# 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. Matjaž Kukar** | matjaz.kukar@fri.uni-lj.si | 914 |
| Assistant Professor **Dr. Marko Robnik Šikonja** | marko.robnik@fri.uni-lj.si | 188 |
| Assistant Professor **Dr. Zoran Bosnić** | zoran.bosnic@fri.uni-lj.si | 459 |
| Assistant **Petar Vračar, M.Sc.** | petar.vracar@fri.uni-lj.si | 459 |
| Junior Researcher **Erik Štrumbelj, B.Sc.** | erik.strumbelj@fri.uni-lj.si | 459 |
| Junior Researcher **Darko Pevec, B.Sc.** | darko.pevec@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

- Artificial intelligence and intelligent systems Research Programme (P2-0209), 2009−2014

- Prediction of betting tips from users' bets selections, research project funded by Intension d.o.o., Maribor, (2008-2009)

- Electricity load forecasting supported by prediction explanation and prediction reliability estimates, Bilateral Collaboration Project (Slovenia-Portugal), 2010-2011.

- Integration of data mining and high-performance computer modeling for coronary artery disease, Bilateral Collaboration Project (SI-SR/10-11-020), 2010 – 2011.

- Machine Learning of Imbalanced Data, Bilateral Collaboration Project (Slovenia-Czech Republic), 2010−2011.

## Laboratory Guests

- Prof. dr. Petr Savicky, University of Prague, 11. 9. 2009 - 17. 9. 2009 and 10. 12. 2009 - 18.12.2009, research collaboration on Artificial intelligence and intelligent systems.

## Invited Talks and Lectures

Zoran Bosnić: Estimation of individual prediction reliability using sensitivity analysis of regression models. Invited lecture. In: M. Bohanec et al. (eds). Proceedings 12th International Multi-conference Information Society - IS 2009, 12.-16. oktober 2009, volume A, Ljubljana: Institut Jožef Stefan, p. 7-10.

## Selected Publications

I. Kononenko, M. Kukar: *Machine Learning and Data Mining: Introduction to Principles and Algorithms*, Horwood publ., 2007 (454 pages).

E.Štrumbelj, I.Kononenko: An efficient explanation of individual classifications using game theory. *J. Mach. Learn. Res.* 2010, 11[1]:1-18

E. Štrumbelj, I. Kononenko, M. Robnik Šikonja. Explaining instance classifications with interactions of subsets of feature values. *Data & Knowledge Engineering,* 68(10):886-904, 2009.

I.Kononenko. Natural and Machine Learning, Intelligence and Consciousness, In: E. Žerovnik et al. (eds.) *Philosophical Insights about Modern Science,* NY: Nova Science publ., 239-258, 2009.

M. Robnik-Šikonja, I. Kononenko: Explaining classifications for individual instances. *IEEE Trans. Knowl. Data Eng.*, 2008, 20:589-600.

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

P. Savicky, M. Robnik Šikonja. Learning random numbers: a MATLAB anomaly, *Applied artificial intelligence,* 22(3):254-265, 2008.

Z. Bosnić and I. Kononenko. Comparison of approaches for estimating reliability of individual regression predictions. *Data & Knowledge Engineering* , 67 (3)504-516, 2008,

L. Šajn, I. Kononenko: Multiresolution image parametrization for improving texture classification. *EURASIP J. Adv. Signal Process*, 2008, pp. 1-12.

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

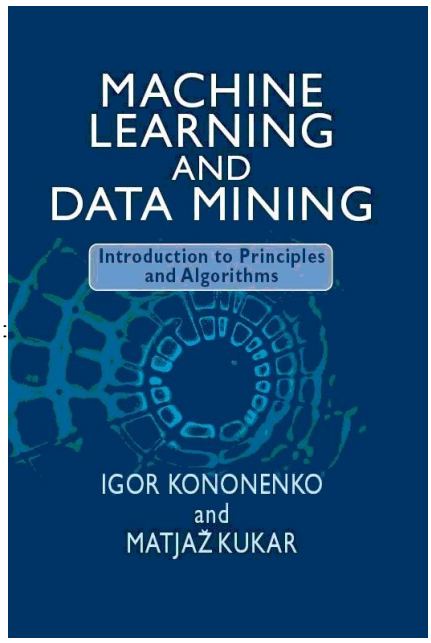
Z. Bosnić, I. Kononenko: Estimation of individual prediction reliability using the local sensitivity analysis. *Appl. Intell.*, 2007, 29(3)187-203

L. Šajn, I. Kononenko, M. Milčinski: Computerized segmentation and diagnostics of whole-body bone scintigrams. *Comput. med. imaging graph.*. 2007, 31( 7) 531-541.

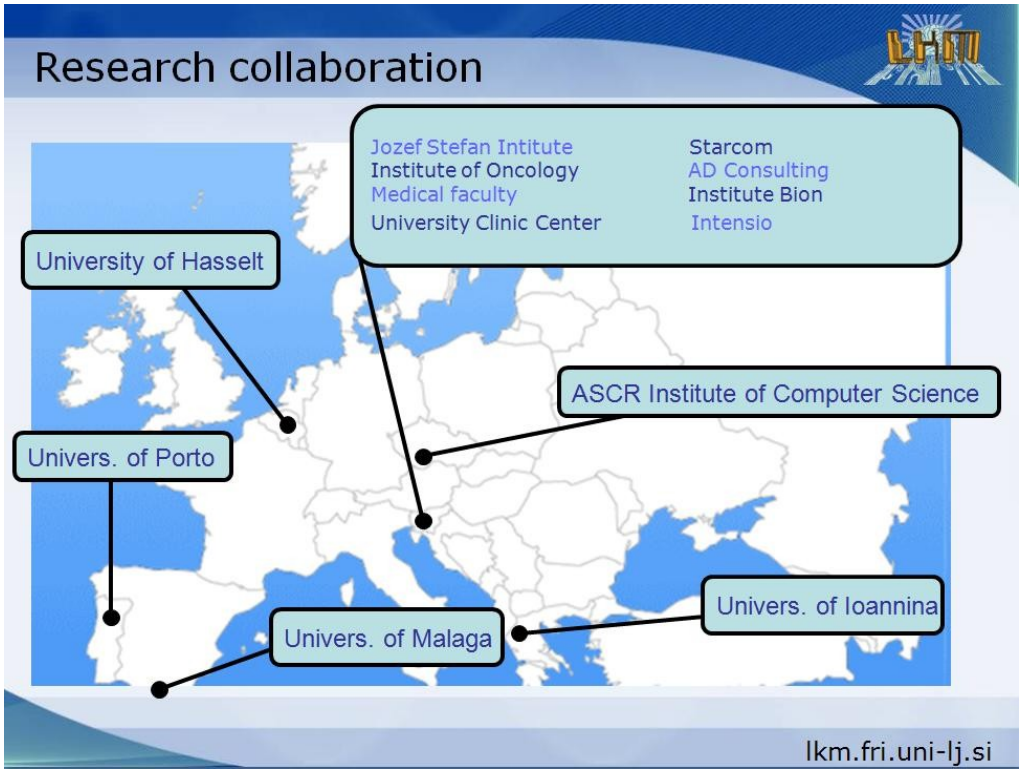
M. Bevk, I.Kononenko: Towards symbolic mining of images with association rules: Preliminary results on textures. *Intelligent Data Analysis*, 10(4)379-393, 2006.

M. Kukar. Quality assessment of individual classifications in machine learning and data mining. *Knowledge and information systems*, 2006, 9(3) 364-384.

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




The book by two members of LKM was published by Horwood and represents the appreciation of our research work.




We collaborate with several Universities and Institutes from Greece, Portugal, Spain, Czech Republic and Belgium.