



INVESTMENTS IN EDUCATION DEVELOPMENT

## Scientific stay

NRU HSE, Moscow, Russia

Jan Outrata

Feb 5, 2012 - Feb 18, 2012

# Place

- National Research University, Higher School of Economics (NRU HSE), Moscow, Russia – 1992 (HSE)/2009 (NRU), 16 000 students, 24 faculties and schools, 26 buildings, income 11 bil. RUB
- Department of Data Analysis and Artificial Intelligence (DAAI), School of Applied Mathematics and Information Science, Faculty of Business Informatics



Figure: Entrance hall of building of DAAI at NRU HSE

# Place

- National Research University, Higher School of Economics (NRU HSE), Moscow, Russia – 1992 (HSE)/2009 (NRU), 16 000 students, 24 faculties and schools, 26 buildings, income 11 bil. RUB
- Department of Data Analysis and Artificial Intelligence (DAAI), School of Applied Mathematics and Information Science, Faculty of Business Informatics
- research areas: modelling socio-economic, political and organizational processes and development of mathematical models for decision-making
- formal concept analysis (FCA) a relative areas: FCA algorithms (Kuznetsov's CBO and S. A. Obiedkov's AddIntent, which belong to the most efficient of its kind), utilizing FCA in machine learning and data mining
- at present 15 people (from that 4 professors and 2 associate professors) and 5 PhD students (1 under supervision also from other university)
- research is funded mostly at local university level from the state and partially also from industry



- + co-workers (S. A. Obiedkov, B. Mirkin) and PhD students (M. Babin, D. Ignatov) at the department
- research: FCA itself (FCA algorithms and complexity of problems in FCA) and utilization of FCA in data mining (biclustering, pattern structures) and machine learning/artificial intelligence (decision-making, rough sets) – fundamental results
- grants and projects are funded mostly from national sources, partially also from industry
- collaboration with people at UP in Olomouc, TU Dresden (B. Ganter), UBP Clermont-Ferrand (L. Nourine), University of London, University of Portugal and research team of LORIA Nancy in France

# Stay run

- consultations of algorithms for computing formal concepts developed at Dept. Computer Science, Palacky University (FCbO algorithm, which improves Kuznetsov's CbO algorithm, and new algorithm which uses attribute sorting) and at their department (Obiedkov's AddIntent algorithm)
- questions of complexity of the algorithms, possible improvements and implementation issues for increasing the performance
- experimental comparison of performance of algorithms, negotiated in the beginning of stay, did not come true – within the fairness of the comparison (i.e. solving the same task) the FCbO algorithm would require major modifications → given the implementation of AddIntent by Obiedkov for our own comparison (implementation of FCbO is available for download on internet)
- discussion of possibilities of utilizing Boolean Factor Analysis (BFA) in their research in the area of recommendation systems using FCA
- consultation of research of methods of lattice drawing with A. Neznanov (co-worker)

# Talks

- 1 Inducing decision trees via concept lattices
  - for master study students within the lecture of prof. Kuznetsov
- 2 Formal concepts as attributes for machine learning
  - on scientific seminar “Mathematical Models of Information Technologies” (<http://ami.hse.ru/en/seminars>)
- 3 Fast factorization by similarity in FCA of data with fuzzy attributes
  - on scientific seminar “Mathematical Models of Information Technologies” (<http://ami.hse.ru/en/seminars>)

# Contacts

- strengthening and deepening of scientific collaboration with the group of prof. Kuznetsov: S. A. Obiedkov, B. Mirkin, M. Babin, D. Ignatov, A. Neznanov and other
- discussing current research on shared topics (algorithms) and setting up new topics for further collaboration (lattice drawing)

# Conclusion

- the stay significantly fulfilled its purpose
- strengthening of scientific collaboration with one of the most significant centers in the area of formal concept analysis (FCA) and relative areas (machine learning)
- given three talks, for master study students and on scientific seminar



**Figure:** Fotos from scientific seminar, on left foto prof. Kuznetsov (on the left) and dr. Outrata (on the right), on right foto dr. Outrata after talks.