

Symposium on Machine Learning and Computational Creativity

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ML & CC, Ljubljana, 4 July 2013

ML & CC Symposium - Why

- Successful research and international collaborations of the Department of Knowledge Technologies:
10 years of KT department at JSI
- New Machine Learning book:
Foundations of Rule Learning, Springer 2012
- New research field:
Computational Creativity

Department of Knowledge Technologies

- **Staff:** 30 researchers, 10 students
- **Main research areas**
 - Data Mining and Machine Learning
 - Text Mining and Human Language Technologies
 - Web Services and Workflows
 - Ontologies and Knowledge Management
 - Decision Support Systems
- **Applications**
 - Medicine, Bioinformatics, Public Health
 - Ecology, Finance, ...

Department of Knowledge Technologies

- Numerous monographs, edited books and conference proceedings
- KT department book exposition in the JSI entrance hall

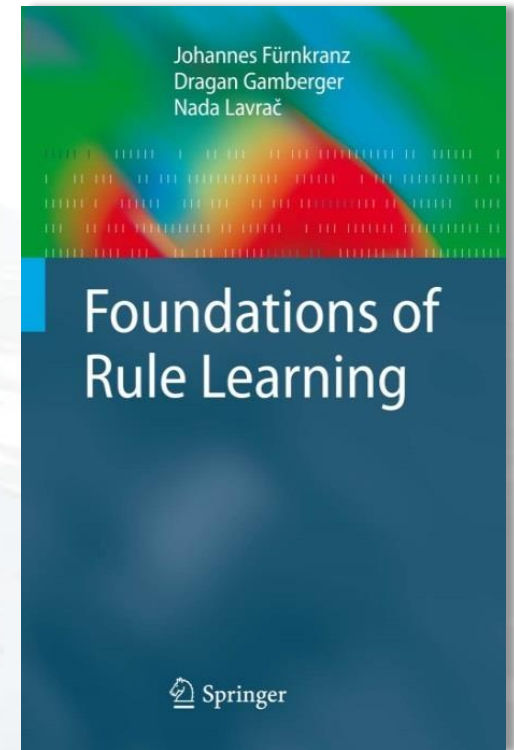


- **Scientific monograph**

FOUNDATIONS OF RULE LEARNING

by **J. Fuernkranz, D. Gamberger, N. Lavrač**

334 pages, Springer, 2012



International collaboration and funding

| Responsible | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|----------------------------|------|------|------|--------------------------------------|------|------|------|------|------|
| Miha Grčar Nada Lavrač | | | | 7.OP FIRST - STREP 720 k 20,5 100 | 275 | 325 | | | |
| Igor Mozetič | | | | MUMIA - COST 2,5 | 2,5 | 2,5 | 2,5 | | |
| Tomaž Erjavec | | | | NETWORKS - ESF 1,5 | | 1,5 | 1,5 | | |
| Igor Mozetič Miha Grčar | | | | 7.OP FOC II - FET 0 | 37 | 117 | 29,3 | | |
| Sašo Džeroski | | | | 7.OP REWIRE - STREP 285 k 2 | 52 | 140 | 91 | | |
| Sašo Džeroski | | | | 7.OP SUMO - STREP 292 k 4 | 117 | 160 | 11,2 | | |
| Marko Debeljak | | | | EVADIFF - TR 75 | | 69 | 97,8 | | |
| Lavrač Nada | | | | 7.OP MUSE - STREP 354 k 21 | | 104 | 158 | 71 | |
| Lavrač Nada | | | | 7.OP PROSECCO - CSA 100 k 11,3 | | 17 | 15 | 56,7 | |
| Lavrač Nada | | | | 7.OP CONCRETE - STRE 396 k 10 | | 132 | 132 | 122 | |
| Lavrač Nada | | | | 7.OP WHIM - STREP 361 k 10 | | 120 | 120 | 111 | |
| Igor Mozetič | | | | 7.OP MULTIPLEX - STR 285 k 10 | | 110 | 115 | 50 | |
| Igor Mozetič | | | | 7.OP SIMPOL - STREP 360 k 5 | | 135 | 145 | 75 | |
| Marko Bohanec | | | | 7.OP DECATHLON - STR 80 k 0 | | 48 | 27 | 5 | |

Computational Creativity Projects

- **MUSE – Machine Understanding for Interactive Storytelling (2012-2015)**
 - Bringing “text-to-life” by text processing and 3D interactive storytelling, rendering natural language text as virtual 3D worlds in which the user can explore the text through interaction, reenactment and guided game playing.

MUSE

Patient Guidelines

On completion of the preparatory phase, the multidisciplinary team makes one of three decisions:

- 1 The operation can go ahead. The team will then give you more information on the operative technique chosen, if you have decided to have the operation, you will be given an operation date and a request for your health insurance fund to agree to help with the operation costs (to find out more www.ameli.fr).
- 2 Your preparation for the operation is not sufficient. You will have to undertake additional preparations. On completion of these, the multidisciplinary team will re-examine your request and make a new decision.
- 3 Surgery is not suitable in your case. The multidisciplinary team will explain the reasons why and offer you another treatment (non-surgical).

NLP Analysis

Connexor Analysis



Feature Structures Extraction

```
(:MAIN "re-examine"
  ((:OBJ "decision"
    (:ATTR "new"))
   (:OBJ "request"
    (:ATTR "you"))
   (:SUBJ "team"
    (:ATTR
      "multidisciplinary"))
    ("completion"))))
```

Plan-based Narrative Engine

Narrative Actions



World State

```
... (...) (can-provide-info drnicholson anaesthesia) (...)
(can-provide-info drdowell digestive-surgery) (...) (can-provide-info drrichards nutrition)
(...) (at-location mrroberts reception) (at-location drsmith or-room) (...)
(at-location msjones patient-room) (...) ...
```

update

staging



3D Visualization (Unreal® Engine - UDK)

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- **MUSE – Potential impact**
 - Education
 - Medicine
 - Airports, ...
 - Game industry

Computational Creativity - What

- Computational creativity (also known as artificial creativity, mechanical creativity or creative computation) is a multidisciplinary research area at the intersection of artificial intelligence, cognitive psychology, philosophy, and the arts.
- The goal of computational creativity is to model, simulate or replicate creativity using a computer, exhibiting behavior which would be considered creative if performed by a human.

Computational Creativity - What

- Specific goals are to be achieved:
 - to construct a program or computer capable of human-level creativity
 - to better understand human creativity and to formulate an algorithmic perspective on creative behavior in humans
 - to design programs that can enhance human creativity without necessarily being creative themselves

Computational Creativity - What

- **Computational creativity subareas:**
 - Creating narratives, stories, metaphors, analogies, jokes, neologisms, poetry, music, visual arts artefacts
 - Creative problem solving – e.g. creative knowledge discovery – the research focus of KT department
 - Bisociative literature mining for cross-domain `knowledge discovery (RaJoLink, CrossBee, TopicCircle, outlier document detection, b-term and b-document detection
 - ... presentation by **Tanja Urbančič**
 - Construction of CC workflows in ClowdFlows

Computational Creativity Projects

- **PROSECCO - Promoting the Scientific Exploration of Computational Creativity (2013-2016)**
 - Coordination and support action, coordinated by **Tony Veale**
- **ConCreTe – Concept Creation Technology (2013-2016)**
 - STREP, coordinated by Geraint Wiggins
- **WHIM – The What-If Machine (2013-2016)**
 - STREP, coordinated by **Simon Colton**

ML & CC Symposium Programme

9:00-9:30

Coffee and Gathering

9:30-9:50

Opening address by Prof. Nada Lavrač

Part I:

Foundations of Rule Learning

(Moderated by Dr. Tomislav Šmuc, Rudjer Bošković Institute)

9:50-10:30

Prof. Johannes Fürnkranz, TU Darmstadt, Germany

Introduction to rule learning

Keywords: Separate-and-conquer rule learning, covering strategy, rule learning heuristics, coverage space, pruning of rules

10:30-11:10

Prof. Nada Lavrač, Jožef Stefan Institute, Slovenia

Advances in subgroup discovery for biomedical research

Keywords: Subgroup discovery, semantic data mining, biomedical applications

11:10-11:50

Dr. Dragan Gamberger, Rudjer Bošković Institute, Croatia

Descriptive modeling in social sciences

Keywords: Features as rule building blocks, data preparation, banking crises domain, risk modeling

11:50-12:00

Discussion

12:00-13:00

Lunch and Informal Discussion

13:00-13:10

Welcome by Prof. Jadran Lenarčič, director of JSI

Part II:

Computational Creativity

(Moderated by Dr. Bojan Cestnik, Temida/Jožef Stefan Institute)

13:10-13:50

Prof. Tony Veale, University College Dublin, Ireland

Computational Creativity: Past, Present and Prosecco

Keywords: The Creative Web, Creativity as a Web-Service, Metaphor, Blending, Divergent Categorization

13:50-14:30

Prof. Hannu Toivonen, University of Helsinki, Finland

Sleep Musicalization

Keywords: data analysis, sleep analysis, computational creativity, emotional data analysis

14:30-15:10

Prof. Tanja Urbančič, University of Nova Gorica, Slovenia

Finding Seeds of Future Discoveries in Current Literature

Keywords: Knowledge discovery, literature mining, biomedical applications

15:10-15:50

Prof. Simon Colton, Goldsmith University London, UK

Towards the What-If Machine

Keywords: Computational ideation, natural language processing, web mining, narratology

15:50-16:30

Discussion and closing address