

Laboratory for Cognitive Modeling

Head: Professor Dr. Igor Kononenko

Fax: (+386 1) 426 4647

Phone: (+386 1) 47 68 + ext.

WWW: lkm.fri.uni-lj.si

Staff	E-mail	Ext:
Professor Dr. Igor Kononenko	igor.kononenko@fri.uni-lj.si	390
Assistant Professor Dr. Matjaz Kukar	matjaz.kukar@fri.uni-lj.si	914
Assistant Professor Dr. Marko Robnik Šikonja	marko.robnik@fri.uni-lj.si	188
Assistant Dr. Zoran Bosnić	zoran.bosnic@fri.uni-lj.si	459
Research Assistant Dr. Luka Šajn	luka.sajn@fri.uni-lj.si	
Junior Researcher Erik Štrumbelj. B.Sc.	erik.strumbelj@fri.uni-lj.si	459

Research Activities

Laboratory for Cognitive Modeling (LKM) was officially founded in 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, and new approaches to building, evaluation and explanation of models, derived from data. Recent research is related to development of methods for evaluating the utility of ordinal attributes, for evaluating the reliability of single models' predictions in classification and regression, for evaluating the reliability of clustering, for explaining single predictions by arbitrary classification or regression model, and for efficient parametrization of images using a subset of possible image resolutions. 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, and studies of consciousness.

Research Projects

Reliable and Comprehensible Machine Learning Approaches with Applications to Medical Diagnostics and Bioinformatics. Bilateral project funded by Slovenian and Greek Ministry of science (2005-2007).

Machine Learning of Probabilities with Applications to Web Portals and Medical Diagnostics (BI-PT/06-07-004).
Bilateral project funded by Slovenian and Portuguese Ministry of science (2006-2007).

Artificial intelligence and intelligent systems (P2-0209). Research Program funded by Slovenian Research Agency (2004-2008).

Laboratory Guests

- Pedro Pereira Rodrigues and Cláudia Camila Dias, University of Porto, Portugal, 5. 10. - 13. 10. 2007, work on joint project Machine Learning of Probabilities with Applications to Web Portals and Medical Diagnostics.

- Raul Fidalgo Merino, University of Málaga, Spain, 20. 08. – 21. 11. 2007, research collaboration on Artificial intelligence and intelligent systems.

- Aristidis Likas, University of Ioannina, 5. - 9. 9. 2007, work on joint project: Reliable and Comprehensible Machine Learning Approaches with Applications to Medical Diagnostics and Bioinformatics.

- Jose del Campo Avilla, University of Malaga, 5. - 12. 9. 2007. Research collaboration on Artificial intelligence and intelligent systems.

Research Visits

- Matjaž Kukar and Zoran Bosnić, University of Porto, Portugal, 24. 09. - 28. 09. 2007, work on joint project Machine Learning of Probabilities with Applications to Web Portals and Medical Diagnostics.

- Marko Robnik Šikonja and Zoran Bosnić, University of Ioannina, Greece, 12. 3. – 16. 3. 2007, work on joint project Reliable and Comprehensible Machine Learning Approaches with Applications to Medical Diagnostics and Bioinformatics.

Invited Talks and Lectures

M. Kukar: Multi-resolution image parametrization in stepwise diagnostics of Coronary Artery Disease: some results and open problems, invited talk at University of Porto, 27. 9. 2007

I. Kononenko: Objective science and subjective spirituality are complementary. Invited lecture. In: I. Kononenko (ed.). *Proceedings of measuring energy fields : international scientific conference, Kamnik, Tunjice, 13-14 October 2007*. Kamnik: Zavod Zdravilni gaj, 2007, pp. 117-124.

Selected Publications

I. Kononenko, M. Kukar: Machine Learning and Data Mining: Introduction to Principles and Algorithms, Horwood publ.,

2007 (454 pages).

I.Kononenko, M. Robnik-Šikonja: Non-myopic feature quality evaluation with (R)ReliefF. In: LIU, H., MOTODA, H.(Eds.). *Computational methods of feature selection..* Boca Raton; London; New York: Chapman & Hall/CRC, 2008, pp. 169-191

Luka Šajn, Igor Kononenko, Metka Milčinski: Computerized segmentation and diagnostics of whole-body bone scintigrams. *Comput. med. imaging graph..* 2007, vol. 31, no. 7, pp. 531-541

M. Robnik-Šikonja, K. Vanhoof: Evaluation of ordinal attributes at value level. *Data Mining and Knowledge Discovery*, 14:225-243, 2007.

M. Bevk, I.Kononenko: Towards symbolic mining of images with association rules: Preliminary results on textures. *Intelligent Data Analysis*, 10(4)379-393, 2006.

M. Kukar. Quality assessment of individual classifications in machine learning and data mining. *Knowledge and information systems*, 2006, vol. 9, no. 3, pages 364-384.

M. Kukar., C. Grošelj. Transductive machine learning for reliable medical diagnostics. *J. med. syst.*, 2005, vol. 29, no. 1, pages 13-32.

M. Robnik-Šikonja, I. Kononenko. Reliable feature evaluation in classification and regression. V: LIU, John X. (ur.). *Control and Learning in Robotic Systems*. New York: Nova Science Publishers, cop. 2005, str. 281-319

L. Šajn, M. Kukar, I. Kononenko, M. Milcinski. Computerized segmentation of whole-body bone scintigrams and its use in automated diagnostics. *Comput. Methods and Programs in Biomedicine*, 80(1)47-55, 2005.

I. Kononenko, I. Jerman (eds.). *Mind-body studies : proceedings of 6th International Conference on Cognitive Science*, Ljubljana, 13-17th October 2003. Ljubljana: Institut "Josef Stefan" (190 pages).

M. Kukar. Transductive reliability estimation for medical diagnosis. *Artificial Intelligence in Medicine*, 29:81-106, 2003.

M. Robnik-Šikonja, D. Cukjati, I. Kononenko. Comprehensible evaluation of prognostic factors and prediction of wound healing. *Artificial Intelligence in Medicine*, 29: 25-38, 2003.

M. Robnik-Šikonja, I. Kononenko. Theoretical and Empirical Analysis of ReliefF and RReliefF, *Machine Learning Journal*, 53: 23-69, 2003.

D. Cukjati, M. Robnik-Šikonja, S. Reberšek, I. Kononenko, D. Miklavčič. Prognostic factors, prediction of chronic wound healing and electrical stimulation. *Medical & Biological Engineering & Computing*, 39:542-550, 2001.

I. Kononenko: Machine learning for medical diagnosis: History, state of the art and perspective, Invited paper, Artificial Intelligence in Medicine – ISSN 0933-3657, 23(1):89–109, 2001.

Figure captions:

LKM-1.JPG : The book by two members of LKM was published by Hoorwood and represents the appreciation of our research work.

LKM-2.JPG : We collaborate with several Universities and Institutes from Greece, Portugal, Switzerland, Russia and Belgium.