

INFOTEHNOLOOGIA TEADUSKOND
INFORMAATIKAINSTITUUT
TEADUS- JA ARENDUSTEGEVUSE AASTAARUANNE 2013

1. Instituudi struktuur

Informaatikainstituut, Department of Informatics

Instituudi direktor Prof Rein Kuusik

- Informaatika aluste õppetool, Chair of Foundations of Informatics, Prof Rein Kuusik
- Infosüsteemide õppetool, Chair of Information Systems, Dr Erki Eessaar
- Infoturbe õppetool, Chair of Information Security, Prof Ahto Buldas
- Tarkvaratehnika õppetool, Chair of Software Engineering, Prof Kuldar Taveter
- Teadmussüsteemide õppetool, Chair of Knowledge-Based Systems, Prof Jaak Tepandi

2. Instituudi teadus- ja arendustegevuse (edaspidi T&A) iseloomustus

(NB! punktid 2.1- 2.6 täidab struktuuriüksus)

2.1 Struktuuriüksusesse kuuluvad uurimisgrupid *(kõik uurimisgrupid näidatakse aruandes eraldi, järgides alltoodud ülesehitust).*

Uurimisgrupi nimetus (eesti ja inglise keeles) ja juhi nimi

- uurimisgrupi teadustöö kirjeldus *(inglise keeles)*;
- uurimisgrupi aruandeaastal saadud tähtsamad teadustulemused *(inglise keeles)*;
- uurimisgrupi kuni 5 olulisemat publikatsiooni aruandeaastal.

Infosüsteemide uurimisrühm – Research Group of Information Systems (Leader: Mart Roost, Members: Dr Enn Õunapuu, Dr Mati Tombak, Dr Tarmo Veskiõja, Karin Rava, Lea Elmik, Ingrid Pappel, Ingmar Pappel).

- *Description:* The research work by this group is centred on the ongoing research project by the Department of Informatics “Model-based Creation and Management of Evolutionary Information Systems” (SF0140013s10) funded by the Estonian Ministry of Education and Research. The goal of the project is to create a method for developing information systems that evolve in an evolutionary way jointly with businesses by means of constant development. We intend to achieve this goal by investigating and applying collaborative information systems’ development by their users and developers. We take an approach of socio-technical systems that combines five research topics represented at the Department of Informatics: information systems self-development (led by Mart Roost), archetypes-based software engineering (led by Prof Jaak Tepandi, please see also Research Group of Archetypes Based Software Factories for Evolving Systems), data mining (led by Dr Innar Liiv, please see also Industrial Data Mining Laboratory), service-oriented architectures (led by Dr Enn Õunapuu, please see also Laboratory of Web Services and Sensor Networks), and agent-oriented modelling (led by Prof Kuldar Taveter, please see also Laboratory of Socio-Technical Systems).

- Results: The main results were following:
 - The definition of an evolutionary information system was made more precise (publication 1).
 - An approach to social self-development of evolutionary information systems was proposed and described (publication 1).
 - A methodology for the engineering of enterprise business architecture, which supports social self-development of evolutionary information systems, was proposed and described (publication 1).
 - This methodology was used and evaluated in an action research project that was performed in the context of the course “Teamwork in information systems development” taught by the Department of Informatics (publication 1).
 - In the research subarea of theoretical foundations of evolutionary information systems, a pattern matching algorithm for superpositional graphs was designed enabling to count a number of matches with time complexity $O(kn)$, where n is the length of a text and k is the length of a pattern. We proved by means of a test application that every solution of the problem for superpositional graphs is also a solution of the pattern matching problem for the corresponding separable permutations and vice versa. As a consequence, we developed an algorithm for counting matches, working in time $O(kn)$, for the case where the text and the pattern are both separable permutations (publication 2). Superpositional graphs are expressive formalisms for representing business rules and will be used for that in the tool that is being developed for enterprise information systems development within the department’s research project “Model-based Creation and Management of Evolutionary Information Systems” (please see also the description of the Laboratory of Web Services and Sensor Networks further below).

- Publications:
 1. Roost, M., Taveter, K., Rava, K., Tepandi, J., Piho, G., Kuusik, R., Õunapuu, E.: Towards Self-development of Evolutionary Information Systems: An Action Research of Business Architecture Development by Students in Socially Networked Groups. In: Franch, X., Soffer, P. (eds.) Advanced Information Systems Engineering Workshops - CAiSE 2013 International Workshops, Valencia, Spain, June 17-21, 2013, LNBIP, vol. 148, pp. 1--15. Springer, Heidelberg (2013).
 2. Tombak, Mati; Loorits, Neeme; Peder, Ahti; Vohandu, Leo (2013). Pattern Matching for Superpositional Graphs and Separable Permutations.

Arhetüübipõhiste evolutsioneeruvate süsteemide tarkvaratehaste uurimisrühm – Research Group of Archetypes Based Software Factories for Evolving Systems (Leader: Prof Jaak Tepandi, Members: Dr Gunnar Piho, Viljam Puusep, Stanislav Vassiljev, Jekaterina Ivask, Tõnis Pihlakas).

- *Description:* The business environment, including procedures, legislation, and technology, is changing fast. Information systems development must adapt to this change, utilizing software tools and methods for large, complex and data-intensive systems. The Research Group of Archetypes Based Software Factories for Evolving Systems investigates archetypes based techniques for domains, requirements and software, integrated as a software factory, evolving together with the business processes, enhancing the dependability of resulting systems, and using collaborative system development by their users and developers so that dependability requirements are satisfied.

The main scientific goal is to develop, formally specify, and evaluate software development model based on business archetypes and archetype patterns, which enables enterprise subjects to further develop the information system during their everyday activities within their natural working environment. To incorporate integrity, robustness, reliability and resilience into evolving software systems, we use specifications written in a general purpose programming language, query optimization in the integration of segregated data models, as well as enhanced simulation and testing methods.

Domain model specification directly in a general purpose programming language can result in benefits of both increased dependability (due to usage of a specification language) and reduced cost and time (due to lack of transformation from specification to code). Query optimization in the integration of segregated data models focuses on finding and formalizing a set of meta-information sufficient for an efficient coupling of segregated data models, at the same time providing a technical solution for describing and retrieving such meta-information. Development of model-driven testing methods aims to solve the research problem of how the system overall architecture and structure affect system usability. In addition, simulation methods support the modelling and evaluation of dependability of resulting systems.

The aspects of the proposed project are aligned with the research project by the department “Model-based Creation and Management of Evolutionary Information Systems” funded by the Estonian Ministry of Education and Research.

- *Results:* The most important research results in 2013 were further development of the archetypes-based process design methodology and elaborating the enterprise domain model based on the mathematical theory of “P-systems” as a practically usable framework for the development of evolutionary enterprise applications.
- *Publications:*
 1. Piho, G.; Tepandi, J.; Puusep, V. (2013). Towards P Systems based Approach for Evolutionary Enterprise Application. 22nd International Conference on Information Systems Development (ISD2013), September 2-4 2013, Seville, Spain. Springer, 2013.
 2. Roost, M.; Taveter, K.; Rava, K.; Tepandi, J.; Piho, G.; Kuusik, R.; Õunapuu, E. (2013). Towards Self-development of Evolutionary Information Systems: An Action Research of Business Architecture Development by Students in Socially Networked

Groups. In: Advanced Information Systems Engineering Workshops - CAiSE 2013 International Workshops, Valencia, Spain, June 17-21, 2013. Proceedings: CAiSE 2013 International Workshops, Valencia, Spain, June 17-21, 2013. (Eds.) Xavier Franch, Pnina Soffer. Heidelberg: Springer, 2013, (Lecture Notes in Business Information Processing; 148), 1 - 15.

3. Piho, G.; Tepandi, J. (2013). Business Domain Modelling with Business Archetypes and Archetype Patterns. Vojtáš, P.; Kiyoki, Y.; Jaakkola, H.; Tokuda, T.; Yoshida, N. (Eds.). Information Modelling and Knowledge Bases XXIV (221 - 240).IOS Press.
4. Kotkas, Vahur; Haav, Hele-Mai; Tepandi, Jaak; Õunapuu, Enn; Grauberg, Jaanus (2013). Uurimisprojekti "Andmeaitade (teiseste andmekogude) loomise põhimõtete väljatöötamine" lõpparuanne. Tallinn: TTÜ Küberneetika Instituut.

Andmebaaside uurimisrühm – Research Group of Databases (Leader: Dr Erki Eessaar, Members: Rünno Sgirka, Mart Karu).

- *Description:* This informal research group performs research in the following directions.
 1. How to semi-automate the process of achieving good database design and evaluating existing database designs? The results would allow developers to come up with databases with better designs and facilitate the evolution of databases. The focus of the research is on the design of relational databases and SQL databases (not the same thing in our view). Firstly, the implicit knowledge about good and bad/questionable database designs must be made explicit. One can do it by specifying domain independent and domain-specific database design patterns and antipatterns that describe good and bad/questionable design practices, respectively. One can use the patterns and antipatterns as important goodness criteria in case of evaluating existing designs, selecting the best design for a new database, or selecting the best refactoring for an existing database. The patterns can be used as building blocks for specifying database designs and later generating the code (and possibly tests) to implement the designs. It is also possible to search a database schema for possible occurrences of domain-independent database design patterns and antipatterns, based on the system catalogue of the database. Secondly, design decisions depend on the context where the system to be designed will be used. The context determines the relative importance of criteria for selecting the best design. We are interested in how to use the Analytic Hierarchy Process or a similar process in the context of comparing database designs and selecting the best design for a given context.
 2. Specification, formalization, evaluation, and application of the set of practices for the development of data-centric transactional information systems. The practices use data to drive the modelling (including process modelling) of systems. These practices are based on the years of experience of teaching the development of information systems to university students with the focus on database development.
 3. Experiments about using the full power of modern server-based database management systems (DBMS) to implement complex, functionally rich systems based on the architectural principle of a “fat database”. Firstly, server DBMSs are like virtual operating systems that one can deploy on many different platforms and locations. Secondly, DBMSs have many built-in features and extensibility mechanisms

(including powerful query language, semantic query optimization, transaction support, triggers, etc.) that simplify the development and optimization of information systems. More specifically, currently we try to build a metamodelling (meta-CASE) system by following this approach.

- *Results:* In the context of research direction 1, the queries for detecting possible occurrences of SQL database design antipatterns within the conceptual schemas of existing databases were created. The queries are based on the system catalogue of a database but some of them also take into account data in the existing tables of the database. The queries were implemented in PostgreSQL. The queries are based on the standardized information schema views. The queries were evaluated based on a set of databases to find frequencies and reasons of false positive results. In addition, a prototype tool for executing the queries was developed. The tool and the queries can be used in the database programming courses. Students can use both to get quick and continuous feedback about their database designs. Academics can use the tool and the queries to speed up the assessment of student databases. The results were presented at the virtual conferences International Conference on Systems, Computing Sciences and Software Engineering (SCSS 12 and SCSS 13).

In the context of research direction 2, the practices about the architectural envisioning of systems and model-driven analysis of their certain subsystems were explicitly specified. We propose a set of practices rather than a complete methodology or a methodological framework, meaning that one can use the practices completely or partially in the context of different methodologies that follow different software development models (waterfall, iterative) and prescribe different sets of roles, software languages, supporting tools, etc. The results were presented at the 22nd International Conference on Information Systems Development (ISD2013), which was held in Seville, Spain, September 2-4, 2013.

In the context of research direction 3, complete rewriting of the metamodelling system was initiated based on the results of the publication 3. This work is currently conducted by a M.Sc. student. We will extensively use database triggers to implement the main functionality of the system.

- *Publications:* Publications that were mentioned in the previous section will appear in 2014 or later. Below are presented the publications that appeared in 2013. All these papers were presented earlier than 2013. Publications 1 and 2 support the research direction 1. Publications 3 and 4 support the research direction 3.

1. Eessaar, E.; Saal, E. (2013). Evaluation of Different Designs to Represent Missing Information in SQL Databases. In: Innovations and Advances in Computer, Information, Systems Sciences, and Engineering: International Conference on Systems, Computing Sciences and Software Engineering (SCSS 11). (Eds.) Elleithy, K.; Sobh, T. New York: Springer, 2013, (Lecture Notes in Electrical Engineering; 152), 173 - 187.
2. Eessaar, E. (2013). On Using a Semiotic Quality Framework to Evaluate the Quality of Conceptual Database Schemas. In: Emerging Trends in Computing, Informatics, Systems Sciences, and Engineering: International Conference on Systems, Computing Sciences and Software Engineering (SCSS 10). (Eds.) Sobh, T; Elleithy, K.. New York: Springer, 2013, (Lecture Notes in Electrical Engineering; 151), 103 - 115.

3. Eessaar, E.; Sgirka, R. (2013). An Ontological Analysis of Metamodeling Languages. 20th International Conference on Information Systems Development (ISD2011), Edinburgh, Scotland, August 24-26, 2011. (Eds.)Pooley, R.; Coady, J.; Schneider, C.; Linger, H.; Barry, C.; Lang, M. . Springer, 2013, 381 - 392.
4. Sgirka, R.; Eessaar, E. (2013). A Quality Model of Metamodeling Systems. In: Emerging Trends in Computing, Informatics, Systems Sciences, and Engineering: International Conference on Systems, Computing Sciences and Software Engineering (SCSS 10). (Eds.)Sobh, T.; Elleithy, K.. New York: Springer, 2013, (Lecture Notes in Electrical Engineering ; 151), 543 - 555.

Tööstusliku andmekaeve labor – Industrial Data Mining Lab (Leader: Dr Innar Liiv, Members: Prof Rein Kuusik, Dr Ermo Täks, Dr Ants Torim, Grete Lind, Jaan Übi, Anton Vedeshin, Tarvo Treier, Ott Lepik, Natalia Järv)

- *Description:* Industrial Data Mining Lab applies state-of-the-art data analysis, data mining and information visualization methods to problems arising in different sectors of the industry. Main industry partners in 2013 were Mitsubishi Motors Corporation and Mitsubishi Corporation, which are two branches in the group of autonomous Japanese multinational companies belonging to Mitsubishi Group. Separate data mining and information visualization projects are under way with both companies, with intensive cooperation and mobility between Tokyo and Tallinn. Lab is teaching-biased and supervision-biased. For example, it has top results in the supervisions of M.Sc. theses. As the lab's name implies, it is also industry-biased with confidential corporate results. However, we are refocusing on preparing for publishing scientific results from those projects in top scientific conferences and journals in 2014 and 2015.
- *Results:* Main scientific results achieved in 2013 were tools for analysing social networks and data mining developed for industry-related research projects like the ones under way with Mitsubishi. Main goals for 2014 and 2015 entail packaging, documenting and publishing these novel engineering and scientific solutions in scientific conferences and journals.
- *Publications:*
 1. Übi, J.; Liiv, I.; Übi, E.; Võhandu, L. (2013). An analysis of community structure detection for educational coepetition. The 2nd IEEE International Conference on E-Learning and E-Technologies in Education (ICEEE2013), Lodz, Poland, September 23-25, 2013. IEEE, 2013, 104 - 109.
 2. Übi, J.; Übi, E.; Liiv, I.; Võhandu, L. (2013). Predicting student retention by comparing histograms of bootstrapping for Charnes-Cooper transformation-linear programming discriminant analysis. The 2nd IEEE International Conference on E-Learning and E-Technologies in Education (ICEEE2013), Lodz, Poland, September 23-25, 2013. IEEE, 2013, 110 - 114.
 3. Torim, A. (2013). Galois Sub-Hierarchies Used for Use Case Modeling. In Proceedings of CLA 2013, pp.21-32

Arvutilingvistika uurimisrühm – Research Group of Computational Linguistics (Leader: Professor Emeritus Leo Võhandu, Members: Kairit Sirts, Ahti Lohk, Ottokar Tilk, Andre Veski)

- *Description:* The lab is active in the field of multidimensional scaling of large matrixes and tensors. The research group has created and applies a novel unifying method for solving three NP-hard tasks: multidimensional scaling, obtaining minimal crossing number in binary graphs, and graph bandwidth minimising.
- *Results:* Ahti Lohk has created an experimental application for iterative separation and possible correction of problematic areas in the internal structures of large relational systems. The preliminary application works on the basis of WordNet in Estonian and WordNet in English by Princeton University. By means of the experimental application, hundreds of mistakes in huge dictionaries have been corrected in collaboration with the researchers in philology from Tartu University. The results of this work will be presented on the Global WordNet conference that will be held in Tartu, Estonia on 25-29 January in 2014. There are also plans under way of establishing a joint lab between Tallinn University of Technology and Princeton University. The lab would serve dictionaries of the WordNet type developed for different languages. There are currently around 70 of such dictionaries available in the world. Their owners would be the customers of the lab.

Kairit Sirts has achieved interesting results in the area of adaptor grammars substantially extending their applicability for minimally guided morphological segmentation. Here the “AG Select” method is of high importance, where grammars for languages with different structures are generated in an automated fashion from the initial data for the languages, instead of attempting to apply the same grammar for all languages.

Prof Leo Võhandu and Tõnu Tamme from Tartu University have developed a methodology and an application prototype enabling to study the differences between various texts by creating Markov models for the sentence structures of these texts. This methodology is required for finding out about structural similarities and differences between sublanguages of Estonian. The results will be presented on the annual conference of the Estonian Society of Applied Linguistics in April of 2014.

- *Publications:*
 1. Lohk, A.; Tilk, O.; Võhandu, L. (2013). How to create order in large closed subsets of wordnet-type dictionaries. *Eesti Rakenduslingvistika Ühingu Aastaraamat*, 9, 149 - 160.
 2. Lohk, A.; Võhandu, L. (2013). Independent Interactive Testing of Interactive Relational Systems. *Advances in Intelligent Systems and Computing* (15 - 23). Springer.
 3. Übi, J.; Liiv, I.; Übi, E.; Võhandu, L. (2013). An analysis of community structure detection for educational cooperation. *The 2nd IEEE International Conference on E-Learning and E-Technologies in Education (ICEEE2013)*, Lodz, Poland, September 23-25, 2013. IEEE, 2013, 104 - 109.
 4. Übi, J.; Übi, E.; Liiv, I.; Võhandu, L. (2013). Predicting student retention by comparing histograms of bootstrapping for Charnes-Cooper transformation-linear programming discriminant analysis. *The 2nd IEEE International Conference on E-Learning and E-Technologies in Education (ICEEE2013)*, Lodz, Poland, September 23-25, 2013. IEEE, 2013, 110 - 114.

Veebiteenuste ja sensorsüsteemide labor – Laboratory of Web Services and Sensor Networks
(Leader: Dr Enn Õunapuu, Members: Kristo Klesment, Irina Kelder, Viljam Puusep, Einar Polis)

- *Description*: The goal of the laboratory is to develop solutions for the era of IoT (Internet of Things). Main components of these solutions are smart devices, processes, and services. For the students we have developed a course „Internet of Things Solutions: Smart Devices, Processes, and Services“. The focus of the research work is on the area of model driven development of smart solutions in the application domains of smart home, e-billing, power engineering, etc.
- *Results*: In 2013 the following research activities were performed:
 - A study of data warehouses was successfully conducted and a report containing the results (publication 2) was published.
 - Sensor devices imitating smart home was acquired and installed for the lab room ICT-636 and 10 student workplaces were equipped with them for conducting experiments and studies within the course “Internet of Things Solutions: Smart Devices, Processes, and Services”.
 - A tool was further developed for enterprise information systems development targeted at SMEs, where information systems development and evolution occur through developing various models at the business level, such as models of goals and business rules, and organisation model. Different business rules’ engines have been experimented with for increasing the adaptability of the tool. The tool was rooted in the ARCHI tool for describing enterprise architectures and in the Bizagi tool for business process modelling.
 - The tool was applied for conducting the following Mektory projects by student teams:
 - Developing an energy efficiency screen for all buildings managed by the Estonian State Real Estate Ltd.
 - Designing and implementing a web page for the company Icon People.
- *Publications*:
 1. Roost, M.; Taveter, K.; Rava, K.; Tepandi, J.; Piho, G.; Kuusik, R.; Õunapuu, E. Towards Self-development of Evolutionary Information Systems: An Action Research of Business Architecture Development by Students in Socially Networked Groups. Lecture Notes in Business Information Processing 148, Heidelberg Springer, 2013, ISBN 978-3-642-38489-9, pp. 1-15.
 2. Kotkas, Vahur; Haav, Hele-Mai; Tepandi, Jaak; Õunapuu, Enn; Grauberg, Jaanus. Uurimisprojekti "Andmeaitade (teiseste andmekogude) loomise põhimõtete väljatöötamine" lõpparuanne. Tallinn, Küberneetika instituut. 2013. 104 lk.

Sotsiotehniliste süsteemide labor – Laboratory of Socio-Technical Systems (Leader: Prof Kuldar Taveter, Members: Dr Alexander Horst Norta, Inna Shvartsman, Kristi Kirikal, Tanel Tenso, Msury Mahunnah, Andrus Kanarbik).

- *Description*: The lab focuses on software engineering methods for designing systems that support humans in their everyday activities. Such systems include educational (training)

systems, intelligent digital assistants for social networking services, systems for simulating real-world phenomena, and systems for individualised healthcare and smart home and office.

- *Results*: In 2013 the lab has conducted research work on designing socio-technical systems in the following directions:
 - Working out principles of designing active environments for multi-agent systems, where the multi-agent system together with its environment forms a socio-technical system (publication 1).
 - Deciding and designing architectures of socio-technical systems consisting of web services and software agents (publication 2).
 - Working out the methods and tools for model-based designing of adaptive multi-agent systems where new versions of agent interaction protocols are generated from high-level models (publication 3).
 - Applying and elaborating the methodology of agent-oriented modelling for designing organizations consisting of humans and software agents (publication 4).
 - In collaboration with the Research Group of Information Systems, an approach of social self-development of information systems has been proposed and described. According to that concept, an information system is developed in a distributed fashion. This means that users of the information system as developers can tune certain parameters of the information system, determining which information is to be collected and how it is to be processed. Also, each agent (actor) playing some role in an organisation should be able to adapt the instance of the role to the agent's particular needs (publication 5).
 - The following case studies were conducted in 2013:
 - Healthminer: Intelligent digital assistant for promoting healthy lifestyle. The purpose of this research project was to create a proof-of-concept prototype for a software application helping its user to follow a healthy lifestyle in the virtual and real world by giving warnings and recommendations for behavioural changes. The project was ordered by Supikas Ltd. and was conducted as a Mektory team project with M.Sc. students.
 - Phoenix. The Phoenix project was dedicated to developing an interactive cookbook application for tablets and cell phones for digital publishing of recipes and other cooking-related information. Phoenix was a joint project between the Mektory of Tallinn University and Technology and Design Factory of Swinburne University of Technology, Australia, with a customer located in Melbourne, Australia. In the project, a team of TTU M.Sc. and Ph.D. students in ICT was responsible for problem domain analysis, development, data mining, and user experience, while a team of design students from Swinburne University of Technology catered for business analysis and visual design.
 - In 2013 the lab continued participation in the project by the EU 7th Framework “Modelling crisis management for improved action and preparedness” (CRISMA).

Our software engineering method of agent-oriented modelling was used by Prof Kuldar Taveter and PhD student Tanel Tenso in the project for requirements engineering and representing Key Performance Indicators of crisis mitigation.

– Publications:

1. Argente, E.; Boissier, O.; Carrascosa, C.; Fornara, N.; McBurney, P.; Noriega, P.; Ricci, A.; Sabater-Mir, J.; Schumacher, M. I.; Tampitsikas, C.; Taveter, K.; Vizzari, G.; Vouros, G. (2013). The role of the environment in agreement technologies. *Artificial Intelligence Review*, 39(1), 21 - 38.
2. Mahunnah, M.; Taveter, K. (2013). A Scalable Multi-Agent Architecture in Environments with Limited Connectivity: Individualised care for healthy pregnancy. 7th IEEE International Conference on Digital Ecosystems and Technologies (DEST) (84 - 89). IEEE
3. Argente, E.; Billhardt, H.; Cuesta, C.; Esparcia, S.; Görmer, J.; Hermoso, R.; Kirikal, K.; Lujak, M.; Perez-Sotelo, J. S.; Taveter, K. (2013). Adaptive Agent Organisations. S. Ossowski (Eds.). *Agreement Technologies* (321 - 353). Springer
4. Argente, E.; Boissier, O.; Esparcia, S.; Görmer, J.; Kirikal, K.; Taveter, K. (2013). Describing Agent Organisations. S. Ossowski (Eds.). *Agreement Technologies* (253 - 275). Springer.
5. Roost, M.; Taveter, K.; Rava, K.; Tepandi, J.; Piho, G.; Kuusik, R.; Õunapuu, E. (2013). Towards Self-development of Evolutionary Information Systems: An Action Research of Business Architecture Development by Students in Socially Networked Groups. In: *Advanced Information Systems Engineering Workshops - CAiSE 2013 International Workshops, Valencia, Spain, June 17-21, 2013. Proceedings: CAiSE 2013 International Workshops, Valencia, Spain, June 17-21, 2013.* (Eds.) Xavier Franch, Pnina Soffer. Heidelberg: Springer, 2013, (Lecture Notes in Business Information Processing; 148), 1 - 15.

2.2 Loetelu struktuuriüksuse töötajate rahvusvahelistest tunnustustest.

Ei ole.

2.3 Loetelu struktuuriüksuse töötajatest, kes on välisakadeemiate või muude oluliste T&A-ga seotud välisorganisatsioonide liikmed.

1. Enn Õunapuu; Association for Computing Machinery (ACM); Liige
2. Enn Õunapuu; Institute of Electrical and Electronics Engineers (IEEE); Liige
3. Enn Õunapuu; IARIA scientific committee member of the Journal Editorial Board
4. Mart Roost; IFIP WG8.2 Information Systems and Organizations töögrupi liige

2.4 Soovi korral esitatakse aruandeaastal saadud T&A-ga seotud tunnustused (va punktis 2.3 toodud tunnustused), ülevaade teaduskorralduslikust tegevusest, teadlasmobiilsusest ning hinnang oma teadustulemustele.

Teadlasmobiilsus:

1. Ahti Lohk: Stazeerimine Princetoni ülikoolis, USA, 18.09.2012-20.01.2013.
2. Msury Mahunnah: Osalemine ettekandega konverentsil "The 6th International Conference on Health Informatics (HEALTHINF 2013)", Barcelona, Hispaania, 10.02-15.02.2013.
3. Ottokar Tilk: osalemine arvutiteaduse talvekoolis, Palmse, Eesti, 03.03-08.03.2013.
4. Gunnar Piho: osalemine ettekandega konverentsil „The 22nd International Conference on Information Systems Development (ISD2013)”, Sevilla, Hispaania, 01.09-05.09.2013.
5. Erki Eessaar: osalemine ettekandega konverentsil „The 22nd International Conference on Information Systems Development (ISD2013)”, Sevilla, Hispaania, 01.09-05.09.2013
6. Olga Mironova: osalemine ettekandega "The Use of Scratch in Estonia" konverentsil "Scratch - Connecting Worlds", Barcelona, Hispaania, 23.07-28.07.2013.
7. Kersti Antoi: osalemine ettekandega "The Use of Scratch in Estonia" konverentsil "Scratch - Connecting Worlds", Barcelona, Hispaania, 23.07.-28.07.2013.
8. Olga Mironova: osalemine ettekandega "Computer Science E-Courses for Students with Different Learning Styles" konverentsil „Federated Conference on Computer Science and Information Systems (FedCSIS 2013)”, Krakow, Poola, 06.09-11.09.2013.
9. Jaan Übi: osalemine kuulajana konverentsil "Educational Data Mining 2013", Memphis, USA, 04.07-13.07.2013
10. Jaan Übi: osalemine ettekandega lineaarse planeerimise ansamblimeetodi kasutamisest diskriminantanalüüsil konverentsil "Operations Research 2013", Rotterdam, Holland, 02.09-09.09.2013.
11. Ants Torim: osalemine ettekandega "Galois Sub-Hierachies Used for Use Case Modeling" konverentsil "The Tenth International Conference on Concept Lattices and Their Applications (CLA 2013)", La Rochelle, Prantsusmaa, 14.10.-19.10.2013.

12. Rein Kuusik: osalemine kuulajana konverentsil “The Second International Conference on Data Analytics (DATA ANALYTICS 2013)“, Porto, Portugal, 29.09-03.10.2013.
13. Jaan Übi: osalemine ettekandega “Computer Science E-Courses for Students with Different Learning Styles” konverentsil „The 2nd IEEE International Conference on E-Learning and E-Technologies in Education (ICEEE2013)“, Lodz, Poola, 21.09-26.09.2013.
14. Erki Eessaar: osalemine ettekandega virtuaalkonverentsil “The 9th Annual International Joint Conferences on Computer, Information, Systems Sciences, & Engineering”, 12.12-14.12.2013.
15. Alexander Norta: osalemine kuulajana konverentsil „The 11th International Conference on Service Oriented Computing (ICSOC 2013)” ja töötoa „The 1st Workshop on Pervasive Analytical Service Clouds for the Enterprise and Beyond (PASCEB’13)” juhtimine, Berliin, Saksamaa, 01.12-06.12.2013.
16. Deniss Kumlander: osalemine ettekandega virtuaalkonverentsil „International Joint Conferences on Computer, Information and Systems Sciences and Engineering (CISSE 13)“, 12.12-14.12.2013.
17. Olga Mironova: artikli avaldamine konverentsil „2nd International Conference on Education Reform and Management Innovation (ERMI 2013)“, Jeju, Korea, 27.12.-28.12.2013.
18. Pirjo Elbrecht: osalemine ettekandega konverentsil „WCIM2013: World Congress on Industrial Materials -Applications, Products, and Technologies“, Taiwan, Hiina, 01.04-02.04.2013.
19. Pirjo Elbrecht: artikli avaldamine konverentsil „IEEE 17th International Conference on Intelligent Engineering System (INES2013)“, Costa Rica, 19.07-21.07.2013.
20. Pirjo Elbrecht, osalemine ettekandega konverentsil „The 4th International Conference and Exhibition on 3D Body Scanning Technologies“, Long Beach, California, USA, 16.11-22.11.2013.
21. Msury Mahunnah: osalemine ettekandega konverentsil “The 7th IEEE International Conference on Digital Ecosystems and Technologies (IEEE DEST)”, Menlo Park, California, USA, 23.07-27.07.2013.
22. Msury Mahunnah: osalemine ettekandega konverentsil “The 6th International Conference on Health Informatics (ICAART)”, Barcelona, Hispaania, 11.02-14.02.2013.
23. Ahti Lohk: osalemine ettekandega “Independent Interactive Testing of Interactive Relational Systems” konverentsil “International Conference on Man-Machine Interactions (ICMMI 2013)”, Beskids, Poola, 21.10-26.10.2013.
24. Arvo Sulakatko: osalemine ettekandega “Research on Ad Hoc Personal Area Network Application Development Kit” konverentsil “The 2013 2nd International Symposium on Computer, Communication, Control and Automation (3CA 2013)”, Singapur, 29.11.-02.12.2013.
25. Mart Roost: osalemine ettekandega konverentsil „Approaches for Enterprise Engineering Research (AppEER)“, Valencia, Hispaania, 17.06-21.06.2013.
26. Inna Shvartsman: osalemine ettekandega konverentsil „International Workshop on Multi-Agent Systems Technology and Semantics (MASTS 2013)“, Praha, Tsehhi Vabariik, 04.09-07.09.2013.
27. Professor Kuldar Taveter: ühise Mektory-tudengiprojekti lõpetamine Swinburne Tehnoloogiaülikoolis Melbournes koostöös Swinburne Design Factoryga. Mektory tutvustamine

Austraalias ning tutvumine Mektory-laadsete organisatsioonidega Austraalias. TTÜ ja Swinburne Tehnoloogiaülikooli koostöö arendamine. Melbourne, Austraalia, 23.05-05.06.2013.

28. Dotsent Innar Liiv ning doktorandid Rain Öpik ja Ago Luberg: osalemine TTÜ innovatsiooni –ja ettevõtluskeskuse visiidil Jaapanisse koos TTÜ innovatsiooni- ja ettevõtluskeskuse direktori Tea Varrakuga, MKMi asekanstler Taavi Kotkaga, EASi rahvusvahelistumise divisjoni direktori Kristi Tiivasega, välisinvesteeringute projektijuhti Tanel Kõrveliga ja EAS-i Jaapani esindaja Kosaku Yamaguchiga, 03-11.05.2013.

Hinnang

- 1) Instituudi nõukogu koondhinnang aruandlusperioodi teadus- ja arendustööle on „väga hea“ (4). Püstitatud ülesanded on valdavalt täidetud, koos Automaatikainstituudiga jätkub osalemine EL-i 7. Raamprogrammi projektis „Kriisihalduse modelleerimine tegevuste ja valmisoleku parandamiseks“ (CRISMA).
- 2) Võrreldes eelmise aruandlusperioodiga on teadusaktiivsus ja tulemused temaatiliselt edasi arenenud, tõsist analüüsi ja arendamist leidis sihtfinantseeritav teadusteema T013. Finantseerimise maht on kasvanud, seda eelkõige välislepingute kasvu arvelt. Samas ei kajasta käesolev aruanne täielikult meie töötajate teadus-arendustegevust, sest et nad osalevad ka välistes teadusprojektides (näiteks Prof Ahto Buldas osaleb Küberneetika instituudi ETF grantides ja AS Cybernetica projektides, mis pole registreeritud meie teadusteemadena, mitmed meie töötajad ja doktorandid on osalenud MEKTORY projektides (E. Õunapuu, I. Liiv, J. Ivask, N. Järv, K. Klesment, A. Sulakatko jt).

Rahalises väljenduses on viimase kuue aasta dünaamika järgmine:

	2008 (EEK)	2009 (EEK)	2010 (EEK/EUR)	2011	2012	2013
Põhiteema	-	-	1 508 900/96400	92700	82400	82400
Baas- finantseerimine	1 230 000	1 425 600	-	-	-	-
ETF grantid	140 000	168 000	-	-	-	-
Välisprojektid	-	-	-	-	21576	40000
Lepingud	32400	300 800	347 400/22203	14345	9000	5300
Individuaalsed toetused	386 310	Andmed puuduvad	Andmed puuduvad	9921	11383	50200
Õppearendus- tegevuse projektid	140 030	35 000	63 000/4026	50600	40500	34000
Kokku	1 928 740	1929400	1919300/122165	162866	164859	211900

- 3) Publitseerimise seisukohalt tuleb aastat lugeda heaks – 30 rahvusvahelist kõrgtaseme (kategooria 1.1 kuni 3.1) artiklit olukorras, kus neid lisaks põhikohaga teaduritele toodavad regulaarselt ka teaduskohustuslikud õppejõud, on hea tulemus (keskmiselt 1,2 artiklit iga teaduskohustusliku õppejõu ja teaduri kohta). Artiklite tootmise protsess on stabiliseerunud ja arvestades suurt õppetöö koormust on raske paremat nõuda. Samas on olemas veel kasutamata reserve suurema rühma kaasautorite ühisartiklite ja doktorantide aktiivsema tegutsemise näol.
- 4) Kaitsti üks, Prof Rein Kuusiku poolt juhendatud doktoritöö (Ermo Täks). Kaitsmiste arv on küll väiksem planeeritud, aga juba 2014. aastal on oodata 4 kaitsmist (Ingrid Pappel, Einar Polis, Jaan Übi, Inna Shvartsman).
- 5) Instituudi juurde kuuluva mitteformaalse struktuurina töötab „Tööstusliku andmekaeve labor“ (juht dots. Innar Liiv), mille raames teostati MEKTORY teine projekt Mitsubishi korporatsiooniga. Lisaks teeb labor koostööd Georgia Ülikooliga ja Salisbury Ülikooliga USA-s ning Università degli Studi di Veronaga Itaalias.
- 6) Instituudi juurde kuuluva mitteformaalse struktuurina töötab „Sotsiotehniliste süsteemide labor“ (juht Prof Kuldar Taveter), mille raames jätkati edukalt EL-i 7. Raamprogrammi projekti „Kriisihalduse modelleerimine tegevuste ja valmisoleku parandamiseks“ (CRISMA). Lisaks teeb labor koostööd Swinburne Tehnikaülikooliga Austraalias, Lõuna Carolina Ülikooliga USA-s ning Lääne-Sveitsi Rakendusteaduste Ülikooliga Sierres (HES-SO).
- 7) Instituudi juurde kuuluva mitteformaalse struktuurina on käivitatud „Veebiteenuste ja sensorvõrkude labor“ (juht vanemteadur Enn Õunapuu). IT Akadeemia abiga sisustati selle õppelabor vajalike sensorseadmete ja makettidega ja töötati välja uus õppeaine „IDU0310 Asjade interneti lahendused: targad seadmed, protsessid ja teenused“.
- 8) Koos Automaatikainstituudiga jätkati osalemist EL-i 7. Raamprogrammi projektis „Kriisihalduse modelleerimine tegevuste ja valmisoleku parandamiseks“ (CRISMA). Edukalt lõppes valikkursuse „Rakenduste loomise ja programmeerimise alused“ loomine Haridus- ja Teadusministeeriumi projekti ”Loodus- ja täppisteaduste ning tehnoloogia (LTT) valdkonna gümnaasiumi valikkursuste õppekomplektid“ raames.
- 9) Vastavalt sihtfinantseeritava teadusteema projektiplaanile jätkati 2013. aastal infosüsteemide evolutsioonilise arendamise ühtse metodoloogia põhjal mudelitest tarkvara genereeriva süsteemi arendamisega. Seda käsitleb rida teaduspublikatsioone. Sihtfinantseeritav projekti raames jätkus mooduli realiseerimine, mis toob ärireeglid äriprotsessi mudelist välja. Loodavas prototüübis võtab protsessi mudel reeglitega ühendust läbi veebiteenuse. Niisugune lahendus toetab hästi evolutsioneeruvust, sest võimaldab otsustuste aluseks olevate ärireeglite muutmist sõltumata vastavast äriprotsessist. Käeoleval aastal on teadus- ja arendustegevuse üheks põhieesmärgiks prototüüpimise lõpuleviimine ja rakendamine. Kõnealusel sihtfinantseeritavas teadusprojektis on andmekaeve töörühm dots. Innar Liivi juhtimisel arendanud erinevaid struktuursete mustrite kaevandamise algoritme, kus mustrid koosnevad infosüsteemi logides registreeritud sündmustest. Meie poolt arendatud mustrite avastamise algoritmide tõhusust katsetasime Mitshubishi teise projektiga äriprotsesside kaevandamisel. Evolutsioneeruvuse teoreetiliste aluste töörühm (juht vanemteadur Mati Tombak) jätkas superpositsiooniliste graafide uurimist mis on ekspressiivsed formalismid ärireeglite esitamiseks. Jätkasime EL-i projektiga CRISMA, kus mh uurime evolutsioneeruvust projektis loodavas kriiside simulatsiooni infosüsteemis.

10) Jätkuvalt toimuvad sihtfinantseeritava teadusprojekti teemalised regulaarsed töögruppide aruandeseminarid ja iganädalased instituudi siseseminarid. Arvestades nende juurde 2 iganädalast doktoriseminari, toimub instituudis pea igal nädalal 4 teadusseminari. Stabiilseks peab muutuma nelja doktoritöö kaitsmine aastas, ka ootaks juba kaitsnud doktorite läbimurret rahvusvahelisele tuntusele oma teadustöös (Innar Liiv, Ermo Täks, Ants Torim). Instituudi akadeemiline personal on suhteliselt noor (keskmine vanus 45 aastat), mitmed pensioniikka jõudnud õppejõud (3 inimest) lahkusid töölt. Plaanime taotleda ja oleme alustanud institutsionaalse uurimistoetuse (IUT) kirjutamist 2014. aasta taotlusvooru. Lähtudes viie aasta noorte doktorite vajadusest on endiselt oluline teaduspersonali ja õppejõudude järelkasvu tagamine.