

DEPARTMENT OF INTELLIGENT SYSTEMS

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The Department of Intelligent Systems focuses its activities on the development of methods and techniques for intelligent computer systems, with applications in the areas of the information society, computer science and informatics, Slovene language and speech processing, and network communication systems. The main research areas are language and speech technologies, agent technologies, the semantic web, evolutionary computing, data mining, search algorithms, decision support, intelligent sensors, distributed supervisory systems, and network voice services. The department collaborates closely with the Faculty of Computer and Information Science at the University of Ljubljana on the joint research programme Artificial Intelligence and Intelligent Systems, which is led by Prof. Ivan Bratko.



Head:
Prof. Matjaž Gams

The department collaborates with the Faculty of Computer and Information Science from the University of Ljubljana on the joint research programme Artificial Intelligence and Intelligent Systems, recognized as one of the best Slovenian research programmes in 2005 by the Slovenian Research Agency in 2006. This was the first promotion of this type for any computer-science research programme. In the area of **language and speech technologies** we developed new language resources for the Slovene language, new algorithms and procedures for Slovene speech synthesis, and were engaged in syntactic parsing of Slovene texts. In cooperation with other research groups we continued the development of the syntactically annotated corpus of Slovene text called the "Slovene Dependency Treebank". Its current size is about 35,000 words. The corpus is intended to aid research in automatic syntactic parsing of Slovene text.

Together with the company Amebis we developed a new version of the Slovene text-to-speech (TTS) system Govorec (Speaker). It is the first and only widely available commercial TTS system for Slovene. It can be accessed at the website govorec.amebis.si. Another good example of knowledge transfer into practice is MMC RTV Govorec (MMC RTV Speaker). This program reads the news from the RTV Slovenia teletext. It was designed **for blind and partially sighted people** as a tool for observing daily events. Users can access fresh news, updated every minute. MMC RTV Govorec is the result of a cooperation involving the Jožef Stefan Institute, Amebis and the RTV Slovenia Multimedia Centre. All three participants donated the application to the blind and partially sighted people of Slovenia, and it is available through the website www.rtv slo.si/govorec.

The department conducts research in the area of **agent technologies**. Agents are autonomous computer programs that simulate the behaviour of human agents. Our research includes learning, modelling and simulating intelligent agents and multiagent systems. In 2006 the emphasis was on modelling strategic multiagent behaviour without prior high-level domain knowledge. We developed a Multi-Agent Strategy Discovering Algorithm (MASDA), which is able to detect and describe a previously unknown strategy of a team of agents based only on agent trace and low-level domain knowledge. The algorithm was successfully tested on two robot football domains: the RoboCup and the 3vs2 Keepaway. This research was part of a recent doctoral dissertation from the field of multiagent system modelling.

Evolutionary computing is the study of search and optimization algorithms imitating the concepts of Darwinian evolution and genetic variation in the exploration of complex problem spaces. In this field we focused on multiobjective optimization and applications of evolutionary algorithms in process-parameter optimization in the continuous casting of steel, and marker optimization in textile production. We upgraded DEMO, an evolutionary algorithm for multiobjective optimization based on differential evolution. It is less complex than other multiobjective

The department was recognized as having one of the best Slovenian research programmes.

Teletext lahko tudi slišite

Vsebino teleteksta vam prebereta Renato ali Matej

Znanost in tehnologija, 11. december 2006 12:38
Ljubljana - RTV SLO

Teletext RTV Slovenija lahko od zdaj uporabljajo tudi slepi in slabovidni, in sicer s pomočjo MMC RTV Govorca.

Sistem, ki je dosežek sodelovanja MMC-ja RTV Slovenija, podjetja Amebis in Instituta Jožefa Stefana, preprosto namestite na računalnik. Z ukazi se premikate po zelenih straneh in vsebinah. MMC RTV Govorec vam vsebino teleteksta, ki se na osebem računalniku osvežuje vsakih 5 minut, prebere. Izberete lahko med dvema glasovoma (Renato in Matej).

Tržna vrednost projekta je ocenjena na 10 milijonov tolarjev, prej omenjeni partnerji pa so aplikacijo slepim podarili, zato je brezplačno dosegljiva na spletu.

Pomemben kamen v mozaiku pripomočkov

Na predstavitvi aplikacije na Institutu Jožefa Stefana je direktor Jadran Lenarčič povedal, da gre pri razvoju govorca za prenos znanja v prakso.

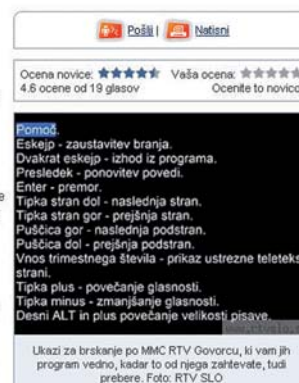
Zvezdan Martič, vodja Multimedijskega centra, je ob tem poudaril, da je RTV zdaj poleg tega, da omogoča podnaslavljanje televizijskih oddaj za gluhe in naglušne, približal svoje vsebine tudi slepim in slabovidnim. Stane Padežnik iz Zveze društev slepim in slabovidnim pa meni, da MMC RTV Govorec predstavlja pomemben kamen v mozaiku pripomočkov.

Kako do Govorca na mojem računalniku?

Namestitev MMC RTV Govorca, ki ga najdete na www.rtv slo.si/govorec, je preprosta. Na svoj računalnik si prenesite namestitveno datoteko in jo zaženite. Skozi postopek vas bodo vodila navodila na zaslonu. Slepim in slabovidnim bo pri namestitvi programa moral nekdo pomagati, nato pa bodo lahko z njim upravljali sami.

A. J.

Figure 1: The MMC RTV Govorec (Speaker) program, which reads the RTV Slovenia teletext news at a home personal computer, was donated to the blind and partially sighted people of Slovenia by the Jožef Stefan Institute, the company Amebis, and the RTV Slovenia Multimedia Centre.



In December 2006 the MMC RTV Govorec (Speaker) program was donated to the blind and partially sighted people of Slovenia. The program reads the regularly updated news from the RTV Slovenia teletext on a home personal computer. It was developed by the Jožef Stefan Institute, the company Amebis, and the RTV Slovenia Multimedia Centre. The estimated contribution of the department to the donation is € 40,000.

optimization algorithms and provides comparable, and in some cases even better results, on test problems. In 2006 the algorithm was connected with a machine learning method, with the focus on handling the classification accuracy and complexity of the induced concepts as conflicting optimization criteria.

In **data mining** the emphasis was on analyzing text data. Text categorization is usually based on content. We, however, used style-based categorization to automatically identify genres of web pages, such as personal and commercial. Our classifier will be used in the ALVIS search engine, developed as part of an EU 6FP project. We also pursued research in the automatic categorization of text documents based on character subsequences. A system for filtering malicious and spam email based on

this method, which was developed at the department, received widespread recognition, and was implemented in one of the most popular spam filtering systems, CRM114.

We study **search algorithms** for game-playing, path-finding and other applications. We explained many cases of the pathological behaviour of search algorithms, i.e., achieving worse results at a greater search depth, and determined for which cases a deeper search is beneficial. We are also developing methods for the automatic selection of the optimal search depth in path-finding.

In the area of **multimedia communications and services** we successfully completed our task in the EU 6FP IST research project **WINDECT** (Wireless Local Area Network with Integration of Professional Quality DECT

Telephony). The project dealt with professional-quality speech services on convergent wireless data communications in LAN/WLAN networks. Our laboratory system for automated metric testing of voice quality in VoIP/VoWLAN systems was augmented with components for VQ measurements on a WINDECT demonstrator system under the support of the local industrial partners Iskratel and Prevent Global. We successfully confirmed toll-quality speech communication on PC-emulated access points and mobile terminals. WINDECT measurement results ensure the support of

professional-quality speech and video services that represent the core of convergent communications systems.

For Telekom Slovenije, the national telecom operator, we realized a feasibility study for the Inteligentni dom Telekom (**Intelligent Home Telekom**) project. The study presents a complete and up-to-date state-of-the-art survey, guidelines for the functional and technical design of the intelligent-home framework, and provides a list of next-generation intelligent-home services. These services depend on ambient intelligence, as they are inherently interconnected, personalized, user-friendly, and operate in self-aware environments. Our main objective is to explore and develop new ambient-intelligence technologies that will embed

intelligence properties into the next-generation intelligent-home products and services.

We participated in three EU 6FP projects: ALVIS (semantic search engine), WINDECT (integration of wireless voice and data transmission services), and WeGo (implementation of e-government). Major applied projects are conducted for the Tax Administration of the Republic of Slovenia (multimedia consultation on income taxes), Telekom Slovenije (intelligent home), Špica and the Slovenian Research Agency (access control) and the Ministry of Defence of the Republic of Slovenia (intelligent supervisory systems).

We also participate in the EU 6FP project WeGo, which deals with the implementation of e-government, and carry out major national applied projects for the Tax Administration of the Republic of Slovenia (multimedia consultation on income taxes), Špica and the Slovenian Research Agency (access control) and the Ministry of Defence of the Republic of Slovenia (intelligent supervisory systems).

A traditional activity of the Department of Intelligent Systems is the organization of the International Multiconference Information Society. In October 2006 the 8th such multiconference was held in Ljubljana, and consisted of eight independent conferences.

The most important publications of the department in 2006 were in the Journal of Machine Learning Research and the Artificial Intelligence journal, ranked as the first and seventh according to impact factor in the field of artificial intelligence.

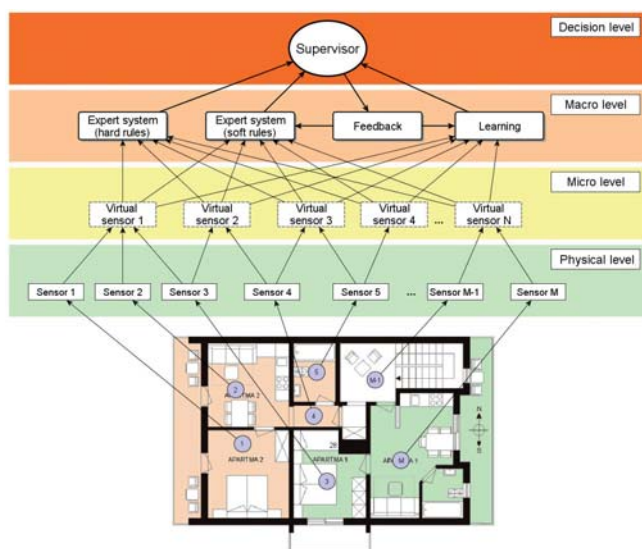


Figure 3: A scheme of the intelligent supervisory system under development for MORS (Ministry of Defence of the Republic of Slovenia)

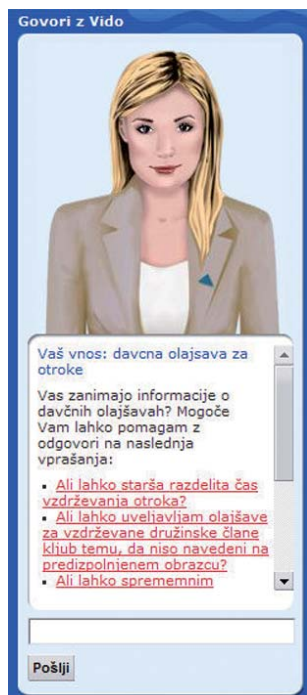


Figure 2: The department collaborates with the company Artificial Solutions in adjusting the virtual tax advisor VIDA for completing the income tax forms for DURS (Tax Administration of the Republic of Slovenia).

Some outstanding publications in the past three years

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1. 9th International Multiconference Information Society IS 2006: Boderline cognitive Sciences, Cognitive Sciences, Collaboration and Information Society, Data Mining and Data Warehouses, Education in Information Society, Intelligent Systems, Language Technologies, Jožef Stefan Institute, Ljubljana, Slovenia, 9–14 October 2006
2. The Second International Conference on Bioinspired Optimization Methods and their Applications BIOMA 2006, Ljubljana, 9–10 October 2006

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INTERNATIONAL PROJECTS

1. Superpeer Semantic Search Engine
ALVIS
6. FP; 002068
EC; Wray Buntine, Complex Systems Computation Group at Helsinki Institute for Information Technology, Helsinki University of Technology, Espoo, Finland
Prof. Matjaž Gams, Dr. Dunja Mladenec, Marko Grobelnik
2. Wireless Local Area Network with Integration of Professional-Quality DECT Telephony WINDECT
6. FP; 506746
EC; Technical manager of the project: Dr. Eva Ravnikar, Ascrom AG, Switzerland;
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3. Numerical Optimization of Continuous of Steel
BI-FI/04-05-009
Dr. Erkki Laitinen, Department of Mathematical Sciences, University of Oulu, Oulu, Finland
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4. Securing and Optimising Smart Access and Personal Identification Systems with Intelligent Agents
BI-RO/05-06/016
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R & D GRANTS AND CONTRACTS

1. Integrated Multi-Media Mobile Applications in Hospitals
Prof. Matjaž Gams

2. Technology of learning in multi-agent systems
Prof. Matjaž Gams
3. Knowledge technology and decision support in medical information portals
Prof. Matjaž Gams
4. Professional System for Mobile Communications for Ministry of Defense
Dr. Marjan Špegel
5. The role of Luka Koper in logistic support of the Slovenian Armed Forces and allies
Asst. Prof. Bogdan Filipič
6. Voice TRAN II: multilingual portable speech communicator for warrior in 21st century
Prof. Matjaž Gams
7. CIVaBiS - An integrated security biometrical system
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RESEARCH PROGRAM

1. Artificial Intelligence and Intelligent Systems
Prof. Matjaž Gams

NEW CONTRACTS

1. Analyses and design of the integrated platform
Telekom Slovenije d.d.
Prof. Gams Matjaž
2. Expert counselling for the introduction of tax advisor
Tax Administration of the Republic of Slovenia
Prof. Gams Matjaž

VISITORS FROM ABROAD

1. Prof. Veljko Milutinović, Faculty of Electrical Engineering, University of Belgrade, Serbia, 16–18 February 2006
 2. Prof. Erkki Laitinen, Department of Mathematical Sciences, University of Oulu, Finland, 26 February – 2 March 2006
 3. Prof. Dana S. Nau, University of Maryland, College Park, USA, 3–6 October 2006
 4. Prof. Günter Rudolph, Department of Computer Science, University of Dortmund, Germany, 8–10 October 2006
 5. Madalin Stefan Vlad, Politehnica University of Bucharest, Romania, 28 May 2006
 6. Prof. Marcin Paprzycki, dr. Maria Ganzha, Systems Research Institute, Polish Academy of Science, Warsaw, Poland, 10–12 October 2006
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