications

- Juan-Carlos Cruz and Stéphane Ducasse. Coordinating open distributed systems. In *Proceedings of International Workshop in Future Trends in Distributed Computing Systems'99*, 1999.
- Serge Demeyer, Stéphane Ducasse, and Sander Tichelaar. A pattern language for reverse engineering. In Paul Dyson, editor, *Proceedings of the 4th European Conference on Pattern Languages of Programming and Computing, 1999*, Konstanz, Germany, July 1999. UVK Universitätsverlag Konstanz GmbH.
- Serge Demeyer. Structural computing: The case for reengineering tools. In Peter Nuernberg, editor, *Proceedings of the 1rst Workshop on Structural Computing – Hypertext'99*, February 1999.
- Tamar Richner. Using recovered views to track architectural evolution. In *ECOOP'99 Workshop Reader LNCS 1543*. Springer-Verlag, June 1999.
- Sander Tichelaar and Serge Demeyer. Sniff+ talks to rational rose – interoperability using a common exchange model. In *SNiFF+ User's Conference*, January 1999. Also appeared in the "Proceedings of the ESEC/FSE'99 Workshop on Object-Oriented Re-engineering (WOOR'99)" – Technical Report of the Technical University of Vienna (TUV-1841-99-13).

A Teaching Activities

A.1 Winter semester 1998/1999:

H. Bieri:	Datenstrukturen und Algorithmen Digitale Bilder Modellierung und Simulation Seminar: Computergeometrie und Grafik
H.P. Blau:	Informatik 1C Programmierung 1
T. Braun:	Computernetze Grundlagen der technischen Informatik Netze und Protokolle für das Internet Seminar: Rechnernetze und verteilte Systeme
B. Achermann, K. Sobottka: X. Jiang:	Künstliche Intelligenz Automaten und formale Sprachen Seminar: Künstliche Intelligenz
G. Jäger:	Automatisches Beweisen Logik und Informatik Praktikum Symbolisches Rechnen Seminar: Theoretische Informatik und Logik
G. Jäger, J. Kohlas:	Inferenz und Deduktion
G. Jäger, J. Schmid:	Seminar: Mengensysteme III
A. Lüthi, P. Küng:	Datenbanken
H. Mey:	Informatik 1A
O. Nierstrasz:	Seminar: Software Composition
O. Nierstrasz, S. Ducasse:	Smalltalk: A reflective Language and Environment
O. Nierstrasz, S. Demeyer, S. Ducasse:	Object-Oriented Re-Engineering

A.2 Summer semester 1999:

H. Bieri:	Datenstrukturen und Algorithmen Computergrafik 3D-Grafik Seminar: Computergeometrie und Grafik
H.P. Blau:	Informatik 2C
H. Bunke:	Compilerbau Seminar: Künstliche Intelligenz Mustererkennung
T. Braun:	Betriebssysteme Multimediakommunikation Rechnerarchitektur Seminar: Rechnernetze und verteilte Systeme
K. Decker:	Paralleles und verteiltes Rechnen
G. Jäger:	Einführung in die theoretische Informatik Grundlagen der Logikprogrammierung Seminar: Logiklabor Seminar: Theoretische Informatik und Logik
G. Jäger, J. Kohlas:	Inferenz und Deduktion
X. Jiang:	Bildanalyse
O. Nierstrasz:	Praktikum Software Engineering Programmiersprachen Programmierung 2 Seminar: Software Composition
Th. Strahm:	Nichtmonotones Schliessen

A.3 Winter semester 1999/2000:

H. Bieri:	Einführung in die Informatik Geometrisches Modellieren Seminar: Computergeometrie und Grafik Seminar: Datenstrukturen und Algorithmen 2
H.P. Blau:	Anwendungssoftware Programmierung 1
T. Braun:	Computernetze Grundlagen der technischen Informatik Mobilkommunikation Seminar: Rechnernetze und verteilte Systeme
H. Bunke:	Automaten und formale Sprachen Künstliche Intelligenz Seminar: Künstliche Intelligenz Praktikum Bildanalyse
G. Jäger:	Datenbanken Logik und Informatik Seminar: Logiklabor Seminar: Theoretische Informatik und Logik
G. Jäger, J. Kohlas:	Seminar: Inferenz und Deduktion
O. Nierstrasz:	Concurrent Programming Einführung in Software Engineering Seminar: Software Composition
O. Nierstrasz, S. Demeyer, S. Ducasse:	Object-Oriented Re-Engineering

B Colloquium in Informatics

- 01/15/1999 Prof. Dr. Mark H. Overmars
Department of Computer Science, Utrecht University, NL
Geometric Algorithms for Part Feeding
- 01/19/1999 Prof. Dr. Bernhard Plattner
Institut für Technische Informatik und Kommunikationsnetze, ETHZ
Router Plugins - eine Architektur für IP-Router der nächsten Generation
- 01/26/1999 Dr. Jürgen Döllner
Institut für Informatik, Universität Münster
Computergraphik und Visualisierung mit der Modeling & Animation
Machine und dem Virtual Rendering System
- 04/06/1999 Prof. Dr. Hans Kamp
Institut für Maschinelle Sprachverarbeitung, Universität Stuttgart
Modelling the Meaning and Logic of Natural Language Quantifiers
- 04/13/1999 Dr. Ralf Keller
Ericsson Eurolab, Aachen
The Role of IP and ATM in the Evolution of the GSM Core Network
- 04/20/1999 Prof. Dr. Jürgen Schürmann, Ulm
Glaubwürdigkeiten für Klassen und Garbage bei einfachen und
strukturierten Klassifikatoren
- 05/04/1999 Prof. Dr. H.N. Teodorescu
University of South Florida, Tampa, USA
Features- and Pattern-Oriented Signal Processing: Neural Approaches
- 05/18/1999 Prof. Dr. Johann Makowsky
Department of Computer Science, Technion and Department of
Mathematics, ETHZ
Counting Subgraphs and How Logic Can help
- 05/25/1999 Prof. Dr. Beat Hirsbrunner
Institut für Informatik, Universität Freiburg
Autonome und koordinierte Multiagentensysteme

11/16/1999 Prof. Dr. Jürgen Richter-Gebert
Institut für Theoretische Informatik, ETHZ
Dynamische Geometrie - Grundlagen und Möglichkeiten

Also within the framework of the Colloquium in Informatics:

11/02/1999 Prof. Dr. Hansjürg Mey (Abschiedsvorlesung)
Institut für Informatik und angewandte Mathematik,
Universität Bern
Informatik: Brücke zwischen Mathematik und Alltag