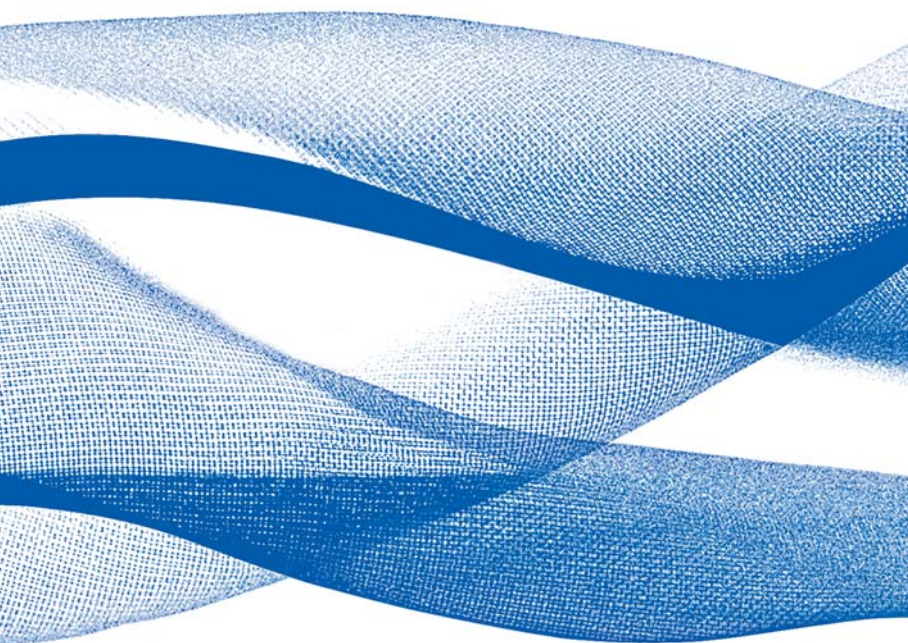University of Ljubljana

FFI Faculty of
Computer and
Information Science

Survey of Activities in 2004

Ljubljana 2005

Faculty of Computer and Information Science

University of Ljubljana

Survey of Activities in 2004

Contents

Prof. Dr. Boštjan Vilfan

Foreword

A note on nomenclature at the University of Ljubljana: Most Central European universities are divided into "faculties", which are sometimes, in turn, divided into departments, and the latter (or the former) into "chairs" presided by a professor who covers a certain field of teaching and research. This scheme prevails at the University of Ljubljana as well, except that "chairs" are not associated with individual professors, but represent a group of professors with related areas of teaching and research. Therefore in the present booklet we use the term "group" instead of "chair" for the latter subdivision.

The present booklet provides some basic facts about the Faculty of Computer and Information Science of the University of Ljubljana pertaining to the year 2004. Henceforth, the faculty will be designated by its Slovenian initials, FRI.

FRI is the leading teaching and research institution in the field of Computer Science in Slovenia, and in spite of its comparatively short history it has a number of active research groups, as well as a lengthy roster of alumni, some of whom have achieved distinction in various fields of computer science in Slovenia and abroad.

Due to a continued high demand for graduates in the area of Computer Science and "Informatics" (business applications which generally rely on the use of data bases) as well as a continued high regard for Computer Science in the public's perception, FRI has avoided the trend of declining enrolment in the engineering and science disciplines up to now. However, we are definitely not complacent, and we hope to continue to attract promising students to our various educational and research programs.

There is no doubt that in the age of globalization FRI faces increasing competition in all areas; however I might note that we have made encouraging progress in attracting EU Commision's funding for our research groups, our members are involved in some interesting cutting-edge applications, and we are on our way to solving our most pressing problem, the shortage of space.

This booklet is a contribution to forging new links to the international Computer Science community, which is a prerequisite for FRI to successfully continue its mission. I hope that readers will find some interesting material and be motivated to establish contacts with our members.

Boštjan Vilfan,
Professor of Computer Science and Dean

About FRI
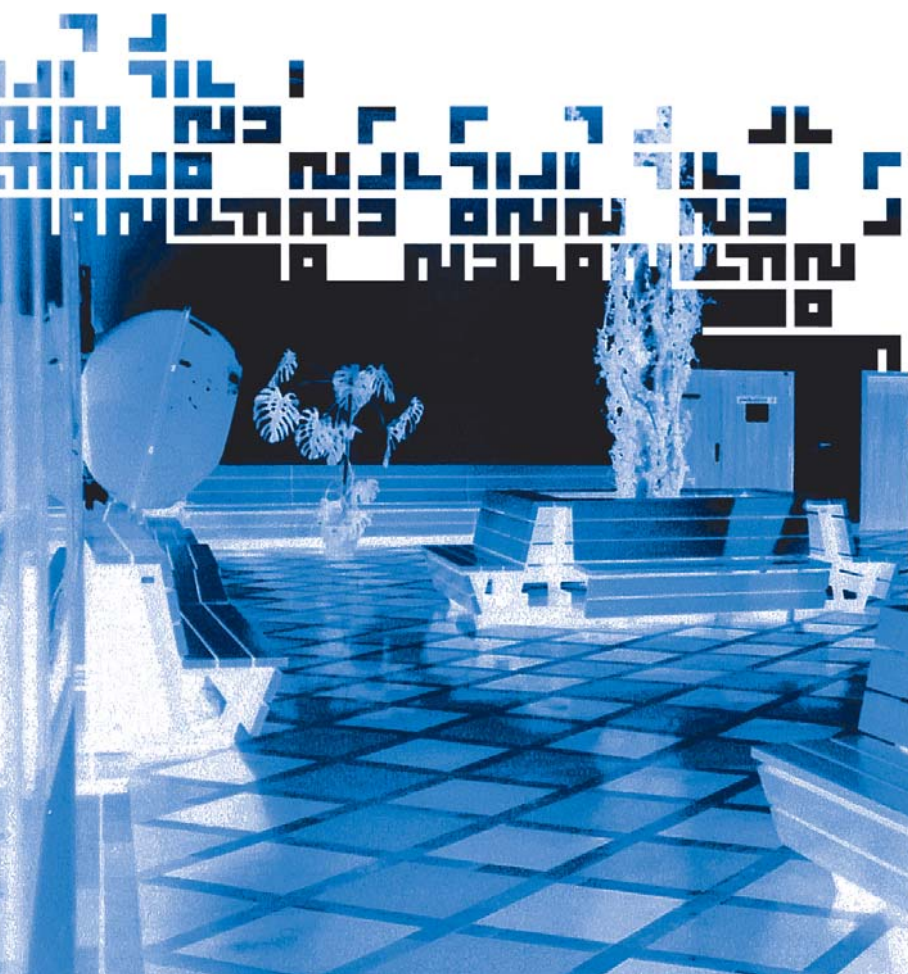
General Information

Dean **Prof. Dr. Boštjan Vilfan**
Vice Dean for Education **Prof. Dr. Viljan Mahnič**
Vice Dean for Research **Prof. Dr. Blaž Zupan**
Head of administration **Ana Prosen, dipl. iur.**

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Note: In the period covered by this publication (2004) the executive positions at FRI were occupied by:

Dean **Prof. Dr. Saša Divjak**
Vice Dean for Education **Prof. Dr. Radko Osredkar**
Vice Dean for Research **Prof. Dr. Aleš Leonardis**

FRI

The Faculty of Computer and Information Science was established in 1996 when the previous Faculty of Electrical Engineering and Computer Science was split into two new faculties. However, the undergraduate program in computer science at the University of Ljubljana started in the academic year 1973/74, first as an elective program after the second year of electrical engineering study, and since 1982 as an independent four year program.

Up till now more than 1600 students completed the undergraduate program in computer and information science and obtained the Ing. or Dipl. Ing. degree. The postgraduate level more than 236 students obtained the Masters degree (M.Sc.) and 69 the Doctoral degree (Ph.D.) in Computer and Information science. Currently, there are about 1627 undergraduate and 146 postgraduate students at the Faculty. The Faculty has 97 of which 78 are teaching and research staff.

The building which houses FRI is shared with the Faculty of Electrical Engineering. FRI has 7 teaching laboratories equipped with a total of about 135 networked personal computers and shares with the Faculty of Electrical Engineering 19 lecture halls. The research laboratories are equipped with about 530 personal computers or workstations. The Faculty's central computer serves as the main e-mail and web server. The Faculty's local network is connected to the Internet through the University's network "Metulj" (Butterfly) and the Academic Research Network of Slovenia (ARNES). Practically all classrooms are covered by wireless network.

The Faculty has a joint library with the Faculty of Electrical Engineering. It houses a large collection of books, textbooks and journals and offers access to several on-line services and databases. Both faculties also share a publishing department which is engaged primarily in publishing textbooks in Slovenian (original and translated) for students.

How to Reach Ljubljana

BY AIR

The Ljubljana airport at Brnik is about 20 km North-West from the center of Ljubljana (see Figure 2). It has fairly good connections with other European airports (Frankfurt, Munich, London, Zurich, Copenhagen, Paris, etc.) and is by Adria, the national Slovenian air carrier, as well as number of other major European airlines.

BY PASSENGER CAR

Ljubljana is connected to all neighbouring countries with a good road system and visitors should not encounter problems on their trip.

BY AIR AND RAIL

Via Austria: By plane to Vienna, Graz or Klagenfurt airport and by train or car to Ljubljana (direct trains go twice daily on weekdays)

Via Germany: By plane to Munich and by train or car to Ljubljana (a direct train goes once every day)

Via Croatia: By plane to Zagreb and by train or car to Ljubljana

Via Italy: By plane to Venice or Trieste and by train or car to Ljubljana

Figure 1: Slovenia in Europe
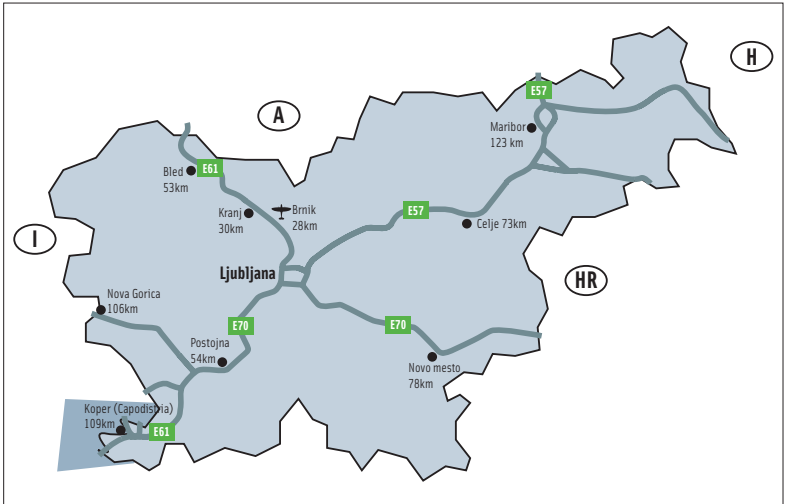
Figure 2: Map of Slovenia

BY RAIL

Ljubljana has good railway links with Austria (Vienna, Klagenfurt, Graz), Germany (Munich), Croatia (Zagreb, Rijeka), Hungary (Budapest) and Italy (Trieste). The above mentioned cities have good international connections with all of the large European cities. Traveling to Slovenia by rail from places further afield, is of course less comfortable and not necessarily cheaper than air travel.

Figure 3: Ljubljana – the Faculty is located within the highlighted area (detailed in Figure 4)

LOCATION OF FRI IN LJUBLJANA

FRI is located in the South-West of Ljubljana (Figure 3) within walking distance of most hotels in the center of Ljubljana. To reach the Faculty from the center take bus lines 1 (direction "Mestni log") or 6 (direction "Dolgi most"). How to reach FRI by car and where to park your car is shown in Figure 4.

Figure 4: Detailed map of Ljubljana – the location of the Faculty is indicated by the highlighted yellow square

Educational Programs
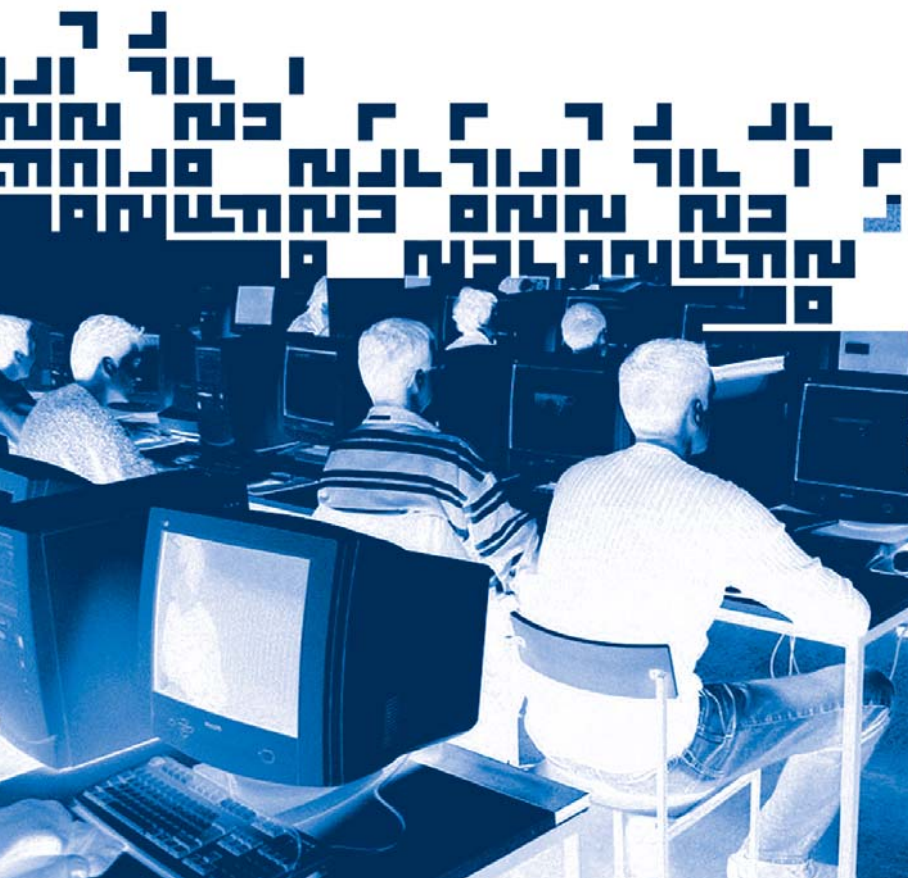
The academic year at the University of Ljubljana is divided into fall and spring semesters. The courses in the fall semester begin on October 1st and end on January 15th. The spring semester courses start on February 15th and end on May 30th. There are three examination periods: winter (January 15th to February 15th), spring (June) and fall (September). Courses consist of lectures, problem solving classes (tutorials), and laboratory work. The weekly numbers of hours for each course shown in the following tables correspond to lectures, problem solving classes, and laboratory work, respectively. The average weekly course load for undergraduate students is cumulatively 25 hours. In the 2004/05 academic year an updated curriculum of the 8-semester (so called "university") programs is starting and the data refers to that program.

FRI participates in several international educational programs, such as the European Union SOCRATES/ERASMUS program and the CEEPUS program which encourage student and teacher mobility between European universities. The study programs of the Faculty of Computer and Information Science are registered with the European Federation of National Engineering Associations (FEANI) and meet the criteria for the title EUR ING.

UNDERGRADUATE PROGRAMMES

FRI Science offers three undergraduate educational programs:

A three-year program (six semesters of lectures, 15 weeks of work in industry, 6 months of Diploma thesis work), which leads to the degree "Dipl. Ing. Of Computer and Information Science",

A four-year "university" program (eight semesters of lectures, 6 months of Diploma thesis work), which leads to the degree "University Dipl. Ing. Of Computer and Information Science", and

A four year interdisciplinary "university" program (eight semesters of lectures, 6 months of Diploma thesis work), which leads to the degree "University Dipl. Ing. of Computer Science and Mathematics".

The entry requirement for the three-year program is completion of a four-year secondary education. For the four-year "university" programs the national secondary school baccalaureate is mandatory. The three-year program is application oriented, while the four-year program offers more extensive and in depth theoretical knowledge. Only graduates of the four-year program can continue their education at the postgraduate level.

The two undergraduate programs consists of a core-curriculum, which contains mainly mathematics and theoretical foundations of computer and information science courses, and three elective modules, entitled,

Information Science,

Computer Systems, and

Computer Software.

Students must choose one of the three modules after the first year in the three-year program and after the second year in the four-year "university" program.

POSTGRADUATE PROGRAMMES

Postgraduate programs at the Faculty of Computer and Information Science consist of four semesters of, followed by a Masters thesis, leading to a M.Sc. degree and subsequently by a Doctoral thesis leading to a Ph.D. degree in Computer and Information Science. Under specified conditions students can proceed from the required postgraduate courses to working directly on their Doctoral thesis, thus bypassing the Masters thesis. The Faculty offers two postgraduate programs:

Computer and Information Science,

Information Systems and Decision Making.

Four-Year Undergraduate Program

FIRST YEAR

General Courses	Fall			Spring		
Discrete Mathematics	3	3	0	3	3	0
Introduction to Programming I	3	0	3	–	–	–
Introduction to Computer Architecture I	3	0	3	–	–	–
Application Software	1	0	4	–	–	–
Foreign Language (English)	0	3	0	–	–	–
Calculus I	–	–	–	3	1	2
Introduction to Programming II	–	–	–	3	0	3
Introduction to Computer Architecture II	–	–	–	3	0	3
Total	**10**	**6**	**10**	**12**	**4**	**8**

SECOND YEAR

General Courses	Fall			Spring		
Calculus II	3	3	0	–	–	–
Introduction to Algorithms and Data Structures I	3	1	2	–	–	–
Introduction to Algorithms and Data Structures II	–	–	–	3	1	2
Business Economics	–	–	–	2	2	0
Total	**6**	**4**	**2**	**5**	**3**	**2**

Courses in Information Science	Fall			Spring		
Information Systems	3	0	3	–	–	–
Databases I	3	0	3	–	–	–
Databases II	–	–	–	3	0	3
Statistics and Data Analysis	–	–	–	2	2	0
Information Systems Design	–	–	–	3	0	3
Total	**6**	**0**	**6**	**8**	**2**	**6**

Courses in Computer Logic and Systems	Fall			Spring		
Logic Structures and Systems I	3	0	3	–	–	–
Digital Electronics I	3	1	2	–	–	–
Digital Electronics II	–	–	–	3	1	2
Input–Output Devices	–	–	–	3	1	2
Computer Systems Organization	–	–	–	2	2	0
Total	**6**	**1**	**5**	**8**	**4**	**4**

Courses in Computer Software	Fall			Spring		
Programming Languages	3	1	2	-	-	-
Introduction to Databases	3	0	3	-	-	-
Introduction to Information Systems	-	-	-	3	0	3
Introduction to Probability and Statistics	-	-	-	2	2	0
User Interfaces	-	-	-	3	0	3
Total	**6**	**1**	**5**	**8**	**2**	**6**

THIRD YEAR

General Courses	Fall			Spring		
System Software	3	0	2	-	-	-
Business Functions	2	2	0	-	-	-
Computer Communications	-	-	-	3	0	3
Total	**5**	**2**	**2**	**3**	**0**	**3**

Courses in Information Science	Fall			Spring		
Organization Theory	3	0	3	-	-	-
Accounting	3	0	3	-	-	-
Application Development Tools and Techniques	3	0	3	-	-	-
Legal and Social Aspects of Informatics	2	0	0	-	-	-
Project Management and Organiz. of Inform. Syst.	-	-	-	3	1	2
Inform. Syst. Standards and Quality Assurance	-	-	-	2	0	1
Communication Methods	-	-	-	2	2	0
Decision Systems	-	-	-	3	0	3
Total	**13**	**2**	**9**	**10**	**3**	**6**

Courses in Computer Logic and Systems	Fall			Spring		
Introduction to Computer Graphics	2	0	2	-	-	-
Introduction to Modelling and Simulation	3	0	3	-	-	-
Digital Signal Processing	3	1	2	-	-	-
Real Time Systems	-	-	-	3	0	3
Logic Structures and Systems II	-	-	-	3	0	3
Computer Equipment Evaluation	-	-	-	2	1	1
Distributed Structures	-	-	-	2	0	1
Total	**8**	**1**	**7**	**10**	**1**	**8**

Courses in Computer Software	Fall			Spring		
Numerical Methods	3	2	0	–	–	–
Introduction to Modelling and Simulation	3	0	3	–	–	–
Programming Systems Design I	3	0	2	–	–	–
Programming Systems Design II	–	–	–	3	1	2
Introduction to Computer Graphics	–	–	–	2	0	2
Applications Development	–	–	–	1	0	2
Methods of Artificial Intelligence	–	–	–	3	0	3
Total	**9**	**2**	**5**	**9**	**1**	**9**

FOURTH YEAR

General Courses	Fall	Spring
Practice	15 weeks	–
Diploma Thesis	–	6 months
Total	**15 weeks**	**6 months**

Four-Year "University" Undergraduate Program

FIRST YEAR

General Courses	Fall			Spring			Credits
Calculus I	3	3	0	–	–	–	7
User Application Software	1	0	3	–	–	–	4.5
Discrete Structures	3	2	0	–	–	–	5.5
Physics	3	3	0	–	–	–	6,5
Programming I	3	0	3	–	–	–	7
Calculus II	–	–	–	3	3	0	6.5
Computer Technologies	–	–	–	3	2	0	5.5
Linear Algebra	–	–	–	2	2	0	4.5
Programming II	–	–	–	3	0	3	7
Switching Circuits and Systems	–	–	–	3	0	3	6.5
Total	**13**	**8**	**6**	**14**	**7**	**6**	**60**

SECOND YEAR

General Courses	Fall			Spring			Credits
Algorithms and Data Structures I	3	0	3	–	–	–	7
Computer Systems Architecture I	3	0	3	–	–	–	7.5
Foreign Language (English)	0	3	0	–	–	–	3.5
Introduction to Information Theory	3	2	0	–	–	–	6
Probability Theory and Statistics	3	2	0	–	–	–	6
Algorithms and Data Structures II	–	–	–	3	0	3	6.5
Computer Systems Architecture II	–	–	–	3	0	3	6.5
Computer Communications and Networks	–	–	–	3	0	2	5
Modeling and Simulation	–	–	–	3	0	3	6
Numerical Methods	–	–	–	3	0	3	6
Total	**12**	**7**	**6**	**15**	**0**	**14**	**60**

THIRD YEAR

Common Courses	Fall			Spring			Credits
Business Economics	2	1	0	–	–	–	3.5
PT	–	2	–	–	–	–	–
Total	**2**	**1**	**0**	**–**	**–**	**–**	**3.5**

Information Science Module	Fall			Spring			Credits
Databases I	3	1	2	-	-	-	6.5
Information Systems	3	1	2	-	-	-	7
Operating Systems Fundamentals	3	0	3	-	-	-	6.5
Software Development Project Management	3	1	2	-	-	-	6.5
Information Systems Development	-	-	-	3	1	2	6
Decision Models and Systems	-	-	-	3	3	0	6
Operations Research	-	-	-	2	0	2	4.5
Multimedia Systems	-	-	-	2	0	1	3.5
Theory of Organization	-	-	-	2	0	0	4.5
Databases II	-	-	-	3	1	2	6,5
Total	**14**	**4**	**9**	**15**	**5**	**7**	**60**

Computer Systems Module	Fall			Spring			Credits
Graphic Techniques and Procedures	3	0	3	-	-	-	6.5
Logic Design Methods	3	0	3	-	-	-	7
Computer Organization	3	0	3	-	-	-	6.5
Operating Systems	3	0	3	-	-	-	6.5
Digital Electronics	-	-	-	3	0	3	6.5
Distributed Systems and Technologies	-	-	-	3	1	2	7
Input-Output Devices and Systems	-	-	-	3	0	3	6.5
Fundamentals of Information Systems	-	-	-	2	0	1	3.5
System Software	-	-	-	3	0	3	6.5
Total	**14**	**1**	**12**	**14**	**1**	**12**	**60**

Computer Software Module	Fall			Spring			Credits
Operating Systems I	3	0	3	-	-	-	6.5
Fundamentals of Databases	3	1	2	-	-	-	6.5
Theoretical Fundamentals of Computer Science I	3	3	0	-	-	-	7
Project Management	3	1	2	-	-	-	6.5
Operating Systems II	-	-	-	3	0	3	6.5
Principles of Programming Languages and Symbolic Programming	-	-	-	3	3	0	7
Computer Graphics	-	-	-	3	0	3	6.5
Fundamentals of Information Systems	-	-	-	2	0	1	3.5
Theoretical Fundamentals of Computer Science II	-	-	-	3	3	0	6.5
Total	**14**	**6**	**7**	**14**	**6**	**7**	**60**

FOURTH YEAR

Common Courses	Fall			Spring			Credits
Computer Systems Performance and Evaluation	3	0	3	-	-	-	6.5
Business Functions	-	-	-	2	1	0	3.5
Total	**3**	**0**	**3**	**2**	**1**	**0**	**10**

Information Science Module	Fall			Spring			Credits
Methods of Communication	3	0	3	-	-	-	6.5
Design and Management of Information Systems	3	1	2	-	-	-	6.5
Business Analysis	2	0	2	-	-	-	4
Electronic Business	3	0	3	-	-	-	6.5
Distributed Information Systems	-	-	-	3	0	3	7
Information Systems Technology	-	-	-	3	0	3	7
Artificial Intelligence	-	-	-	3	2	1	7
Information Society	-	-	-	3	0	2	5.5
Total	**14**	**1**	**13**	**14**	**3**	**9**	**60**

Computer Systems Module	Fall			Spring			Credits
Soft Computing Methods	3	3	0	-	-	-	6.5
Optical- and Nanotechnologies-	3	0	3	-	-	-	6.5
Digital Signal Processing	3	0	3	-	-	-	7
Seminar	0	0	3	-	-	-	3.5
Parallel Architecture of Computers	-	-	-	3	0	3	7
Process Informatics	-	-	-	3	0	3	6.5
Computer Reliability and Diagnostics	-	-	-	3	0	3	6.5
Telematics	-	-	-	3	3	0	6.5
Total	**12**	**3**	**12**	**14**	**4**	**9**	**60**

Computer Software Module	Fall			Spring			Credits
Digital Signal Processing	3	0	3	-	-	-	6
Machine Perception	3	0	3	-	-	-	6
Artificial Intelligence I	3	2	1	-	-	-	6
Compilers	3	0	2	-	-	-	5.5
Intelligent Distributed Software Technologies	3	0	3	-	-	-	7.5
Software Technology	-	-	-	3	0	3	7
Knowledge Engineering	-	-	-	3	2	0	6
Artificial Intelligence II	-	-	-	3	1	1	6
Total	**15**	**2**	**12**	**14**	**4**	**7**	**60**

Four-Year "University" Interdisciplinary Program "Computer Science and Mathematics"

FIRST YEAR

Course	Fall			Spring			Credits
Calculus 1	3	3	0	–	–	–	8
Discrete Mathematics 1	3	2	0	–	–	–	7
Computer Lab	1	0	3	–	–	–	6
Introduction to Programming 1	2	0	2	–	–	–	6
Calculus 2	–	–	–	3	3	0	8
Discrete Mathematics 2	–	–	–	3	3	0	8
Introduction to Programming 2	–	–	–	2	0	2	6
Linear Algebra 1	–	–	–	2	2	0	6
Tutorial	0	0	2	0	0	2	5
Total	**9**	**5**	**7**	**10**	**8**	**4**	**60**

SECOND YEAR

Course	Fall			Spring			Credits
Linear Algebra 2	2	2	0	–	–	–	5
Numerical Methods 1	2	0	2	–	–	–	5
Algorithms and Data Structures 1	3	0	3	–	–	–	7
Computer Architectures 1	3	0	3	–	–	–	7
Theory of Programming Languages	2	0	2	–	–	–	5
Algorithms and Data Structures 2	–	–	–	3	0	3	7
Calculus 3	–	–	–	3	3	0	7
Combinatorics	–	–	–	3	3	0	7
Numerical Methods 2	–	–	–	2	0	2	5
Declarative Programming	–	–	–	2	0	2	5
Physical Education	0	0	2	0	0	2	–
Total	**12**	**2**	**10**	**13**	**6**	**7**	**60**

THIRD YEAR

Course	Fall			Spring			Credits
Introduction to Data Bases	3	1	2	–	–	–	6
Probability and Statistics	3	3	0	–	–	–	7
Computability Theory	3	3	0	–	–	–	7
Operating Systems	3	0	3	–	–	–	7
Optimization	–	–	–	3	0	3	7
Computational Complexity	–	–	–	3	3	0	7
Computational Geometry	–	–	–	3	0	3	7
Computer Graphics	–	–	–	3	0	3	7
Elective*	–	–	–	2	2	0	5
PT	0	0	2	0	0	2	–
Total	**12**	**7**	**5**	**14**	**5**	**9**	**60**

FOURTH YEAR

Course	Fall			Spring			Credits
Cryptography and Coding Theory 1	2	2	0	–	–	–	5
Artificial Intelligence 1	3	2	1	–	–	–	6
Communication Theory	2	2	0	–	–	–	4.5
Elective*	6	6	0	–	–	–	15
Cryptography and Coding Theory 2	–	–	–	2	2	0	5
Artificial Intelligence 2	–	–	–	3	1	1	5
Alternative Models of Computation	–	–	–	2	2	0	4.5
Elective*	–	–	–	6	6	0	15
Total	**13**	**12**	**1**	**13**	**11**	**1**	**60**

ELECTIVE COURSES

Course	Fall			Spring			Credits
Symbolic Computing	2	0	2	–	–	–	5
Algorithms for Discrete Structures	2	0	2	–	–	–	5
Topics in Data Analysis	2	0	2	–	–	–	5
Logic in Computer Science	2	2	0	–	–	–	5
Scientific Communication	2	2	0	–	–	–	5
Computer Perception	2	0	2	–	–	–	5
Real Time Systems	2	0	2	–	–	–	5
Soft Computing	2	2	0	–	–	–	5
System Performance Analysis	2	0	2	–	–	–	5
Case Studies in Data Mining	2	0	2	–	–	–	5
Approximative Algorithms	–	–	–	2	2	0	5
Graph Theory	–	–	–	2	2	0	5
Operational Research	–	–	–	2	0	2	5
Dynamical Systems	–	–	–	2	2	0	5
Topics in Data Structures	–	–	–	2	0	2	5
Computer Architectures 2	–	–	–	2	0	2	5
Machine Learning	–	–	–	2	2	0	5
Pattern Recognition	–	–	–	2	0	2	5
Computer Vision	–	–	–	2	0	2	5
Human Machine Interaction	–	–	–	2	2	0	5
Modeling and Simulation	–	–	–	2	0	2	5
Fault Tolerance and Computer System Diagnostics	–	–	–	2	2	0	5
Distributed Systems and Technologies	–	–	–	2	0	2	5
Distributed Information Systems	–	–	–	2	0	2	5

Computer and Information Science Postgraduate Program

The postgraduate curriculum in Computer and Information Science is comprised of:

six required courses (30 hours each),

four elective courses (30 hours each),

two seminars (150 hours).

The total postgraduate course work consists of 450 hours.

FIRST YEAR

Courses (30 hours)	Fall	Spring
Selected Topics in Symbolic Computation and Computer Arithmetics	30 hours	
Analysis of Algorithms	30 hours	
Theory of Computer Languages		30 hours
Theory of Computational Procedures		30 hours
Elective Course	30 hours	
Elective Course		30 hours

SECOND YEAR

Courses (30 hours)	Fall	Spring
Architecture and Organization of Computers	30 hours	
Theory of Information Systems		30 hours
Elective Course	30 hours	
Elective Course		30 hours
Seminar	75 hours	75 hours

ELECTIVE COURSES (30 HOURS EACH)

Selected Topics in Computer Architecture

Reliability of Computer Systems

Multiprocessor Architectures and Parallel Algorithms

Artificial Intelligence Methods

Digital Signal Processing

Cellular Automata and Parallel Processing

Neural Networks

Integrated Computer Support of Manufacturing

Databases

Concepts for Modeling of Visual Information

Special Course in Information Science

Special Course in Operations Research

Special Course in Programming Technology

Methods of Applied Mathematics

Selected Topics in Combinatorial Mathematics

Machine Learning

Logic

Approximation and Randomized Algorithms

Cryptography and Computer Security

Differential and Computational Geometry

System Methods

Distributed and Decentralized Information Systems

Decision Systems

Interpersonal Relations and Communication

Information Systems Development Tools

Project Management

Multimedia Techniques

Selected Topics of Economics

Automation of New Public Management

Information Systems in Natural Sciences and Technology

Information Systems and Public Administration

Reengineering of Business Processes

Information Systems Quality and Standardization

Information Systems Sociology – Information Society

Statistical Information Systems

Reliability of Computer Systems

Visual Information Handling

Operational Research in Information Science

Fuzzy Logic Based Decision Making

Portfolio Management

Macroeconomics Modeling

Computer Networks with Services

Computer Supported Cooperative Work

Data Mining and Knowledge Discovery in Databases

Evolutionary Computing

Intelligent Agents

Electronic Business

Computer Structures and Nanotechnologies

Embedded Systems

Numerical Linear Algebra

Topology in Computer Science

Information Systems and Decision Making Postgraduate Program

The program (a total of 450 hours) is comprised of the following:

two required courses (60 hours each),

a combination of three to five elective courses (Main elective courses of 60 hours each, other elective courses 30 hours each),

seminar (150 hours).

Semester	Courses
1	Functions and Decision Making (Required course)
	Elective courses
2	Information Systems (Required course)
	Elective courses
3	Information Systems Development (Main elective course)
	Management and Theory of Organization (Main elective course)
	Information Systems Management in Business Systems
	(Main elective course)
	Elective courses
	Seminar
4	Master's thesis

ELECTIVE COURSES (30 HOURS EACH)

Elective courses (see page 24) are common to both postgraduate programmes, i.e., Computer and Information Science and Information Systems and Decision Making.

Research

Research activities (as well as most Diploma, Master, and Doctoral theses research) at FRI are performed in fifteen research laboratories which are organized in six groups.

The main sources of research funding are the Ministry of Higher Education, Science and Technology, Slovenian Research Agency, Ministry of Defense, European Union programs (6th FP, COST), various bilateral programs: USA–Slovenian, French–Slovenian (Proteus), Austrian–Slovenian, Czech–Slovenian, Norwegian–Slovenian, Portuguese–Slovenian, and UK–Slovenian (ALINK). The Ministry of Higher Education, Science and Technology, together with the Slovenian Research Agency, also supports the majority of postgraduate students by means of individual scholarships. Many application projects are financed by Slovenian companies.

For more information consult the Web pages of individual laboratories which are all accessible from the Faculty's home page.

SOFTWARE GROUP

Laboratory for Computer Graphics and Multimedia
Laboratory for Biomedical Computer Systems and Imaging

COMPUTER LOGIC, SYSTEMS AND NETWORKS GROUP

Laboratory for Adaptive Systems and Parallel Processing
Laboratory for Computer Architecture
Computer Communications Laboratory
Computer Structures and Systems Laboratory

INFORMATICS GROUP

Information Systems and Database Systems Laboratory

THEORETICAL COMPUTER SCIENCE GROUP

Laboratory for Algorithms and Data Structures
Laboratory for Architecture and Signal Processing
Software Engineering Laboratory

ARTIFICIAL INTELLIGENCE GROUP

Computer Vision Laboratory
Visual Cognitive Systems Laboratory
Artificial Intelligence Laboratory
Laboratory for Cognitive Modeling

MATHEMATICS AND PHYSICS GROUP

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RESEARCH ACTIVITIES

The Laboratory of Computer Graphics and Multimedia is involved in several activities related to multimedia technologies, computer-based education and learning, human-computer interaction, and virtual and augmented reality. The laboratory is a member of the international consortium CoLoS, together with 18 European and some other Universities. The main area of interest of CoLoS consortium is computer supported conceptual learning of natural sciences. The laboratory also cooperates with Microsoft in introducing new software technologies.

The main ongoing research activities in the laboratory are dedicated to development of multimedia tools and applications, grid computing, and educational applications, especially interactive learning and didactic simulation of natural phenomena.

Several studies were started as part of Ph.D. researches, including emergent multi-agent systems, music information retrieval and adaptive hypermedia systems in education. Research on emergent multi-agent systems focuses on construction of cooperative behaviour in complex systems using evolutionary computation and emergence to design global behaviour of the systems. In music information retrieval researches, the focus is on extraction of higher-level cognitive parameters (melody, harmony, rhythm) from audio signals. The research from the field of adaptive hypermedia deals with the problems of describing user's knowledge considering the uncertainty in its description and focuses on educational systems, which can adapt their functional features to the individual user.

In the past, members of the laboratory cooperated with other research groups in the development of military training systems, medical imaging applications, various simulation tools for computer supported industrial automation, including robotized environments, and computer supported quality control and management systems.

TEACHING

Programming 2 (C and Java), Operating Systems, Computer Graphics, Multimedia Technologies, Computer Integrated Manufacturing.

EQUIPMENT

The laboratory is equipped with several computers, printers, scanners, presentation and videoconferencing equipment, and some virtual reality equipment. Professional software tools for 3D design, visualization, animation, and video editing are also available.

CURRENT PROJECTS

Hands on Science (Socrates Comenius, 110157-CP-1-2003-1-PT-COMEN-IUS-C3).

Conceptual Learning of Natural Sciences CoLoS.

AgentGrid: Design of multi-agent systems using GRID (CRP, V2-0129).

GRIDForum.SI: Grid infrastructure for virtual organizations (CRP, V2-0890).

Technologies for education and development of innovative environments (Centres of excellence).

First Click on Slovene, a multimedia CD for learning Slovene as a foreign language (interdisciplinary project under supervision of American Embassy in Ljubljana).

Digital archive OSNP (with Science Research Centre of the Slovenian Academy of Sciences and Arts).

Exploring a 3D world by means of virtual reality

SOME PAST PROJECTS

Informatization of educational institutions (CRP, V5-0668-02).

Didactical aspects of the use of information technologies - IKT (teaching and learning) (CRP, V5-0638-02).

Chemistry through computer simulations (CRP, V5-0646-02).

Teaching using new technologies for persons with special needs (hearing impaired) (CRP, V5-0639-02).

Thematic Network European Computing Education and Training (213871-CP-1-2001-1-BG-ERASMUS-TN).

WebKit, Intuitive Physical Interface on the Web (IST-2001-34171-WEB-KIT).

Partial music transcription for searching collections of musical samples (Z2-4443-1539-02).

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RESEARCH ACTIVITIES

The laboratory is involved in basic research connected to biomedical signal and imaging data. The main research goals are summarized as following:

understanding and describing the physiological phenomena,

use of the computer in modeling and understanding of physiologic relationships,

locally and remotely monitoring physiologic events, graphically displayed anatomic details and physiologic functions, visualizing and representing biomedical signal and imaging data,

developing standardized databases to study physiologic mechanisms and to evaluate performance and robustness of recognition techniques,

characterizing data, and establishing the detection criteria and recognition techniques to automatize as much as possible the analysis of bioelectric patterns, examinations, procedures, and medical practice, in order to improve the quality and reliability of the examinations,

interpret the data and the results qualitatively and quantitatively,

develop performance measures and protocols to evaluate detection techniques,

develop biomedical information technologies and software.

The principal research topic currently underway is the development and evaluation of recognition algorithms for accurate detecting of transient ischaemic events in biomedical data using the LTST DB (Long-Term ST Database).

The second research topic is maintaining, updating and distribution of standardized international reference-annotated ECG database LTST DB. The database is result of a multinational research effort and contains 86 24-hour ambulatory recordings with a number of human-annotated transient ischaemic and non-ischaemic ST events. The database is intended

to serve as a reference set in evaluating the performance of ST analyzers, and as a reference set to study physiologic mechanisms responsible for ischeamia. See:

http://www.physionet.org/physiobank/database/ltstdb/

and

http://www.physionet.org/challenge/2003/.

The next research topic is development of interactive graphic user interface editing tools (SEMIA – semi-automatic) to visualize, display and annotate long-term electrocardiograms. SEMIA, version 3.0.1, to view diagnostic and morphology feature-vector time series, and to examine human annotations of the LTST DB is under GNU General Public Licence and is available from:

http://www.physionet.org/physiobank/database/ltstdb/semia/.

The next research topic is the characterization of temporal patterns of transient ischaemic events and time-frequency representations of diagnostic parameters in ambulatory ECG signals. The goals are to differentiate physiologic mechanisms generating ischaemia and predicting impending ischaemia.

Another important contribution of the laboratory to the world community is interactive graphic tool EVAL_ST to evaluate performance and robustness of ischaemia analysers. The tool is under GNU General Public Licence and is available from:

http://www.physionet.org/physiotools/eval_st/.

Another topic concerns the investigation and assessment of effective methods for monitoring patients affected by cardiovascular diseases, outside the specialized cardiac units, through computer analysis and the interpretation of non-invasive bio-signal data, with the ultimate goal of cardiac telemonitoring via the Internet.

The Laboratory supports a Web mirror site (http://physionet.fri.uni-lj.si) for a part of Europe to the PhysioNet Web site (http://www.physionet.org) which is located at the Massachusetts Institute of Technology in Cambridge, USA. Maintaining of the PhysioNet Web site is supported by the U.S. National Institutes of Health. Physionet offers free access via the Web to large collections of recorded physiologic signals and related open-source software.

TEACHING

Graphic Techniques and Procedures, User Interfaces, Basics of Com-puter Graphics, and System Software.

EQUIPMENT

The equipment currently consists of two SUN SPARC workstations running UNIX Solaris, IBM RS/6000 server B50 running UNIX AIX, Apple PowerMac G4 running MacOS X and MacOS 9, several PC computers running Windows XP and LINUX, and other standard laboratory equipment (printers, CD and DVD writers, DAT tape unit).

PROJECTS

Automated detection of Transient ST-Segment Changes During Ambulatory ECG-Monitoring, U.S.-Slovenian Joint Project, Project #95–158 (1995–98); funded by the National Institutes of Health, USA, and the Slovenian Ministry of Science and Technology; research partner: Biomedical Engineering Center, Massachusetts Institute of Technology, Cambridge, USA.

Development of Long Term ST Database (LTST DB) funded by the Medtronic, Inc., Mineapolis, USA, (1997–2002), and by the Zymed, Inc., Camarrilo, USA (1999–2002); research partners: Massachusetts Institute of Technology, Cambridge, USA, Beth Israel Deaconess Medical Center, Boston, USA, CNR Institute of Clinical Physiology, Pisa, Italy, University Medical Center, Ljubljana, Slovenia, and Department of Systems & Informatics, Firenze, Italy. See also: http://www.physionet.org/physiobank/database/ltstdb/

Maintaining, updating and distribution of the Long Term ST Database (LTST DB), (2002–); research partners: Beth Israel Deaconess Medical Center, Boston, USA, and CNR Institute of Clinical Physiology, Pisa, Italy; (Database is vailable from: Laboratory of Biomedical Computer Systems and Imaging, Faculty of Computer and Information Science, Ljubljana, contact: Dr. Franc Jager); Samples of the database are available from:

http://www.physionet.org/physiobank/database/ltstdb/.
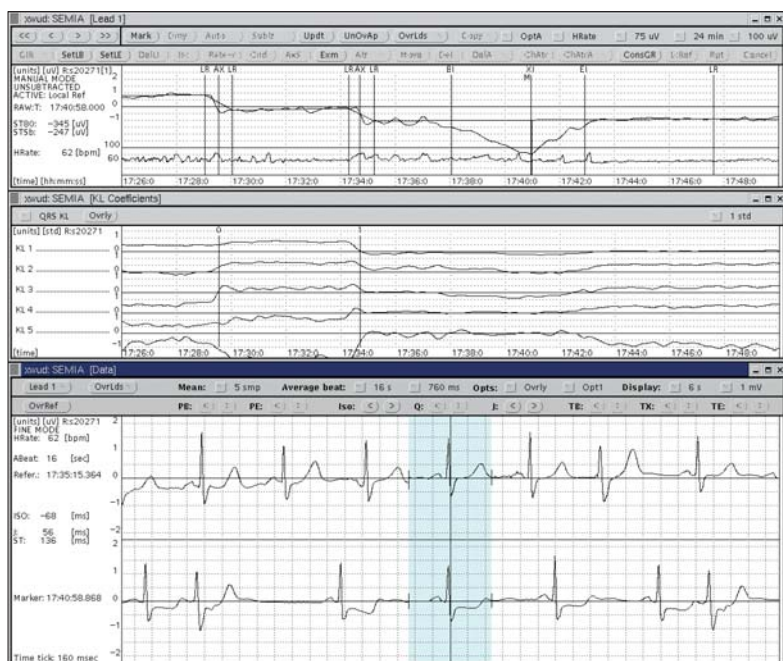
SEMIA, version 3.0, semi-automatic interactive graphic editing tool to annotate ambulatory ECG records

VISITS

September 2004: Franc Jager visited the Massachusetts Institute of Technology, Cambridge, USA, for one week working on current joint collaborative research topics.

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RESEARCH ACTIVITIES

Main research activities are concentrated around the following topics:

Neural networks in data mining, prediction, recognition and control problems,

Evolutionary algorithms in optimization problems,

Identification of real dynamic systems with Recurrent Neural networks,

Fuzzy and Neuro-Fuzzy Controllers,

Process Informatics and Programmable Technologies,
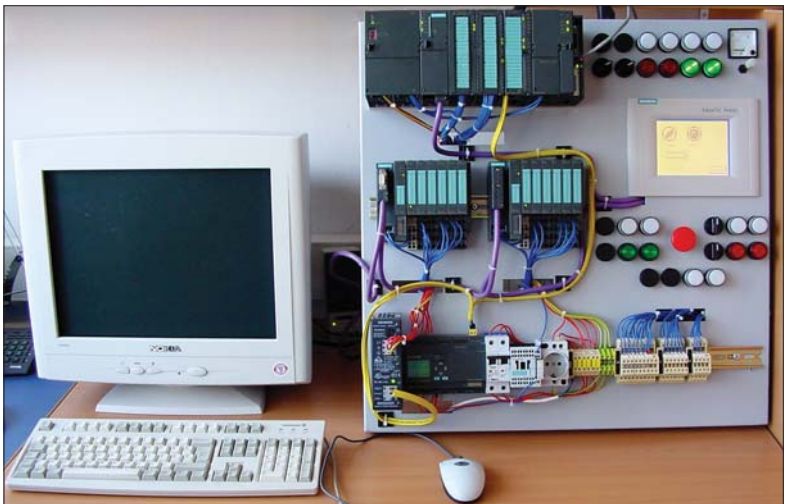
Siemens automation equipment used in Process Informatics Course

Cellular structures and Complex Systems,

Knowledge extraction from large databases

Parallel processing/programming in GRID environments

TEACHING

Logical Structures and Systems I, II, Elements of Information theory, Cellular Structures and Systems, Adaptive Systems, Neural Networks, Cellular Automata and Parallel Processing, Digital Structures, Digital Electronics II, Distributed Structures, Digital Logic, Logical Circuits and Structures, Computer Basics and Programming I.

EQUIPMENT

Cluster of 16 powerful Pentium IV computers, ten PC (Pentium IV) computers, five notebooks (Pentium III, IV), four HP laserjet printers (BW, colour), HP scanners (BW, colour), digital camera, SW-HW tool ViewLogic Office for FPGA design, Khepera mobile robot., Simatic SW-HW equipment.

PROJECTS

Extraction of virtual knowledge from large data bases with soft computing in GRID technologies, CRP project (MŠZŠ, MID), head prof. dr. A. Dobnikar.

Intelligent data minimg in GRID technology, Bilateral project with University of Coimbra, Portugal, head prof. dr. A. Dobnikar

Data mining of rubber mixing and testing data bases with soft computing techniques, ARRS project, head prof. dr. Andrej Dobnikar

Relating the Physical Properties of Polymeric Materials by Parallel Implementation of Soft Computing Methods, MŠZŠ project , head ass. prof. dr. U. Lotrič.

Computing cluster

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RESEARCH ACTIVITIES

Research activities cover computer architectures, software-hardware co-design, parallel processing, embedded systems and programmable logic.

The main research work is dedicated to short SIMD processing and the integration of these new processing facilities into high-level programming languages. Currently, the most significant activities are development of syntax and semantics extensions to the ANSI C in such a way that we could use short SIMD processing facilities in C programming language and development of its vectorizing compiler which is capable to auto-matically extract short SIMD parallelism from loops. We call it MMC (multimedia C) language. We have also introduced a new data-dependence test for array references with linear subscripts. We have named this test the D-test. It is appropriate for the vectorization for modern SIMD microprocessors and is more accurate than existing tests. The test takes into account the architectural properties of modern SIMD microprocessors and allows the existence of those data dependences in the loops that do not prohibit the vectorization for SIMD microprocessors.

The part of research work is directed toward the development of special computer hardware which, through its programmable ALU, is capable of performing custom selected functions. We are also working on RISC architecture microprocesor named MOVE, and HIP which is programmed with VHDL, and then realized with field-programmable gate array (Xilinx FPGA Virtex I and II). These architecture is also suitable for the embedded system applications.

TEACHING

Undergraduate level: Digital Structures, Computer Organization and Microprogramming, Organization of Computer Systems, Introduction to Computer Graphics, Programmable Logic Systems, Architecture and Organization of Computer Systems.

Postgraduate level: Parallel Systems, Architecture and Organization of Computers, Selected Topics in Computer Architecture.

EQUIPMENT

The computing equipment currently consists of several personal computers (PC) running Windows NT/2000 and Linux, Alpha workstation DEC 3000 AXP running Unix 4.0 and SUN SPARC workstation running UNIX Solaris. Almost all PC computers have frame grabbers and video cameras. There is also other standard equipment (HP colour scanner, printers, CD writers, DAT tape unit, and special Xilinx development protoboards.

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P. Bulić, V. Guštin. How to Exploit Multiprocessing Features of the SGI Origin 200, *Electrotechnical Review*, vol. 67, number (5), pp. 275–280, 2000.

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V. Guštin, M. Čufer. Motion detection using fuzzy logic comparator. *IEEE Trans. on Consumer Electronics*, Vol. 41, No. 2, pp. 360–366, 1995.

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RESEARCH ACTIVITIES

Main research interests of laboratory members are distributed systems design and development – especially grid architectures, communication security and other security issues, formal validation and testing techniques of communication protocols and distributed processes, computer networks design, content networks and peer-to-peer systems, mobile computing, agile methodologies in development of software and information systems and service oriented architecture with related technologies.

In 2004, we have researched most actively the following three areas:

In the area of grid systems we were researching the possibilities of introducing security mechanisms and digital certificates in an open source grid platform within .NET framework. We also evaluated the possibilities of executing some popular data-mining algorithms in grid environment.

In the area of software development methodologies, we were researching the properties of agile methodologies, especially test-driven development. Within a group of our students, we conducted an experiment, comparing the efficiency of test-first and test-last programming and statistically evaluated the results.

In the area of distribute systems architecture, we studied the suitability of Service Oriented Architecture for use in the military systems, especially its appropriateness in the context of Network Centric Operation.

EQUIPMENT

Hardware: 24-port Gigabit Switch Dell PowerConnect 2624, Gigabit local network within the Laboratory, direct gigabit optical connection to research backbone, Dell Power Vault NAS 745 (4 x 250 GB), Wireless LAN Access Point and several Wireless LAN network cards, Bluetooth Access Point and several Bluetooth adapters, 10 personal computers with

Windows XP or Linux, 4 Windows 2003 Servers, 2 Dell D-600 notebooks, 1 Panasonic Toughbook Notebook, digital still camera and digital video camera, 2 Compaq/hp Pocket PC, 3 Dell Axim handhelds, several Java-enabled mobile phones, ActiveCard SmartCard readers and smart cards, modems, Web cameras, printers, scanner and other office equipment, etc.

Software: Several network management tools and utilities, firewalls, sniffers; Oracle 10g database and development tools, SharePoint Portal Server, Web server, Microsoft development tools and utilities, several open-source Java development tools and utilities, Alchemi grid, Activ Pack for Windows.

TEACHING

Computer Communications, Computer Communications and Networks, Planning and Managing Information Systems, Telematic Systems, Communications in Distributed Systems (Faculty of Electrical Engineering), Introduction to Information Systems (Faculty of Social Sciences). Introduction to Computer Networks, Computer Networks and Services, Distributed and Decentralized Information Systems, Distributed Information Systems and Data Integrity (Faculty of Electrical Engineering), Computer Networks (Faculty of Mechanical Engineering).

PROJECTS

In the past, Laboratory of Computer Communications members have been engaged in several projects from the areas of computer network structure, architecture, design and management (University of Ljubljana network backbone), computer network security, distance learning, information systems design and management and distributed systems design.
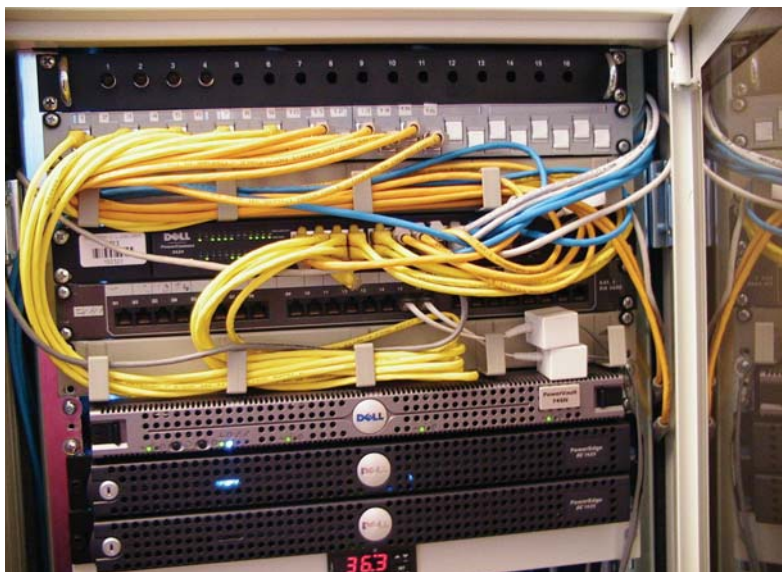
Communication infrastructure within the Laboratory

In 2004, the Laboratory members took part in

VIKING – Secure Information-Communication Infrastructure of the Next Generation, (Slovenian Target Research Program), supported by Ministry of Defense and Ministry of Science, Education and Sport), 2004–2006.

Introducing security mechanisms and digital certificates in GRID environment, (Open Sorce 2004), supported by Ministry of Information Society, 2004.

Extraction of virtual knowledge from large databases with soft computing and GRID technologies (Slovenian Target Research Program), supported by Ministry of Information Society and Ministry of Education, Science and Sport, 2003–2005.

Relating the Physical Properties of Polymeric Materials by Parallel Implementation of Soft Computing Methods, supported by Ministry of Education, Science and Sport and Sava d.d., 2003–2005.

Clinical paths data mining with soft computing, supported by Ministry of Education, Science and Sport and The University Clinic of Respiratory and Allergic Diseases Golnik, 2003–2005.

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M. Ciglarič, M. Trampuš, M. Pančur, T. Vidmar. Message routing in pure peer-to-peer networks. In: M.H. Hamza (ed.). *21st IASTED International Multi-Confer ence Applied Informatics, February 10–13, 2003 Innsbruck, Austria.* Applied informatics, (Applied informatics). Anaheim; Calgary; Zürich: ACTA Press, cop. 2003, pp. 813–817.

Distance learning:

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Computer networks, distributed systems and security:

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M. Trampuš, M. Ciglarič, M. Pančur, T. Vidmar. Are E-commerce users defenceless? In: *IPDPS, International Parallel and Distributed Processing Symposium, April 22–26, 2003, Nice, France. Proceedings: e-zbornik.* Los Alamitos (etc.): IEEE Computer Society, 2003, pp. 1–7.

M. Trampuš, M. Ciglarič, M. Pančur, T. Vidmar, A. Krevl, P. Rome, Ž. Aksentič, G. Berginc. Uporaba pametnih kartic za varno hranjenje dokumentov. In: M. Bohanec (ed.), B. Filipič (ed.), M. Gams (ed.), D. Trček (ed.), B. Likar (ed.). *Inteligentni in računalniški sistemi. Kompleksni sistemi v e-poslovanju: Proceedings A of the 6th International Multi-Conference Information Society IS 2003, 13–17th October, Ljubljana, Slovenia.* Ljubljana: Institut "Jožef Stefan", 2003, pp. 155–158.

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M. Pančur, M. Ciglarič, M. Trampuš, T. Vidmar. Towards empirical evaluation of test-driven development in a university environment. In: B. Zajc (ed.), M. Tkalčič (ed.). *The IEEE Region 8 EUROCON 2003: computer as a tool: 22–24. September 2003, Faculty of Electrical Engineering, University of Ljubljana, Slovenia: proceedings.* Piscataway: IEEE, cop. 2003, vol. 2, pp. 83–86.

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Computer Structures and Systems Laboratory

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RESEARCH ACTIVITIES

The principal scientific research directions of the Computer Structures and Systems Laboratory are fuzzy logic applied to distributed processing and future processing structures. With respect to these directions the latest research was dedicated to modeling of the dynamics of organized groups of moving entities (e.g. flocking birds) and to the generalization of the binary quantum-dot cell.

Most of the professional work of the laboratory is carried out through different projects for industrial partners and is primarily oriented towards wireless computer networks, performance evaluation and reliability diagnostics.

TEACHING

Theory of Switching Circuits, Computer Modeling and Simulation, Computer Systems Performance and Evaluation, Computer Reliability and Diagnostics, Computer Structures in Nanotechnology, Fuzzy Logic, Logic Design of Computers, Computer Equipment Evaluation, and Introduction to Modeling and Simulation.

EQUIPMENT

The laboratory is equipped with several computers four of which are Silicon Graphics workstations (Octane, Indigo^2) and several Pentium 4 PC's. Some of the other equipment available and used in the laboratory are printers (HP LaserJet 2420, EPSON Stylus Photo 2100), Wacom Intuos3 digitizer, a scanner, video input/output equipment from Silicon Graphics, a Hewlett-Packard Logical Analyzer and a Hewlett-Packard Oscilloscope.
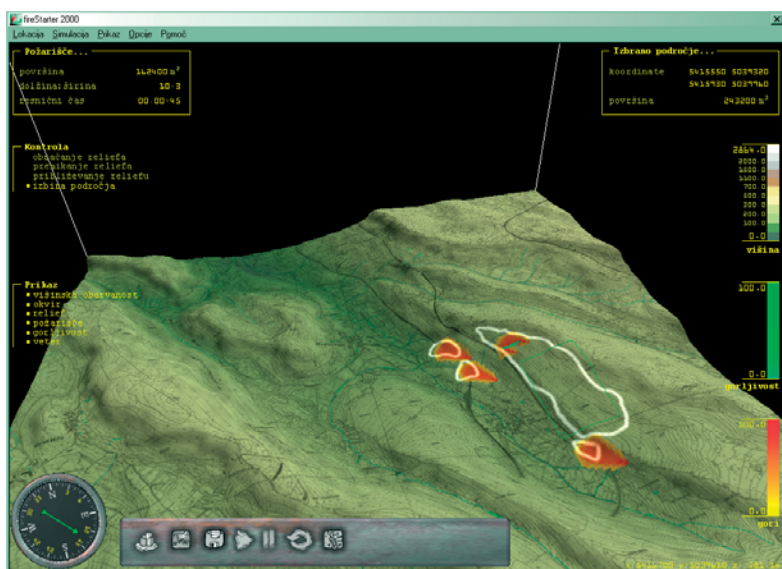
Visualization of wind-driven wild land fire prediction by means of fuzzy logic

PROJECTS

Mobile Medical Monitoring (in cooperation with Technikum Joanneum, Kapfenberg, Austria).

Wireless communication platforms for Iskra Transmission, Ljubljana, Slovenia.

Design and implementation of a software support module for wireless communication based on Bluetooth standard for ComLand, Ljubljana, Slovenia.

Prototype of a self cooking appliance using Bluetooth communication between the kitchenware lid and the cooking stove for Poudarek, Domžale, Slovenia.

Reliability analysis and redesign of the parliamentary voting system for Slovenian National Assembly, Ljubljana, Slovenia.

Analysis of the possibility of Bluetooth based communication use in domestic appliances for Hermes SoftLab, Ljubljana, Slovenia.

WebSET, a 5th Framework EU project.

Design and implementation of a ADSL communication device for IskraTEL, Kranj, Slovenia.

Design and implementation of a FLASH memory file system for IskraTEL, Kranj, Slovenia.

Design and implementation of a ISDN telephone device prototype for IskraTEL, Kranj, Slovenia.

Computer assisted prediction of wind-driven wild land fire using fuzzy logic for Slovnian Ministry of Defence, Ljubljana, Slovenia.

Product batching based on fuzzy control for IMK, Ljubljana, Slovenia.

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J. Virant, *Design considerations of time in fuzzy systems*, London, UK: Kluwer Academic Publishers, 1999.

J. Virant, N. Zimic, "Attention to time in fuzzy logic," *Fuzzy Sets and Systems*, vol. 82, pp. 39–49, 1996.

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RESEARCH ACTIVITIES

The Information Systems Laboratory is involved in basic research in the field of Information and Database Systems. The following primary areas of research are currently being pursued:

Software Development Methodologies (SDM). Based on the collaborative practice research we strive to define the methodology and supporting tools for designing new or adapting existing SDMs. Specifically, we focus on the methodology socio-technical suitability to both organisation and project-specific requirements. From the topic two PhD theses have been developed. An approach for reengineering methodologies (Agile methodology framework) and supporting tools (Agile methodology toolset – see figure below) present the most important results of this research.

IT/IS Strategy Planning. The strategy planning is one of the research areas that have been traditionally present in the Information systems laboratory since its existence. In 2004 we published the second edition of the methodology that focuses on how to build strategic plans for information systems. The methodology is based on many years of practical experiences in developing strategic plans for a range of organisations. In the context of IT/IS planning we focus research on: IS/IT architectures, information systems reengineering, business process reengineering, electronic business, and COBIT and other standards.

Contemporary approaches to software development. In collaboration with software companies we do research on the maturity level of the new approaches to software development. Recently we have been focusing on: "Model-driven development", "Business-rule approach", and "Method engineering".

Mobile business and mobile applications. We explore different mobile applications models focusing on the research of the context-awareness and context-aware mobile application model. The results have been presented as the Methodology for developing mobile applications.

Intelligent Agents and Multi-Agent Systems. In this area we do research on the development of agents – autonomous entities capable of acting in its environment. The research encompasses: research on mutual communication among agents using ACL and use of rules in several aspects, modelling multi-agent systems, using agent oriented modelling languages (AML, AUML) and other agent based methodologies. We focus on utilization of intelligent agents and multi-agent systems for business systems and their information systems.

Semantic web and knowledge discovery. Research on Semantic Web as a next step in the evolution of the Internet is focused on ontologies, rules, rule engines and Semantic Web languages.

Data Mining applications and Decision Support Systems. Our areas of interest are innovative approaches for decision support. We combine research on this area with the research in the area of mobile applications and as result we do research on mobile decision support. We have also developed data mining decision support system based on Oracle Data Mining API and Engine. In the area of applied research we have created several strategic reports on different models of introduction of data mining to information systems.
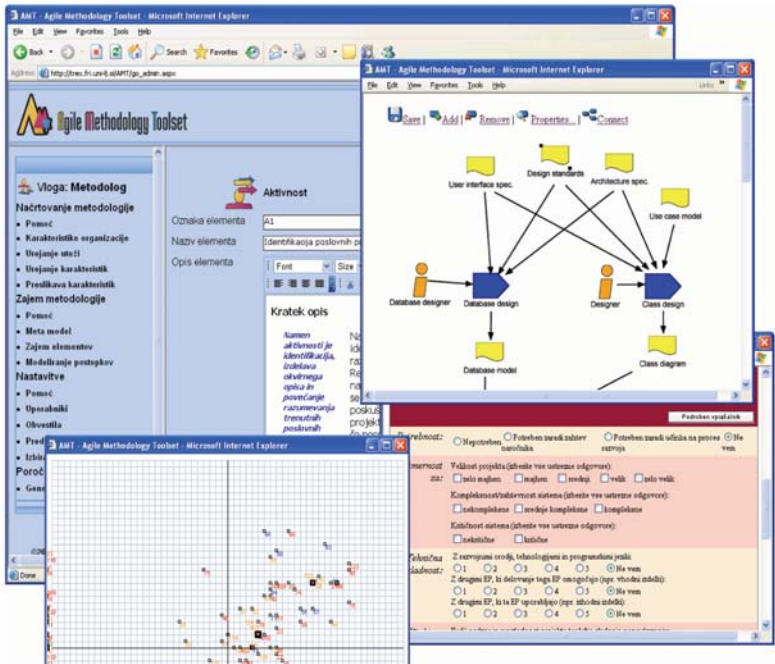
Screenshot of the AMT system

TEACHING

Undergraduate: Information Systems, Design and Management of Infor-

mation Systems, Selected Topics in Informatics, Theory of Information Systems, Information Systems Development, Introduction to Information Systems, Databases, and Introduction to Databases.

Postgraduate: Information systems, Information Systems Development, and Database Systems.

EQUIPMENT

The computing equipment encompasses about 15 PC workstations running Microsoft Windows and Fedora Linux. Single and dual processor servers are running under various operation systems like Microsoft Windows Server, Linux and Solaris. Most powerful servers are hosting virtual machines with research environments. All computers are connected over gigabit local network. Meeting place is equipped with wireless projector.

Software equipment consists of Oracle servers and development tools, Microsoft development tools and server software, ILOG Business Rule Management Suite, and development software tools of vendors like IBM/Rational, Sybase, MySQL, Apache, Tomcat, JADE...

In 2005 the laboratory has been completely renovated

PROJECTS

The Information systems laboratory has been involved in many research and applied projects. The selection of recent project is listed below.

MasterProc – Mastering the development process and information technologies in developing solutions for electronic business. Research project of the Centre of Excellence "Information and Communication Technologies". Ministry of Education, Science and Sport, Ministry of the Economy, and European Regional Development Fund (ERDF), 2004- 2007.

Research program »Competitiveness of Slovenia 2001-2006«, Research project: *"A methodology and prototype for business rule management in organisations".* Ministry of Information Society and Ministry of Education, Science and Sport, 2001- 2004.

Research program "Competitiveness of Slovenia in 2001-2006". Research

project *"Design and Development of multiagent systems for innovative decision support"*, Ministry of education, science and sport, 2004-2005.

Object *Oriented Approach to Application Development - based on modelling language UML and application framework MAF* – release 2.0. Marand, d.o.o., 2004-.

Unified Information Systems Development Methodology (EMRIS), Government centre of informatics, 1998-2004.

Applied Research on Multi agent systems and Prototype of Multi agent system on JADE platform, Marand d.o.o., 2005-2006.

Information System Development Methodology for Intereuropa IT, d.o.o. Intereuropa IT, d.o.o., 2003.

Development of the IT/IS Strategy Plan for Common Functions in Government Institutions. Central Government Agency of Informatics, Ljubljana, 2003-2004.

CRM Implementation in Mobitel GSM, Mobitel, 2002 – 2004.

Renovation and development of information system for School Administration and Management. Development project funded by the Ministry of Information Society, 2001-2002.

Analysis and Development of Mobile and WEB (WAP-WEB) platforms for Decision Support and Customer Care, Mobitel, 2000 – 2003.

Development of the IT/IS Strategy Plan for the University of Ljubljana, University of Ljubljana, 2000 – 2001.

Development of the IT/IS Strategy Plan for Clinical Centre Hospital Ljubljana, Clinical Centre Hospital Ljubljana, 1999 – 2000.

Analysis of the existing IT processes in KAD using COBIT model, Kapitalska družba, 2004 – 2005.

SELECTED PUBLICATIONS

Journals and Monographs

BAJEC Marko, MARJAN Krisper. *A methodology and tool support for business rule management in organisations.* Information Systems, Vol. 30 (2005), pp. 423–443.

RUPNIK, Rok, KRISPER, Marjan. *Data Mining Application Systems as a New Type of Decision Support Systems (in Slovene).* Uporabna informatika (Ljubljana), 2005, Vol. 13, No. 2, pp. 61-73.

RUPNIK, Rok, KRISPER, Marjan, BAJEC, Marko. *A new application model for mobile technologies.* International Journal of Information Technology and Management, 2004, Vol. 3, No. 2/3/4, pp. 282-291.

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BAJEC, Marko. *Educational portals: a way to get an integrated, user-centric university information system.* In: TATNALL, Arthur (ed.). Web portals : the new gateways to Internet information and services. Hershey (PA): Idea Group Publishing, cop. 2005, pp. 252-269.

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ZRNEC, Aljaž. *Web Services are not Enough.* Electro technical Review, 2004, Vol. 71, No. 5, pp. 249-254.

Conference papers

BAJEC, Marko, KRISPER, Marjan. Issues and challanges in business rule-based information systems development. In: BARTMANN, Dieter (ed.), RAJOLA, Federico (ed.), KALLINIKOS, Jannis (ed.). Information systems in a rapidly changing economy : proceedings. Regensburg: Institute for Management of Information Systems, cop. 2005, pp. 1-12

BAJEC, Marko, KRISPER, Marjan, RUPNIK, Rok. The scenario for constructing flexible, people-focused systems development methodologies. In: LEINO, Timo (ed.), SAARINEN, Timo (ed.), KLEIN, Stefan (ed.). Proceedings of the 12th European conference on information systems. Turku: Turku School of Economics and Business Administration, 2004.

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VAVPOTIČ, Damjan, KRISPER, Marjan. Measuring and improving technical and social suitability of software development methodology. In: DZEMYDIENE, Dale (ed.). Advances in theory, practice and education : doctoral consortium : drafts of student papers. Vilnius, 2004, pp. 8-11

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Laboratory for Algorithms and Data Structures

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RESEARCH ACTIVITIES

Staff members perform research in the areas of approximation and randomized algorithms, algorithms for problems in linear algebra (in particular matrix multiplication), combinatorial optimization (routing and other problems involving circulant graphs, robustness of the facility location problem), parallel computation (mapping and scheduling, algorithms in parallel systems, hardware supported multithreading), compiler design (parsing methods and attribute grammars), operating systems design, grid computing (data replication on Data Grids)

TEACHING

Undergraduate: Algorithms and Data Structures 2, Compiler Design, Operating Systems, Operating System Components, Theoretical Computer Science 1, Theoretical Computer Science 2. Introduction to Programming 2, Programming Systems Development 1.

Graduate: Approximation and Randomized Algorithms, Theory of Computation.

EQUIPMENT

Equipment consists of a network of PC's running under Linux and/or Windows XP/W2000 plus miscellaneous additional items of computer infrastructure offering adequate computational support for the staff as well as students performing thesis work, as well as occasional guests.

PROJECTS

Since Autumn 2003 members of the laboratory participate in a two-year project ''Grid Technology as a Standard Communication-Computing Infrastructure'' jointly with the Jozef Stefan Institute and the company XLAB, Ltd. (both located in Ljubljana, Slovenia);

In Summer 2004 the laboratory has obtained a grant for a three-year project "Exact and non-exact Algorithms and Techniques."

In Summer 2004 the laboratory has obrtained a grant for the project "Computational Service on GRID Infrastructure"jointly with Jozef Stefan Institute and the company XLAB, Ltd.

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FURTHER INFORMATION

See the following Web pages:

http://lalg.fri.uni-lj.si/~vilfan/

http://lalg.fri.uni-lj.si/~borut/

http://sliva.fri.uni-lj.si/~sliva/

http://kepa.fri.uni-lj.si/

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RESEARCH ACTIVITIES

The Laboratory for Architecture and Signal Processing is dedicated to research, undergraduate, and postgraduate education in computer architecture and digital signal processing. The laboratory is engaged in national and international research projects, which include development projects for the industry. The following primary areas of research are currently being pursued:

1. In Computer Architecture: Design and development of special-purpose computers, both hardware and software. Comparative studies of RISC vs. CISC processors. DSP processor design and architecture. Cache replacement and coherence preservation strategies. Input/output architectures.

2. In Digital Signal Processing: Design and development of algorithms, hardware and software. Complexity of integer minimax approximation problem. Theoretical aspects and performance bounds for finite word-length digital filters. A general purpose finite word-length FIR design program has been developed during the course of this work. Spectrum and vibration analyses. DSP processor applications. A low-cost DSP processor based spectrum analyzer has also been developed.

3. In Speech Processing: Speech recognition over telephone lines. Considerable experience from collaborating on the COST-232 European project has been acquired. The laboratory contributed to the collection of the European multi-English database. In the framework of a project with the Slovenian Telekom one of the first real-time systems for speaker-independent recognition of Slovenian digits and control words over the telephone has been developed. A national database of 780 speakers from all across Slovenia has been collected. A new technique that uses asymmetrical window functions for feature extraction is being evaluated.

TEACHING

Undergraduate level (5-year "University" program): Computer Architecture 1, Computer Architecture 2, Digital Signal Processing, Input/Output Systems.

Undergraduate level (4-year program): Principles of Computer Architecture 1, Principles of Computer Architecture 2, Digital Signal Processing, Input/Output Devices.

Postgraduate level: Architecture and Organization of Computer Systems, Digital Signal Processing.

EQUIPMENT

Computing equipment consists of PC computers running Windows and/or Linux operating systems, scanners, and printers. The special equipment for speech and digital signal processing consists of internal and external DSP boards with several different DSP processors from Texas Instruments and Analog Devices. In addition to standard general-purpose software, the laboratory also has a speech recognition software tools like HMM Toolkit, CSLU Toolkit, and a real-time working demo of an isolated word recognition system over the telephone line.

PROJECTS

Adaptive system for computer recognition of Slovenian speech. Research project funded by the Slovenian Ministry of Education, Science, and Sport and the Ministry for Information Society (2003–2005).

A scheduling algorithm for the optimal cycle time of a printed circuit board assembly line. Research project within the scope of *Algorithms and complexity.*

Finite word-length minimax approximation algorithm. Research project within the scope of *Algorithms and complexity.*

Evaluation of asymmetrical window functions in a speech recognition system. An independent postgraduate student research project.

User friendly human-machine interface using the speech technologies. An independent postgraduate student research project.

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RESEARCH ACTIVITIES

The Software Engineering Laboratory is involved in teaching and research in the areas of Software Engineering and Information Systems with an emphasis on Software Quality Management, Software Metrics, Information Systems Development, Information Systems Audit and Control, and Data Warehouses. The staff has recently worked on two international projects within the EC TEMPUS and INCO-COPERNICUS programs, as well as on several development projects for the industry. The following areas of research are currently being pursued:

1. In Software Quality Management: Comparative studies of different software quality models (SW-CMM, ISO 9000 family of standards, SPICE, Bootstrap etc.). Adaptation of SW-CMM to the needs of small orga-nizations. Personal and Team Software Process.

2. In Software Metrics: Different approaches to software measurements (e.g. GQM, bottom-up). Definition of appropriate metrics for the deve-lopment of applications in a database environment. Development of a metrics model to support the level 4 of SW-CMM in small organizations.

3. In Information Systems Audit and Control: Investigation of systematic approaches (such as COBIT) to IT control and audit in order to help IT professionals in developing and maintaining information systems that would satisfy fiduciary, security and quality requirements.

4. In Information Systems and Data Warehouses: Agile methodologies for information systems development. Development of administrative and management information systems for higher education institutions. Information quality assessment and improvement.

TEACHING

Undergraduate level: Introduction to Programming I, Basic Algorithms and Data Structures I, Software Systems Development II, Programming I, Software Technology, Technology of Information Systems.

Postgraduate level: Information Systems Development, Special Course in Programming Technology.

EQUIPMENT

Laboratory is equipped with two Oracle servers (Oracle Portal, Oracle 9i, Forms and Report Server running under Windows 2000), SQL Server (running under Windows 2000), Web server (running under Linux), several PC computers (running under Windows XP and Windows 2000), and two printers: HP LaserJet 2100 M and HP OfficeJet G55.

PROJECTS

A metrics model for quantitative management and control of database oriented applications development satisfying the requirements of SW-CMMI level 4. An independent Ph.D. student research project.

Data warehouse for the University of Ljubljana. Integration of data from different member institutions in order to support analytical processing at the university level.

E-student: Web-based *s*tudent records information system covering enrolment, examination records, degree records, and various statistical surveys (partly supported by the Slovenian Ministry of Information Society).

CONFERENCES

Members of the laboratory organized the 10th Conference of European University Information Systems Organization EUNIS 2004 that took place in Bled on 29 June – 2 July 2004.

OTHER ACTIVITIES

Membership: V. Mahnič member of the Program Committee for the EURO-MEDIA APTEC 2002 Conference, Modena, Italy, April 2002.

Membership: V. Mahnič member of the Board of Directors of EUNIS (European University Information Systems Organization).

Membership: V. Mahnič member of the Scientific Committee for the EUNIS 2003, the 9th International Conference of European University Information Systems Organization, Amsterdam, July 2003.

Membership: V. Mahnič and I. Rožanc members of the Scientific Committee for the EUNIS 2004, the 10th International Conference of European University Information Systems Organization, Bled, 29 June – 2 July 2004.

Membership: V. Mahnič member of the Scientific Committee for the EUNIS 2005, the 11th International Conference of European University Information Systems Organization, Manchester, June 2005.

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Computer Vision Laboratory

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RESEARCH ACTIVITIES

The laboratory is involved in basic research in computer vision, with emphasis on range image interpretation, object recognition and tracking, face detection and face recogntion, panoramic imaging, and multimedia applications.

Range image interpretation includes range image acquisition, segmentation of range images using the "recover-and-select" paradigm and modeling of shapes using different types of parametric models (i.e. superquadrics, surface patches). Possible applications include automatic creation of CAD models for reverse engineering applications, creation of models for virtual reality applications, part-based object recognition, and next-view planning for intelligent image acquisition. Superquadric models are used also for object tracking in sequences of intensity images.

We generate panoramic images by assembling multiple images captured in sequence by moving the camera using a pan-tilt robotic manipulator. The sequential image acquisition using the robotic manipulator makes possible also the generation of panoramic stereo pairs and panoramic depth images as a consequence. We use panoramic images for mobile robot navigation, for designing efficient user interfaces for remote camera manipulation and for visual surveillance applications.

For human face detection and recognition in difficult illumination conditions we study the use of skin colour and appearance.

An ongoing collaboration with the New media department of the Academy of Fine Arts at the University of Ljubljana supports the creation of interactive art installations using the latest information technology. The art projects serve as an excellent frame for testing our research results in practical applications, in particular we applied face detection in the installation "15 seconds of fame", body position tracking in "Virtual skiing" and locomotion-based person identification in "Coincidence-matrix-dating club" project.

The interactive installation "Virtual skiing" enables a visual immersion into the feelings of gliding on snow through a winter landscape. The computer rendered winter landscape is displayed over the entire wall in front of the skier. As on carving skis you can turn by shifting your body to the right or left to evade the trees. The speed of descent can be regulated by lowering or raising your body so that the air resistance is decreased or increased. The interface to the virtual world is implemented by computer vision techniques which capture the posture of the skier's body in real time.

TEACHING

Teaching at the undergraduate and graduate level: Introductory computer science, Software engineering, User interface design, Computer vision, Methods of communication, Project management.

EQUIPMENT

Network of about 20 Linux/Windows/Macintosh computers. The special vision equipment consists of a structured light range scanner with a translational and rotational computer-controlled table, several pan/tilt units, video, CCD, panoramic and web cameras.

CURRENT PROJECTS

Computer vision, 1539–0214. A basic research program funded by the Slovenian Ministry of Education, Science, and Sport (2004–2008).

Development of a thin client for Loterija Slovenija (2003–2005).

Leonardo: A multi-national exploration in interaction design education and research, Pilot program in cooperation between EU and New Zealand (2004–2007).

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RESEARCH ACTIVITIES

Visual Cognitive Systems Laboratory (ViCoS) was officially founded in November 2004. Most of the research activities described in this Survey were performed while the members of ViCoS were still with the Computer Vision Laboratory.

Visually enabled cognitive systems are intelligent systems that use vision among other sensors in order to act and interact in everyday situations that emerge in natural and urban environments. This includes a plethora of devices, ranging from mobile robots to intelligent environments, personal devices, and cognitive assistants. The Visual Cognitive Systems Laboratory is involved in basic research in such systems, with emphasis on visual learning and recognition. Other activities include panoramic imaging for mobile robotics and range image modeling and interpretation.

Research in the area of visually enabled cognitive systems focuses on various theories, at different levels of abstraction, regarding requirements, architectures, forms of representation, kinds of ontologies and knowledge, and varieties of mechanisms relevant to integration and control of vision systems. In this context, cognitive vision implies functionalities for knowledge representation, learning, reasoning about events and structures, recognition and categorization, and goal specification, all of which are concerned with the semantics of the relationship between the visual agent and its environment. This requires a vast effort in a multidisciplinary understanding of cognitive processes, involving studies in cognitive psychology, neuroscience, and philosophy of mind.

Specifically, research in the area of visual learning and recognition has focused on subspace methods, such as Principal Component Analysis (PCA), Linear Discriminant Analysis (LDA), Independent Component Analysis (ICA), Canonical Correlation Analysis (CCA), Support Vector Machines (SVM), etc., which enable direct view-based building of visual

representations and subsequent visual recognition of objects, scenes, and activities. Our main research achievement in the framework of subspace methods is development of robust approaches to both learning and recognition. Applications include recognition of objects, scenes, and activities in visual cognitive tasks, such as surveillance and smart vision-based positioning using wearable computing in urban environments as well as in other applications of cognitive systems, such as mobile robots and cognitive assistants.

Our theoretical findings on visual learning and recognition very often ground in a realistic scenario of spatial orientation of mobile robots, which represent a target platform for many of the methods developed. In long terms, we aim at developing algorithms for autonomous exploration and building of topological maps which can be used in cognitive agents for autonomous navigation in unbounded environments. Such cognitive agents will ultimately be able to perceive and understand their environment, to categorise and recognise objects and subjects around them as well as actions they are performing, and will be able to interact with the environment and communicate with humans in a user friendly way.

Research in the area of range image interpretation includes range image acquisition, segmentation of range images using the "recover-and-select" paradigm and modeling of shapes using different types of parametric models. Possible applications include automatic creation of CAD models for reverse engineering applications, creation of models for virtual reality applications, and part-based object recognition.

TEACHING

Teaching at the *undergraduate and graduate level:* Multimedia systems, Machine Perception, Intelligent distributed software technologies, Computer vision, Visual information in information systems (Faculty of Computer and Information Science); Introductory computer science, Computer graphics, Algorithms and data structures (Faculty of Education).

EQUIPMENT

Network of about 10 Linux/Windows computers. In-door and out-door iRobot robots for visual learning and navigation experiments, shared with the Computer Vision Laboratory. A Katana HD6M light weighted robot arm with 6 degrees of freedom. The special vision equipment consists of a structured light range scanner (shared with the Computer Vision Laboratory) with a translational and rotational computer-controlled table, panoramic cameras, digital IEEE-1394 cameras, an IEEE-1394 two-lens stereo vision camera system, DV video cameras and equipment for digital photography.

CURRENT PROJECTS

Computer vision, 1539-0214. A basic research program funded by the Slovenian Ministry of Higher Education, Science and Technology (2004-2008).

Mobile robot localization using panoramic vision

Cognitive Systems for Cognitive Assistants-CoSy, FP6-004250-IP, (2004-2008).

Vision Technologies and Intelligent Maps for Mobile Attentive Interfaces in Urban Scenarios - MOBVIS, FP6-STREP, (2005-2008).

Computational and Cognitive Vision Systems: A Training European Network, VISIONTRAIN, FP6-2002-Mobility-1, (2005-2009).

Cognitive Vision Systems – CogVis, FP5 project, CEC (IST-2000-29375) (2002–2004).

European Research Network for Cognitive Computer Vision Systems – ECVision, FP5 (IST-2002-35454), (2002–2005).

Omnidirectional Vision. A Slovenian–Czech Intergovernmental Science and Technology Cooperation Project.

Robust Approaches to Recognition Problems in Computer Vision. A Slovenian–Austrian Intergovernmental Science and Technology Cooperation Project.

Analysis of omnidirectional images, A Slovenian–USA Intergovernmental Science and Technology Cooperation Project.

Development of new techniques for recognition and categorization, A Slovenian-Greek Intergovernmental Science and Technology Cooperation Project.

Austrian–Czech–SI project "Robust and Adaptive Approaches to Scene and Object Recognition" (CONEX) .

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RESEARCH ACTIVITIES

The laboratory carries out research in machine learning, inductive logic programming, AI approaches to systems control, qualitative reasoning, and information visualization. Research results concern the learning from noisy data in attribute-based learning for classification and regression, evaluation of attributes in machine learning, the automatic discovery of concept hierarchies and constructive induction in machine learning, combining logical and numerical learning, applying machine learning to systems control and qualitative modeling, and reconstruction of human control skill. A notable aspect of much of this research is its application to problems in functional genomics and bioinformatics, medical diagnosis and prognosis, ecological modeling, and mechanical engineering.

TEACHING

The staff of the AI Laboratory is engaged in teaching the following courses: Artificial Intelligence and Symbolic Programming, Principles of Programming Languages, Decision Models and Systems, Artificial Intelligence Methods, Tools and Application Development, Projects and organization of information systems, Standards and quality of information systems, Decision systems, Methods of Artificial Intelligence (postgraduate), Theory of Programming Languages (postgraduate), Data mining (postgraduate).

EQUIPMENT

The computer equipment at the laboratory consists of a network of a dozen Windows XP, Windows 2000, Mac Os X and Linux-based personal computers and servers, and several laser and ink jet printers and scanners.

RECENT AND CURRENT PROJECTS

Artificial Intelligence and Intelligent Systems: Research program funded by SMESS (2004–2008).

ASPIC - Argumentation Service Platform with Integrated Components. Project funded by the EU 6th Framework Program (2004–2006).

CLOCKWORK – Creating Learning Organisation with Contextualised Knowledge-Rich Artifacts: European IST Program Project, funded by the European Commission (2000–2003).

Knowledge discovery methods for functional genomics: Basic research project funded by SMESS (2001–2004).

Research, Development and Practical Evaluation of Tools for Data Mining and Decision Support in Medicine: SMESS USA-SI Collaboration Grant (2003–2004).

Knowledge-based Data Mining Approach for Discovery of Genetic Pathways from Mutant Data: SMESS USA-SI Collaboration Grant (2003–2004).

The AI Laboratory also participates in European Networks of Excellence: *KDNet - European Knowledge Discovery Network of Excellence and MONET – European Network of Excellence in Model-Based and Qualitative Reasoning.*

VISITORS AND INVITED LECTURES IN 2004

John Fox (Cancer Research UK, UK): *Reasons to believe and grounds for doubt: 25 years of debate in computer science and AI, 6 May 2004.*

Gad Shaulsky (Baylor College of Medicine, Houston, USA): *Dictyostelium Bioinformatics, 20–26 October 2004.*

Nancy Van Driessche (Baylor College of Medicine, Houston, USA): *Dictyostelium Microarray Data Analysis, 16–19 June 2004.*

Pat Langley (Stanford University, USA): 1 October *2004.*

Riccardo Bellazzi (Universita di Pavia, Italy): *AI in Systems Biology, 18–20 March 2004.*

SYSTEMS DEVELOPED

A number of software systems have been developed or are under development by members of this laboratory. These include:

Orange: a machine learning suite that can be used either through scripting in Python or with an intuitive and easy to use, yet powerful graphical user interface. Includes methods such as induction of decision and regression trees, naive Bayes classification, association rules, clustering, function decomposition, support vector machines, logistic-regression, evaluation methods, data pre-processing, visualization, specialized tools for genomic research, etc. Runs on MS Windows, Mac OS X, Linux and Solaris. (http://www.ailab.si/orange)

GenePath: a web-enabled tool for reconstruction of genetic networks from genetic experimental data. Features what-if analysis, explanation, visualization of networks, and methods that allow incorporating background knowledge (http://www.genepath.org). In November 2003, GenePath was awarded an entry in NetWatch: Best of the Web review of *Science* magazine.

LR: learning regression trees, including bagging and boosting. (http://ai.fri.uni-lj.si/dorian/software.htm)

QUIN: machine learning tool for induction of qualitative trees from numerical data.

QCGrid: system for transformation of qualitative trees into numerical predictors.
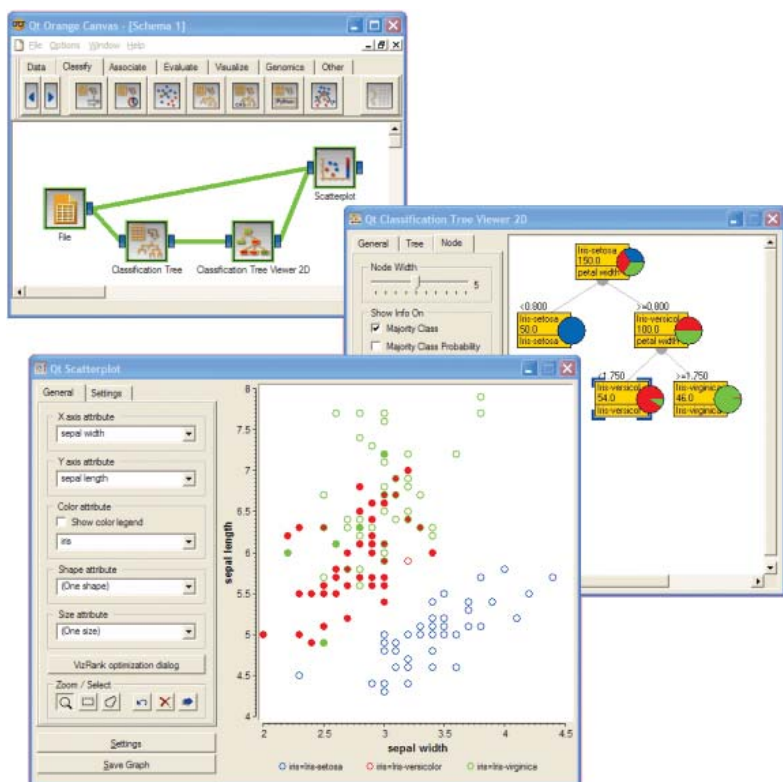
Screenshots of Orange's visual programming interface and two GUI components called Orange Widgets (http://www.ailab.si/orange)

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RESEARCH ACTIVITIES

Laboratory for Cognitive Modeling (LKM) was officially founded in December 2001. LKM carries out research in cognitive modeling, machine learning, neural networks, picture and data mining. Research results concern the modeling of noisy data related to cognitive, medical, biological and other processes. We are developing, testing and applying new approaches and algorithms for modeling from numeric, symbolic and pictorial data. LKM collaborates with psychologists, physicians, biologists, physicists and chemists. A notable aspect of much of this research is its application to problems in image analysis, medical diagnosis, ecological modeling, alternative medicine, studies of consciousness and manifestation of cognitive processes and consciousness through subtle energies.

TEACHING

The staff of LKM is engaged in teaching the following courses: Programming Languages, Artificial Intelligence Methods, Algorithms and Data Structures 1, Knowledge Engineering, Fundamentals of Algorithms and Data Structures 2, Database Systems 1 and 2, Introduction to Databases, Machine Learning (postgraduate), Knowledge Discovery in Databases (postgraduate).

EQUIPMENT

The computer equipment consists of a network of a dozen Windows and Linux-based personal computers and servers, laser and ink jet printers. We also use Crown-TV camera for Gas Discharge Visualization and Olympus BX51 Microscope with digital camera.

RECENT PROJECTS AND COLLABORATION

Knowledge synthesis from data and background knowledge: Basic research project funded by Slovenian Ministry of Education, Science and Sports.

Reliable and Comprehensible Machine Learning Approaches with Applications to Medical Diagnostics and Bioinformatics: Bilateral project funded by Slovenian and Greek Ministry of science.

Cost sensitive intelligent data analysis: Postdoc research project funded by Slovenian Ministry of Education, Science and Sports.

Intelligent data analysis in medicine: Basic research project funded by Slovenian Ministry of Science and Technology.

Several applicative projects concerning intelligent data analysis and data mining.

Several applicative projects concerning the analysis of various subtle influences on human and plant GDV pictures.

Collaboration with academic institutions:

Technical University SPIFMO, St. Petersburg, Russia,

University of Sydney, Australia,

University of Stuttgart, Germany,

Limburg's University Center, Belgium,

University of Ioannina, Greece,

Biotehnical Faculty, University of Ljubljana,

Faculty of Arts, University of Ljubljana,

FRI, Computer Vision Lab and Artificial Intelligence Lab.

Collaboration with research institutions:

Research Institute of Organic Agriculture, Frick, Switzerland,

Research Institute Aco de Paou, Valernes, France,

Institute for Bioelectromagnetics and New Biology BION, Ljubljana,

Jozef Stefan Institute, Ljubljana,

Clinic Center, Ljubljana.

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RESEARCH ACTIVITIES

The research activities of the laboratory involve various fields of mathematics with special emphasis on applications to computer and information science. The following areas of mathematics are studied:

scientific computing and numerical solutions of differential equations, in particular, methods for geometric integration of differential equations,

graph theory, mostly topological and structural properties of graphs, vertex colorings of graphs and weighted graphs as a natural generalization of the channel assignment problem,

algebraic topology, in particular cohomology of topological spaces with group actions, applications of topology to computer science, and computational topology,

nonlinear dynamical systems and their application in geometry, physics and mechanics,

linear and nonlinear mathematical techniques in appearance based models and their application to computer vision (in cooperation with the Computer vision laboratory),

computational geometry and geometry of cycles (in cooperation with members of the Faculty of Electrical Engineering and the Faculty of Mathematics and Physics) with applications to surface modeling,

in the area of incidence structures we study problems related to combinatorial and geometric configurations (the study of combinatorial properties

of configurations via their incidence graphs, and the study of possibility of the realization of configurations in other incidence structures).

The laboratory organizes the Mathematical seminar at the FRI, where members of the lab and other researchers report on current work, connected to the research and teaching activities of the lab.

Several members of the lab are also members of research groups of the Institute of Mathematics, Physics, and Mechanics. Members of the lab are involved in joint research work with other research groups at the Faculty of Computer and Information Science and the Faculty of Electrical Engineering and with the following institutions: NTNU Trondheim, Norway, and University in Bergen, Norway.

TEACHING

Members of the lab teach courses on the undergraduate level on calculus, numerical mathematics, discrete mathematics and statistics with data analysis. Several of these courses are strongly supported by standard packages for visualization and computation like Mathematica or Matlab. On the graduate level, the courses Differential and computational geometry, Numerical linear algebra, and Topology in Computer Science are offered.

EQUIPMENT

The laboratory is equipped with computers connected into a local network with relevant computer algebra systems like Mathematica and Matlab. The computers run under Linux operating system and, as much as possible, public domain software is used.

PROJECTS

Algorithms for digital control of scanning probe microscopes, two-year applied research project funded by the Slovenian Ministry of Education, Science and Sports and Elatec d.o.o.

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