DEPARTMENT OF INTELLIGENT SYSTEMS

E-9

The Department of Intelligent Systems develops new methods and techniques for intelligent computer systems, with applications in the areas of the information society, computer science and informatics, and network communication systems. The main research areas are ambient intelligence, computational intelligence, agent and multi-agent systems, and language and speech technologies. The department collaborates closely with the Faculty of Computer and Information Science at the University of Ljubljana on the joint research program "Artificial Intelligence and Intelligent Systems", led by Prof. Dr. Ivan Bratko. The department also collaborates closely with industry and contributes significantly to the introduction of intelligent systems into products and services.

Intelligent systems simulate intelligence so that a typical user perceives them as truly intelligent. In reality, these systems use complex mechanisms and implement them on digital computers to imitate human behaviour, while they also exploit raw, exponentially growing computer power. This field is rapidly developing worldwide.

Head:
Prof. Matjaž Gams

Ambient intelligence is a research area aiming to introduce technology into our everyday environment in a friendly way that is undemanding for the user. The main topic of ambient intelligence tackled by the department in 2015 was e-health. As a result of our extensive earlier work on e-health, we are now attempting to translate some solutions for the elderly into practice through the H2020 project **InLife**. We prepared a smart-watch application that detects falls and similar events. To reduce the number of false alarms, the application takes into account the context of each potential fall, for example, it ignores events after which the user continues to move normally. We also studied user requirements and the best ways for the elderly to interact with technology, as well as developing an application to support their carers. Project solutions will be piloted in cooperation with the Slovenian company Doktor 24 and international partners. In the AAL project **Fit4Work**, whose goal is to help older workers do their job more easily, we worked on a method to recognize stress from the measurements of physiological sensors in a wristband. To this end, we performed extensive real-life measurements and an induced-stress experiment. In both cases intelligent stress detection was successful, but the problem proved very difficult. In the same project we also developed a method that uses ontology and sensors at the workplace to recommend actions such as changing the temperature or ventilation. In the FP7 project **COMMODITY12**, which telemonitors diabetic patients, we continued analysing the patients' lifestyle with a smartphone and a wearable ECG monitor. We improved a method that first automatically recognizes which of these devices a patient carries, then it normalizes the orientation of the phone and detects in which pocket it is carried, and finally invokes the appropriate models to recognize the patient's activity and estimates his/her energy expenditure. The method was presented at the Slovenian Innovation Forum. In addition, we analysed data from real-life patient trials. We used the trial data to develop a method

In the FP7 project COMMODITY12 we developed a method to analyse human movement with a smartphone, which was accepted by the Slovenian Innovation Forum and included in a mobile application that encourages children to be physically active.
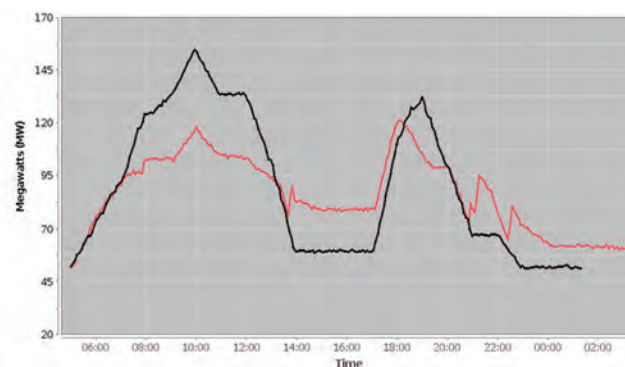

Figure 1: In the European project ACCUS we developed a platform for monitoring and controlling several key city subsystems. This figure shows energy-consumption smoothing by applying negotiations and finding the Nash equilibrium.

that can detect too low or too high levels of blood sugar using the ECG monitor. The method for a human energy expenditure estimation from the COMMODITY12 project was adapted for the **e-Gibalec** mobile application, which monitors the physical activity of children and reports it to their parents and physical-education teachers. It also uses gamification and elements of social networks to encourage the users to be more active. Finally, we started analysing tennis using sensors in a postdoctoral research project.

Computational intelligence is a study of stochastic search, optimization and learning methods, inspired by physical and biological systems. Research in this area at the Department of Intelligent Systems focuses on evolutionary computation methods. We study extensions of evolutionary algorithms for multi-objective optimization and their speedup, and apply these algorithms

The COPCAMS project results in an embedded computer system for manufacturing quality control based on computer vision, machine learning and optimization.
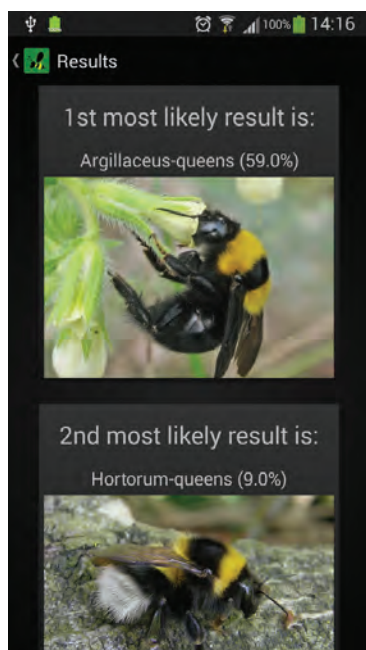
Figure 2: Mobile application for bumblebee classification, which finds the most likely bumblebee species and type based on the bumblebee's sound.

in engineering design and optimization problems. In a doctoral research project we studied the use of surrogate models in multi-objective optimization. The objective functions were approximated with Gaussian process models that, in addition to predicting the function values, estimate the confidence intervals of the predictions, while the Pareto dominance relations were generalized to take into account the confidence intervals. These extensions were incorporated into an optimization algorithm called GP-DEMO. Numerical experiments on benchmark functions and real optimization problems from metallurgical production and medical signal analysis confirmed that the new approach results in fewer incorrect comparisons of solutions and requires less-exact solution evaluations in the optimization process. The key area of testing and transferring our methods to practice is production-process optimization. We continued our work within the **COPCAMS** project, approved for funding under the Artemis call. Together with the Slovenian industrial partner Kolektor Group and international partners we are developing production quality-control procedures that are based on computer vision, machine learning and optimization. In the past year, our activities were concentrated on the optimization of computer-vision procedures to achieve the highest possible accuracy in predicting the product quality, and their implementation on the target embedded architecture to be deployed on the production line. For the Restoration Center in Ljubljana, which is part of the Institute for the Protection of Cultural Heritage of Slovenia, we previously developed the **Pedius** program for the computer-aided reassembly of wall-painting fragments, and a mobile and web application **e-Pedius** to support crowdsourcing in fragment reassembly. Equipped with these tools, the users managed to reconstruct the Roman frescoes based on thousands of fragments from an archaeological site in the region of Celje, Slovenia, last year.

In the field of **agent and multi-agent systems** the key research areas are focused on the development of smart autonomous systems for the control of smart cities and smart homes, and intelligent systems for improving existing educational processes and the preservation of cultural heritage. The European project **AC-CUS** is aimed at developing an integration and coordination platform for urban systems to build applications across various domains, providing adaptive and cooperative control for urban subsystems, and optimizing the combined performance of the city. The platform currently balances the overall electricity consumption in the city by curbing the electricity spikes that occur during the day. In addition, the system optimizes the electricity consumption in smart houses and the production in thermal power plants, and manages the traffic flow and

The ACCUS project aims at developing a coordination platform for smart cities that will enable the control of various city subsystems and provide several services for citizens.

thus affects the external parameters, such as air quality. The smart city control continuously monitors the conditions in the city and, for example, when a warning about high air pollution is triggered, it decides to reduce the traffic flow, the energy consumption in residential areas and production in the local thermal power plant. The monitoring system, in several time steps, verifies the effects of the control actions and, if required, sends additional corrections until an adequate level of air quality is achieved. A similar system is studied within the **OPUS** project, where the focus is on the development of smart-home automation services. The aim is to apply advanced machine-learning and optimization methods in order to generate real-time control strategies that increase the users' comfort and, at the same time, decrease the operational costs of the smart home. We experimentally demonstrated that it is possible to achieve energy savings without lowering the comfort. Additional improvements were achieved when applying learning algorithms to heat pumps. The controller learns the user's behaviour and formulates a strategy for water heating during periods of cheaper electricity and, at the same time, lowers the temperature of the stored water during days of lower consumption. In the **Metis** project we developed an intelligent system that improves the existing educational processes and enables the early detection of pupils with learning difficul-

Figure 3: Mobile application for monitoring and encouraging the movement of students for effective sports education

ties in primary and secondary schools. This year we also started the Horizon 2020 Twinning project **eHeritage**. The Twinning partners will provide support to increase the capacity and quality of the research and innovation excellence of the Romanian partner in the area of cultural heritage preservation using intelligent methods and 3D modelling, and employing augmented and virtual reality. Another important challenge addressed in the project is to expand the recognition of the project partners through an increase in the dissemination activities by targeting publications in high-profile journals and conferences.

212 virtual assistants were developed and implemented for 212 Slovenian municipalities, providing answers to questions in natural language about municipalities and Slovenian regions.

In the field of **speech and language technologies** we work on speech synthesis, semantic analyses of text and question answering. Special attention is paid to the requirements of the elderly, handicapped and visually

impaired people, and to apply our solutions to smart devices and homes. Together with the Amebis company, we developed a new speech synthesizer for Slovene. Both the comprehensibility and naturality of the synthesized speech have been greatly improved. We also developed a free service for speech synthesis on mobile devices. For the purposes of the institute we adapted the virtual assistant, Robi, which enables employees and visitors to quickly and easily find information about the institute, and also provides a rich set of additional applications offering various functionalities (employee phone book, infrastructure malfunction reporting, etc.). We also developed virtual assistants for all 212 Slovene municipalities with a basic knowledge base that was constructed using artificial intelligence methods.

The focus points of the research and developmental potential of the department are also being expressed in successfully developed, integrated and deployed solutions, available on major digital platforms and available to a wide population of users. The methods used in typical applied projects combine the procedures of intelligent agents, statistical methods and machine learning, and serve as a basis for user interfaces on smart phones, tablets or desktop computers. The projects' services are developed for all key mobile platforms (Android, iOS and Windows) and through classic web clients.

A system for recognizing animal species from their sounds has been implemented as an open mobile and web application (http://animal-sounds.ijs.si/). It recognises Slovenian frogs, birds, bumblebees and Chinese cuckoos.

From 28 September to 14 October 2015, the **18th International Multiconference Information Society – IS 2015** (is.ijs.si) took place at the Jožef Stefan Institute and the Faculty of Computer and Information Science. It consisted of twelve independent conferences with around 600 participants that presented approximately 300 papers. Four conference awards were presented: for lifetime achievements ("Donald Michie and Alan Turing" award) to Prof. Jurij Tasič, for current achievements in the field of information society to Asst. Prof. Domen Mongus, and the information strawberry and lemon for the best and worst public information-society services.

Figure 4: In 2015, the Department of Intelligent Systems took over the coordination of the Horizon 2020 project HeartMan, which will develop an intelligent application for helping patients with congestive heart failure.
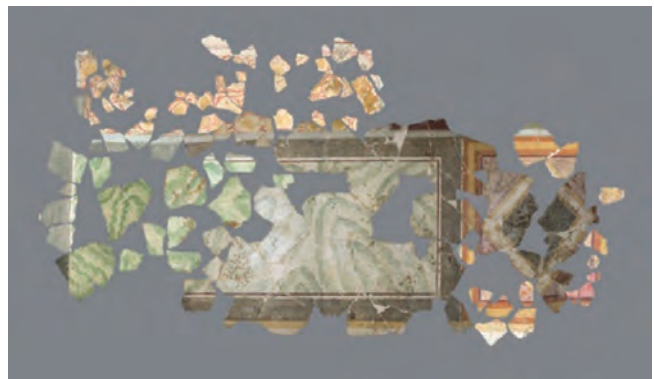

Figure 5: Using software tools Pedius and e-Pedius developed at the Department of Intelligent Systems, the Restoration Center in Ljubljana managed to reconstruct Roman frescoes from an archeological site in the region of Celje, Slovenia.

Some outstanding publications in the past year

1. Gjoreski, H., Kaluža, B., Gams, M., Milić, R., Luštrek, M. Context-based ensemble method for human energy expenditure estimation. Applied Soft Computing, 37 (2015), 960–970
2. Luštrek, M., Gjoreski, H., Gonzáles Vega, N., Kozina, S., Cvetković, B., Mirchevska, V., Gams, M. Fall detection using location sensors and accelerometers. IEEE Pervasive Computing, 14 (2015) 4, 72–79
3. Mlakar, M., Petelin, D., Tušar, T., Filipič, B. GP-DEMO: Differential evolution for multiobjective optimization based on Gaussian process models. European Journal of Operational Research, 243 (2015) 2, 347–361
4. Tušar, T., Filipič, B. Visualization of Pareto front approximations in evolutionary multiobjective optimization: A critical review and the prosection method. IEEE Transactions on Evolutionary Computation, 19 (2015) 2, 225–245

Organization of Conferences, Congresses and Meetings

1. Workshop on High Performance Predictable Embedded Systems for Cognitive Applications, HiPPES4CogApp, 10th International Conference on High Performance and Embedded Architectures and Compilers, HiPEAC 2015, Amsterdam, The Netherlands, 20. 1. 2015
2. 26th Slovene Workshop on Nature-Inspired Algorithms, AVN, Katarina nad Ljubljano, 19. 5. 2015
3. Student Workshop at the Genetic and Evolutionary Computation Conference, GECCO 2015, Madrid, Spain, 11. 7. 2015
4. 1st International KEYSTONE Conference, IKC 2015, Coimbra, Portugal, 8.–9. 9. 2015
5. Special section on Metaheuristic Optimization, 13th International Symposium on Operations Research in Slovenia, SOR 2015, Bled, 24. 9. 2015
6. 18th International Multiconference Information Society, IS 2015, Ljubljana, 28. 9.–14. 10. 2015; independent conferences:

- Intelligent Systems
- Facing Demographic Challenges
- Collaboration, Software and Services in Information Society
- Cognitive Sciences
- Data Mining and Data Warehouses
- Education in Information Society
- 2nd Student Conference for Ph.D. Students
- 2nd Student Conference for Undergraduate Students
- Cognitonics
- 8th International Conference on Informatics in Schools: Situation, Evolution, and Perspective
- SPS EM-Health Workshop
- Workshop Smart Cities and Communities as a Development Opportunity for Slovenia
- 27th Slovene Workshop on Nature-Inspired Algorithms, AVN, Maribor, 4. 12. 2015

Awards and Appointments

1. Božidara Cvetković, Vito Janko, Mitja Luštrek: Recognition for API for Motion Analysis, Slovenian Innovation Forum 2015, Šempeter pri Novi Gorici, 17.–18. 11. 2015
2. Hristijan Gjoreski, Rok Piltaver, Matjaž Gams: Best Paper Award for "Person identification by analyzing door accelerations in time and frequency domain", 12th European Conference on Ambient Intelligence, AmI 2015, Athens, Greece, 11.–13. 11. 2015
3. Anton Gradišek, Fulbright scholarship for work in USA, 27. 10. 2014–24. 6. 2015
4. Mario Konecki, Alen Lovrenčić, Matjaž Gams: Using customized reports in introductory programming courses, 3rd International Academic Conference on Development in Science and Technology, IACDST 2015, Paris, France, 11. 10. 2015

Patent granted

1. Matjaž Gams, Rok Piltaver, Hristijan Gjoreski, Method for Identification of Persons Entering a Room, SI24485 (A), Slovenian Intellectual Property Office, 31. 03. 2015.

INTERNATIONAL PROJECTS

1. 7FP - Xperience; Robots Bootstrapped through Learning from Experience
   Prof. Matjaž Gams
   European Commission
2. 7FP - Commodity12; Continuous Multi-parametric and Multi-layered Analysis of Diabetes Type 1&2
   Dr. Mitja Luštrek
   European Commission
3. Adaptive Cooperative Control in Urban (sub) Systems
   Prof. Matjaž Gams
   Ministry of Economic of the Republic of Slovenia
4. COgnitive & Perceptive CAMeraS: COPCAMS
   Prof. Bogdan Filipič
   Ministry of Economic of the Republic of Slovenia
5. CIP Programme; EcoDots
   Dr. Mitja Luštrek
   European Commission
6. H2020 - IN LIFE; INdependent Living support Functions for the Elderly
   Prof. Matjaž Gams
   European Commission
7. H2020 - eHERITAGE; Expanding the Research and Innovation Capacity in Cultural Heritage Virtual Reality Applications
   Prof. Matjaž Gams
   European Commission

RESEARCH PROGRAM

1. Artificial Intelligence and Intelligent Systems
   Prof. Matjaž Gams

R & D GRANTS AND CONTRACTS

1. Research on adaptive predictive domain models
   Dr. Boštjan Kaluža
2. DysLex: Universal voice e-reader for the Slovenian language as a personal learning tool for people with dyslexia and different types of visual disturbances
   Dr. Tomaž Šef
3. Metis: E-service for the early detection of learning issues
   Dr. Erik Dovgan
4. e-Xercise: Mobile application to monitor and promote exercise in schoolchildren for more effective physical education
   Dr. Mitja Luštrek
5. ASPO
   Prof. Matjaž Gams
   Slovene Human Resources and Scholarship Fund, Ljubljana
6. Adaptive Cooperative Control in Urban (sub) Systems
   Prof. Matjaž Gams
   Ministry of Economic of the Republic of Slovenia
7. COgnitive & Perceptive CAMeraS: COPCAMS
   Prof. Bogdan Filipič
   Ministry of Economic of the Republic of Slovenia
8. Optimizing the Management of Energy Efficient Smart Buildings
   Dr. Tomaž Šef
   Ministry of Education, Science and Sport of the Republic of Slovenia
9. Self-management of physical and mental fitness of older workers
   Dr. Mitja Luštrek
   Ministry of Education, Science and Sport of the Republic of Slovenia

NEW CONTRACTS

1. The development of text-to-speech system for Slovenian language
   Dr. Tomaž Šef
   Alpineon d. o. o.

VISITORS FROM ABROAD

1. Julien Thepot, University of Paris Sud XI, Paris, France, 13. 4.–18. 7. 2015
2. Chauraud Quentin, University of Paris Sud XI, Paris, France, 18. 4.–18. 7. 2015
3. Defendini David, University of Paris Sud XI, Paris, France, 18. 4.–18. 7. 2015
4. Lienard Loïciz, University of Paris Sud XI, Paris, France, 18. 4.–18. 7. 2015
5. Ahmed Atia, University of Paris Sud XI, Paris, France, 22. 5.–30. 7. 2015
6. He Hui, College of Communication and Information Engineering, Shanghai University, Shanghai, China, 5. 6.–14. 8. 2015
7. Scholz Stephan, University of Technology, Computer Cybenetics and Systems Theory, Ilmenau, Germany, 24. 8.–31. 12. 2015
8. Mario Konecki, Faculty of Organization and Informatics, Department of Theoretical and Applied Foundations of Information Sciences, Varaždin, Croatia, 28. 9.–14. 10. 2015
9. Mladen Konecki, Faculty of Organization and Informatics, Department of Theoretical and Applied Foundations of Information Sciences, Varaždin, Croatia, 28. 9.–14. 10. 2015

STAFF

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1. Prof. Ivan Bratko*
2. Asst. Prof. Aleš Dobnikar*
3. Prof. Bogdan Filipič
4. **Prof. Matjaž Gams, Head**
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6. Dr. Domen Marinčič*
7. Dr. Tomaž Šef

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9. Dr. Hristijan Gjoreski
10. Dr. Anton Gradišek
11. Dr. Matej Guid*
12. Dr. Miha Mlakar
13. Dr. Aleksander Pivk*
14. Dr. Tea Tušar
15. *Dr. Vedrana Vidulin, on postdoctoral leave since 11. 03. 14*

Postgraduates
16. Jani Bizjak, B. Sc.
17. Robert Blatnik, M. Sc.
18. Božidara Cvetković, B. Sc.
19. Vito Janko, B. Sc.
20. Tomaž Kompara*, B. Sc.
21. Dr. Jana Krivec*
22. Damjan Kužnar, B. Sc.
23. Martin Pečar, B. Sc.
24. Rok Piltaver*, B. Sc.
25. *Rok Piltaver, B. Sc., left 01.09.15*
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27. Jernej Zupančič, B. Sc.

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29. Blaž Mahnič, B. Sc.
30. Gašper Pintarič*, B. Sc.
31. Jure Šorn, B. Sc.

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33. Mitja Lasič
34. Liljana Lasič
35. Lana Zemljak

Note:
* part-time JSI member

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ORIGINAL ARTICLE

1. D. Conić, Anton Gradišek, Z. Radaković, M. Iordoc, M. Mirković, M. Čebela, K. Batalović, "Influence of Ta and Nb on the hydrogen absorption kinetics in Zr-based alloys", *Int. j. hydrogen energy*, vol. 40, no. 16, pp. 5677-5682, 2015.
2. Božidara Cvetković, Boštjan Kaluža, Matjaž Gams, Mitja Luštrek, "Adapting activity recognition to a person with Multi-Classifier Adaptive Training", *Journal of ambient intelligence and smart environments*, vol. 7, no. 2, pp. 171-185, 2015.
3. Erik Čuk, Matjaž Gams, Rok Piltaver, Franc Strle, Vera Maraspin-Čarman, Jurij F. Tasič, "Intelligent system for diagnosis of erythema migrans", *Appl. artif. intell.*, vol. 29, no. 2, pp. 134-147, 2015.
4. Hristijan Gjoreski, Boštjan Kaluža, Matjaž Gams, Radoje Milić, Mitja Luštrek, "Context-based ensemble method for human energy expenditure estimation", *Applied soft computing*, vol. 37, pp. 960-970, 2015.
5. Hristijan Gjoreski, Simon Kozina, Matjaž Gams, Mitja Luštrek, Juan Antonio Álvarez-García, Jin-Hyuk Hong, Julian Ramos, Anind K. Dey, Maurizio Bocca, Neal Patwari, "Competitive live evaluations of activity-recognition systems", *IEEE pervasive computing*, vol. 14, no. 1, pp. 70-77, 2015.
6. Anton Gradišek, Tomaž Apih, "Hydrogen dynamics in partially quasicrystalline $Zr_{69.5}Cu_{12}Ni_{11}Al_{7.5}$: fast field cycling relaxometry study", *The journal of physical chemistry. C, Nanomaterials and interfaces*, vol. 119, no. 19, 10677-10681, 2015.
7. Igor Korelič, Violeta Mirchevska, Vladislav Rajkovič, Mirjana Kljajić Borštnar, Matjaž Gams, "Multiple-criteria approach to optimisation of multidimensional data models", *Informatica (Vilnius)*, vol. 26, no. 2, pp. 283-312, 2015.
8. Jana Krivec, "Analytical review of mindfulness-based educational programs - a missing linkage between humans and a modern world", *Research in social change*, no. 7, iss. 2, pp. 107-144, May 2015.
9. Mitja Luštrek, Hristijan Gjoreski, Narciso Gonzáles Vega, Simon Kozina, Božidara Cvetković, Violeta Mirchevska, Matjaž Gams, "Fall detection using location sensors and accelerometers", *IEEE pervasive computing*, vol. 14, no. 4, pp. 72-79, 2015.
10. Miha Mlakar, Dejan Petelin, Tea Tušar, Bogdan Filipič, "GP-DEMO: differential evolution for multiobjective optimization based on Gaussian process models", *Eur. J. oper. res.*, vol. 243, no. 2, pp. 347-361, 2015.
11. Rok Piltaver, Božidara Cvetković, Boštjan Kaluža, "Denoising human-motion trajectories captured with ultra-wideband real-time location system", *Informatica (Ljublj.)*, vol. 39, no. 3, pp. 311-322, 2015.
12. Tea Tušar, Bogdan Filipič, "Visualization of Pareto front approximations in evolutionary multiobjective optimization: a critical review and the prosection method", *IEEE trans. evol. comput.*, vol. 19, no. 2, pp. 225 - 245, 2015.
13. Domen Zupančič, Mitja Luštrek, Matjaž Gams, "Multi-agent architecture for control of heating and cooling in a residential space", *Comput. j.*, vol. 58, no. 6, pp. 1314-1329, 2015.
14. Domen Zupančič, Mitja Luštrek, Matjaž Gams, "Trade-off between energy consumption and comfort experience in smart buildings", *Inf. technol. valdyn.*, vol. 44, no. 4, pp. 420-432, 2015.

SHORT ARTICLE

1. Hristijan Gjoreski, "An approach for context-based reasoning in ambient intelligence", *Informatica (Ljublj.)*, vol. 39, no. 1, pp. 99-100, 2015.

PUBLISHED CONFERENCE CONTRIBUTION

1. Božidara Cvetković, Vito Janko, Mitja Luštrek, "Demo abstract: activity recognition and human energy expenditure estimation with a smartphone", In: *Percom workshops*, IEEE International Conference on Pervasive Computing and Communication Workshops, March 23-27, 2015, St. Louis, Missouri, USA, Danvers, IEEE = Institute of Electrical and Electronics Engineers, pp. 193-195.

2. Božidara Cvetković, Violeta Mirchevska, Vito Janko, Mitja Luštrek, "Recognition of high-level activities with a smartphone", In: *UbiComp'15: proceedings of the 2015 ACM International Joint Conference on Pervasive and Ubiquitous Computing, September 7-11, 2015, Osaka, Japan*, New York, ACM, cop. 2015, pp. 1453-1461.

3. Božidara Cvetković, Urška Pangerc, Mitja Luštrek, "Prepoznavanje in napovedovanje hiperglikemij in hipoglikemij na neinvaziven način", In: *Inteligentni sistemi: zbornik 18. mednarodne multikonference Informacijska družba - IS 2015, 7. oktober 2015, [Ljubljana, Slovenia]: zvezek A: proceedings of the 18th International Multiconference Information Society - IS 2015, October 7th, 2015, Ljubljana, Slovenia: volume A*, Rok Piltaver, ed., Matjaž Gams, ed., Ljubljana, Institut Jožef Stefan, 2015, pp. 13-16.

4. Božidara Cvetković, Rok Piltaver, Matjaž Gams, Mitja Luštrek, "Evolution of activity monitoring through various projects", In: *ICT Innovations 2015: web proceedings*, (ICT Innovations Conference Web Proceedings (Skopje)), Suzana Loshkovska, ed., Saso Koceski, ed., Skopje, ICT ACT, cop. 2015, pp. 313-322.

5. Kristina Drusany Starič, Božidara Cvetković, Alenka-Uršula Levičnik, Jože Starič, "One health concept of measuring and monitoring wellbeing", In: *ICT Innovations 2015: web proceedings*, (ICT Innovations Conference Web Proceedings (Skopje)), Suzana Loshkovska, ed., Saso Koceski, ed., Skopje, ICT ACT, cop. 2015, pp. 303-312.

6. Gašper Fele-Žorž, Karolina Počivavšek, Jaka Konda, Ana Marija Peterlin, Alen Ajanovič, Ana Prodan, Saša Rink, Anton Gradišek, Matjaž Gams, Mojca Matičič, "Application for sexually transmitted infection risk assessment", In: *Inteligentni sistemi: zbornik 18. mednarodne multikonference Informacijska družba - IS 2015, 7. oktober 2015, [Ljubljana, Slovenia]: zvezek A: proceedings of the 18th International Multiconference Information Society - IS 2015, October 7th, 2015, Ljubljana, Slovenia: volume A*, Rok Piltaver, ed., Matjaž Gams, ed., Ljubljana, Institut Jožef Stefan, 2015, pp. 24-28.

7. Bogdan Filipič, Miha Mlakar, Tea Tušar, "Multiobjective optimization of process parameters in steel production", In: *SOR '15 proceedings*, 13th International Symposium on Operational Research in Slovenia, Bled, Slovenia, September 23-25, 2015, Lidija Zadnik Stirn, ed., et al, Ljubljana, Slovenian Society Informatika, Section for Operational Research, 2015, pp. 99-104.

8. Carlos Martins da Fonseca, Carlos Henggeler Antunes, Renauld Lacour, Patrick M. Reed, Tea Tušar, "Visualization in multiobjective optimization", In: *Understanding complexity in multiobjective optimization: January 11-16 2015*, (Daggstuhl-seminar-report, no 15031), Salvatore Greco, ed., Wadern, IBFI, 2015, pp. 129-139.

9. Matjaž Gams, "Begunci 2015 - vrh evropske demografske ledene gore", In: *Soočanje z demografskimi izzivi: zbornik 18. mednarodne multikonference Informacijska družba - IS 2015, 5. oktober 2015, [Ljubljana, Slovenia]: zvezek B: proceedings of the 18th International Multiconference Information Society - IS 2015, October 5th, 2015, Ljubljana, Slovenia: volume B*, 18. Mednarodna multikonferenca Informacijska družba - IS 2015, Ljubljana, 6. oktober 2015, Janez Malačič, ed., Matjaž Gams, ed., Ljubljana, Institut Jožef Stefan, 2015, pp. 12-14.

10. Matjaž Gams, "Superintelligence", In: *Inteligentni sistemi: zbornik 18. mednarodne multikonference Informacijska družba - IS 2015, 7. oktober 2015, [Ljubljana, Slovenia]: zvezek A: proceedings of the 18th International Multiconference Information Society - IS 2015, October 7th, 2015, Ljubljana, Slovenia: volume A*, Rok Piltaver, ed., Matjaž Gams, ed., Ljubljana, Institut Jožef Stefan, 2015, pp. 34-37.

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MENTORING

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3. Igor Avbelj, *Real-time updating of a recommender for personalized TV program:* master's thesis, Ljubljana, 2015 (mentor Ivan Bratko).
4. Vito Janko, *Razvoj programa za igranje 1-2-3 šaha:* master's thesis, Ljubljana, 2015 (mentor Matej Guid).
5. Urša Krevs, *Computer analysis and comparison of chess players' game-playing styles:* master's thesis, Ljubljana, 2015 (mentor Matej Guid).
6. Matevž Pavlič, *Estimating the quality of arguments in argument-based machine learning:* master's thesis, Ljubljana, 2015 (mentor Matej Guid).
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