Laboratory for Cognitive Modeling

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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

- Machine Learning of Probabilities with Applications to Web Portals and Medical Diagnostics, Bilateral Collaboration Project (BI-PT/06-07-004), 2006−2008

- Prediction of Betting Tips from Users' Bets Selections, Research project funded by Intension d.o.o., Maribor, (2008-2009)

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

Laboratory Guests

- Prof. dr. Petr Savitsky, University of Prague, 19. - 26. November 2008, research collaboration on Artificial intelligence and intelligent systems.

Research Visits

- Marko Robnik Šikonja: University of Hasselt, Belgium, 17. August – 30. September 2008. Research cooperation on new method for analysis of ordered data in marketing.

Invited Talks and Lectures

I. Kononenko: Scientific and holistic medicine are complementary: the same is true for scientific and holistic medicine. In: Proc. *ICHM 2008*, Kottayam: Institute for Holistic Medical Sciences Chathukulam Buildings Parumbaikadu, 2008, pp. 1-11.

Selected Publications

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

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

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. 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, 9(3) 364-384.

M. Kukar., C. Grošelj. Transductive machine learning for reliable medical diagnostics. J. med. syst., 2005, 29(1)13-32.

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

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. 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.

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

Figure captions:

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

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