



Andreas Holzinger
VO 706.996 W DiplomandInnen Seminar
VO 706.997 W DissertantInnen Seminar



Welcome to the Holzinger Group HCI-KDD Part 4: How do we contribute to the international scientific community

a.holzinger@hci-kdd.org

Web: <http://hci-kdd.org/scientific-working-for-students>



- The “best” is the enemy of the “good” – whenever you try to be “perfect” – there is the danger that you finalize nothing*) ...”

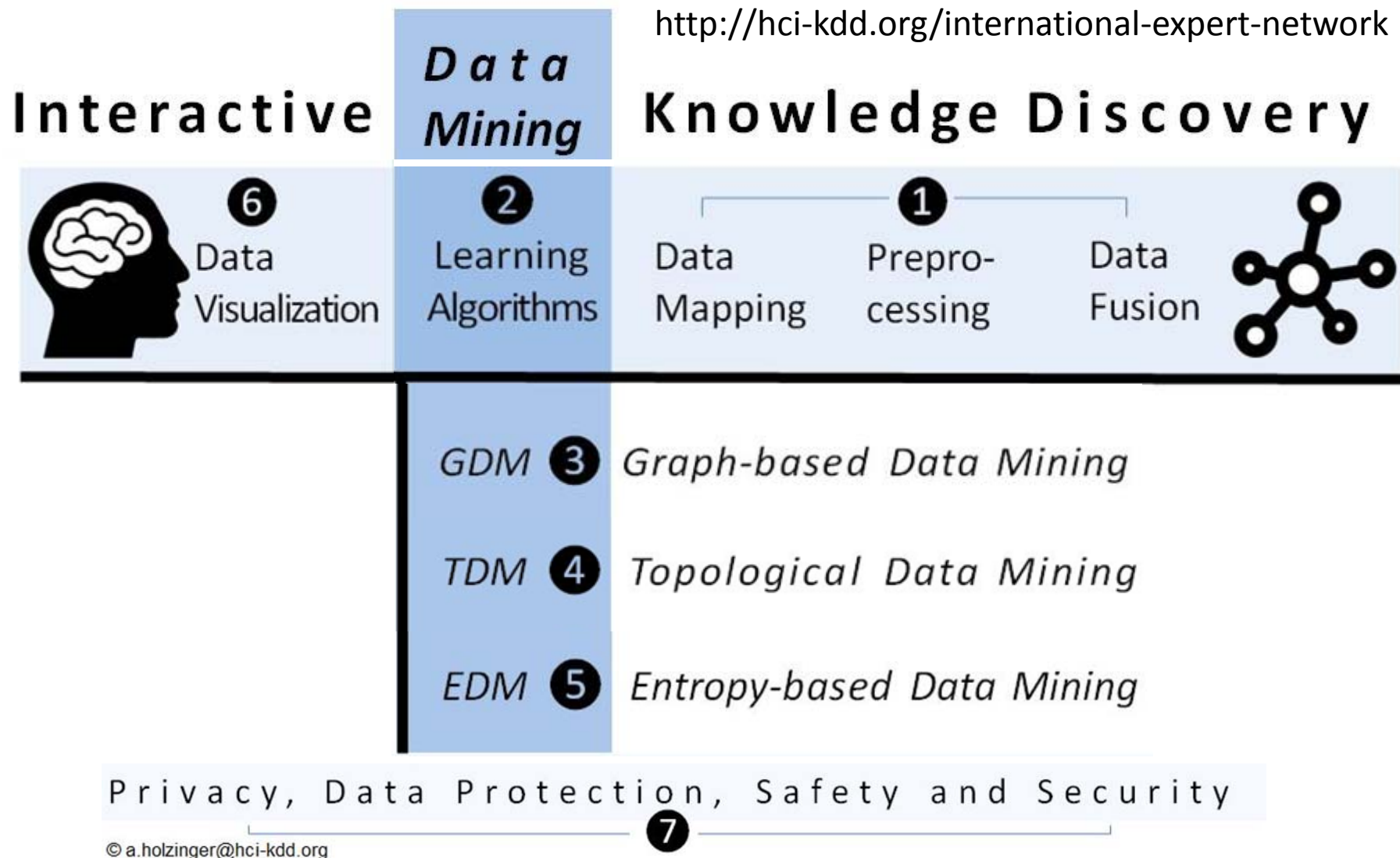
*) zero, nada, null



François-Marie Arouet (1694 – 1778)
known as “Voltaire”



- At the end of this seminar you should
- ... be familiar with the formal requirements
- ... be aware of the requirements for a PhD
- ... know the HCI-KDD approach
- ... have an overview on our research topics
- ... understand what research is
- ... getting started with your work
- ... understand how to write a paper



Holzinger, A. 2014. Trends in Interactive Knowledge Discovery for Personalized Medicine: **Cognitive Science meets Machine Learning**. IEEE Intelligent Informatics Bulletin, 15, (1), 6-14.

- $180 + 120 = 300$ ECTS min. for **PhD admission**
- Duration: **36 months** regular (max. 48 months)
- Classes over the 36 months: **14 course hours***
e.g. this course LV 706.997 has one hour, LV 706.315 has two hours, 706.046 has three hours
- **PhD-Plan** for the 36 months with deliverables
- Deliverables in form of **papers** to international peer-reviewed conferences/journals
- **Recommended output:** 2 papers per year (e.g. one conference and one journal)
- **Minimum: 1 paper per year**

*) in German: Semesterwochenstunden (semester course hours),
there are no ECTS necessary!

Friday 14 October lecture on variational inference.

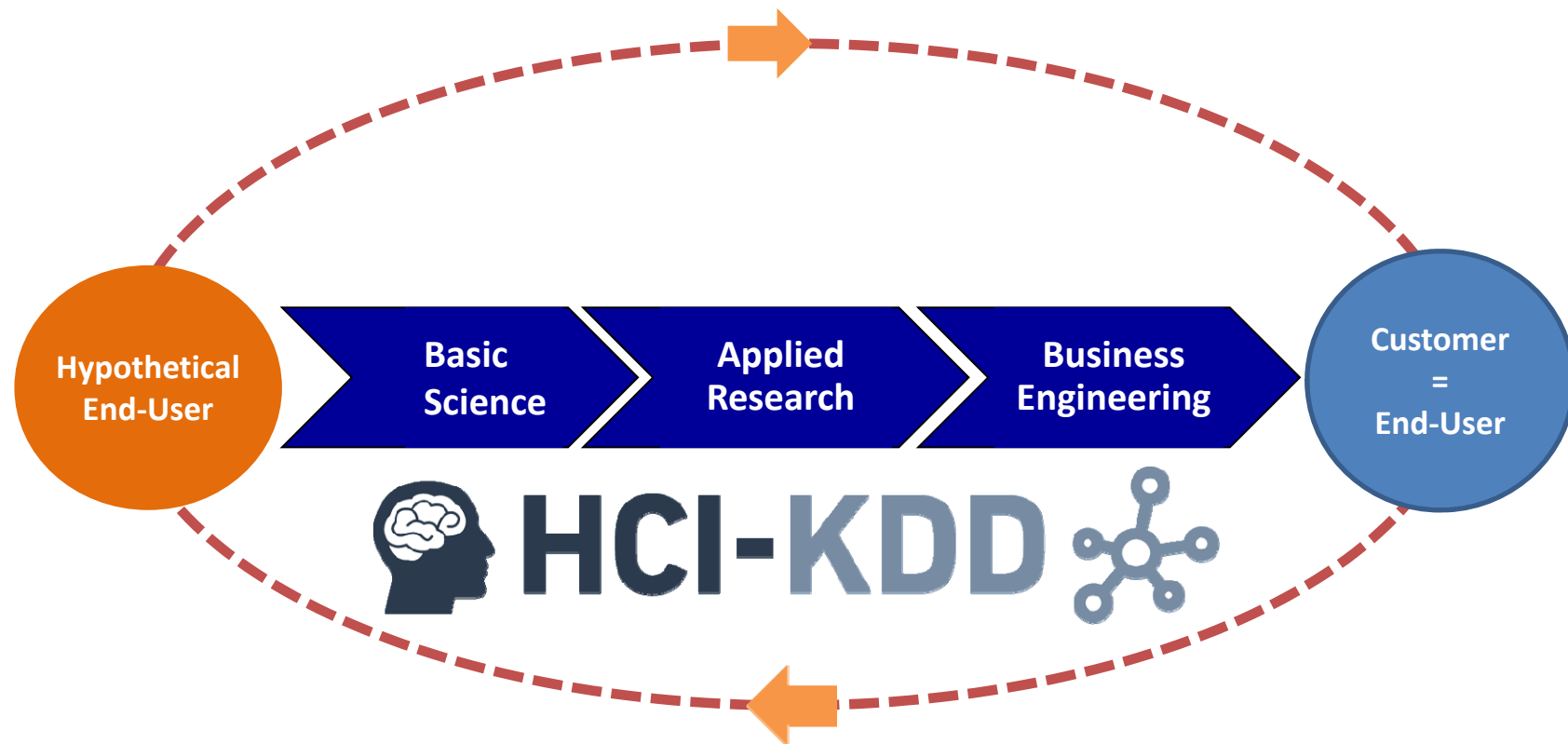
Final Project

In the second half of the course, you will complete a project. The ideal outcome of this project would be a paper that could be submitted to a top-tier machine learning conference such as NIPS, ICML, UAI, AISTATS, or KDD. There are different ways to approach this project, which are discussed in a more comprehensive document that is available from the course website under the Files tab. There are four separate components of the project:

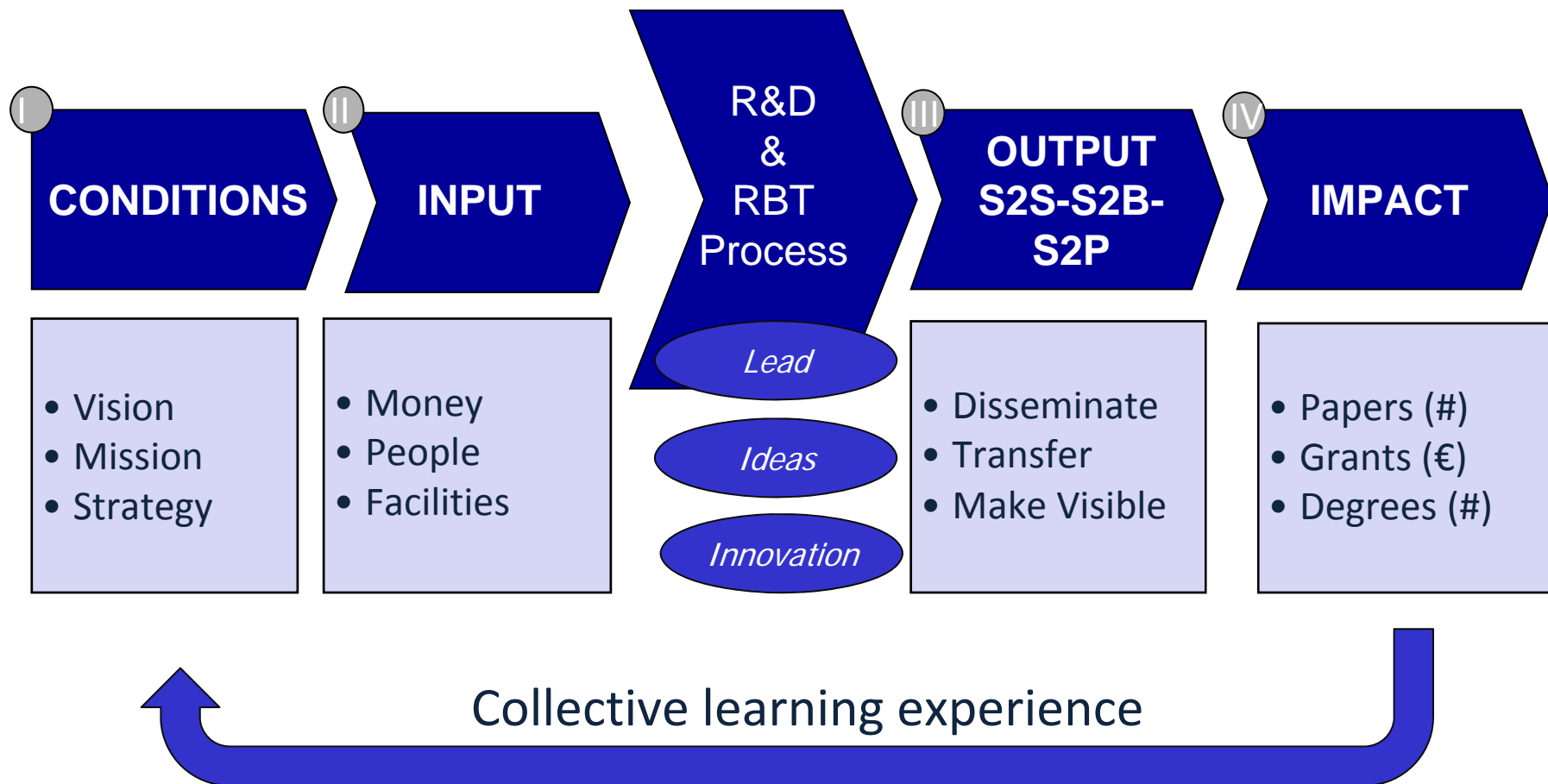
**... to contribute to the
international scientific
community**

How to contribute to the international scientific community?

Science is testing crazy ideas – Engineering is putting these ideas into Business



Holzinger, A. 2011. Successful Management of Research and Development, Norderstedt: BoD.



Holzinger, A. 2011. *Successful Management of Research and Development*, Norderstedt, BoD.

In Journals



In Proceedings



In Magazines



Book Chapters



Note: Should be included in the DBLP: <http://dblp.uni-trier.de/db/>

Not to be confused with Student Textbooks or Monographs:



1 Towards interactive Machine Learning (IML): Applying Ant Colony Algorithms to Solve the Traveling Salesman Problem with the Human-in-the-Loop Approach

2 Andreu Holzing¹, Marko Plase², Katharina Holzing³, Gloria Cerasela Crispu⁴, Camelia-M. Plase⁵, and Vlad-P. Palade⁶

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3 Abstract. Most Machine Learning (ML) researchers focus on automatic Machine Learning (ML) where great advances have been made, for example, in speech recognition, recommender systems, or autonomous vehicles. Automatic approaches greatly benefit from the availability of "big data". However, sometimes, for example in health information, we are confronted not with a small number of data sets or rare events, and with complex problems where ML approaches fail or deliver unsatisfactory results. Here, interactive Machine Learning (IML) may be of help and the "human-in-the-loop" approach may be beneficial in solving computationally hard problems, where human expertise can help to reduce an exponential search space through heuristics.

4 In this paper, experiments are discussed which help to evaluate the effectiveness of the IML "human-in-the-loop" approach, particularly in solving the "black box" of directly enabling a human to directly and indirectly manipulating and interacting with an algorithm. For this purpose, we selected the Ant Colony Optimization (ACO) framework, and use it on the Traveling Salesman Problem (TSP) which is of high importance in solving many practical problems in health information, e.g. in the study of proteins.

5 Keywords: Interactive Machine Learning - Human-in-the-loop - Traveling Salesman Problem - Ant Colony Optimization


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P. Holzing et al. (Eds.): CHAID 2016, LNCS 9817, pp. 91–96, 2016.
DOI 10.1007/978-3-319-33032-2_9

6 Introduction and Motivation for Research

Automatic Machine Learning (AML) is increasingly making big theoretical as well as practical advances in many application domains, for example, in speech recognition [1], recommender systems [4], or autonomous vehicles [5].

The AML approaches sometimes fail or deliver unsatisfactory results, where being confronted with complex problems. Here interactive Machine Learning (IML) may be of help and a "human-in-the-loop" may be beneficial in solving computationally hard problems, where human expertise can help to reduce, through heuristics, an exponential search space.

We define IML approaches as those that can interact with both computational agents and human agents, and optimize their learning behavior through these interactions [6]. To clearly distinguish the IML approach from a classic supervised learning approach, the first question is to define the human's role in this loop (see Fig. 1). [7].



7 Fig. 1. The IML human-in-the-loop approach. The main issue is that humans are not only involved in preprocessing, by selecting data or features, but actually during the learning phase they are directly interacting with the algorithm, thus shifting away the black-box approach to a glass-box; there might also be more than one human agent interacting with the computational agent(s), allowing for co-reasoning or co-qualification approaches

There is evidence that humans sometimes still outperform ML-algorithms, e.g. in the inductive, often almost instantaneous interpretation of complex patterns, for example, in diagnostic radiologic imaging: A promising technique to fill the semantic gap is to adapt an expert-in-the-loop approach, by integrating the physicians high-level expert knowledge into the retrieval process and by acquiring higher relevance judgments regarding a set of initial retrieval results [8].

Despite these apparent assumptions, so far there is little quantitative evidence on effectiveness and efficiency of IML-algorithms. Moreover there is practically no evidence of how such interaction may really optimize these algorithms as it is a subject that is still being studied by cognitive scientists for quite a while and even though "natural" intelligent agents are present in large numbers throughout the world [9].

From the theory of human problem solving it is known that for example, medical doctors can often make diagnoses with great reliability - but without being able to explain their rules explicitly. Here IML could help to equip algorithms with such "tacit/explicit" knowledge and learn thereof. The importance of

8 often poses higher complexity and prevent a global overview. An increase of the crisis is possible, if there is for example a preprocessing phase of suboptimal clustering [10].

Further challenges are in the transfer of our approach to other nature-inspired algorithms which have a lot of potential for the support of solving hard problems [11].

IML can be particularly helpful whenever we are lacking large amounts of data, deal with complex data and/or rare events where traditional ML-algorithms suffer due to insufficient training samples. A doctor-in-the-loop can help where human expertise and long-term experience is useful, however, the optimal way will be in hybrid solutions in combining the "best of two worlds", following the HIC-KDD approach [17, 18].

In the future it is planned to use gamification [19] and crowdsourcing [10], with the grand goal to make use of many humans to help to solve hard problems.

9 Conclusion

We demonstrated that the IML approach [9] can be used to improve current TSP solving methods. With this approach we have enriched the way the human-computer interaction is used [17]. This research is in-line with other successful approaches. Agile software paradigms, for example, are governed by rapid responses to change and continuous improvement. The agile rules are a good example on how the interaction between different teams can lead to valuable solutions. Gamification works for applying the Game Theory concepts and results to non-game contexts, for achieving specific goals. In this case, gamification could be helpful by considering the human and the computer as a coalition. There are numerous open research directions. The challenge now is to translate these approaches to other similar problems, for example on protein folding, and at the same time to scale up on complex software applications.

10 References

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- 1 = Paper title
- 2 = Authors with Affiliations
- 3 = Abstract
- 4 = Keywords
- 5 = Content (formally divided into: 1) Introduction and

- Motivation for Research >
- 2) Background and Related Work
- 3) Experimental method, setting, results,
- 4) Discussion, 5) Future Work, 6) Conclusion)
- 6 = References

- is a **message** to the international research community
- is written in the scientific language today - **English** (Latin in medieval times and Greek in ancient times)
- reports something **of value** for other researchers
- should be useful, and what other researchers can use, will be **referenced** (brings citations)
- is subject to **peer review**
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Experimental full text search

Search for: in

The full text search facility is an experimental service which may be less up-to-date than the normal search. See [full text search help](#) (search).

- Stop Reading! Start Writing!
- Read along when writing:
- SQ3R-Method:
 - Survey (read title, abstract, conclusion, subheadings)
 - Question (what are the major insights of this paper?)
 - Read: with regard to the question above
 - Recite: summarize with your own words
 - Review: Try to reflect the major insights of the paper
- Do not waste time! Be economic! It is simply impossible to read everything and all!

- **Classic Newtonian** approach:
 - Ask question > develop theory > form a hypothesis to proof/disproof theory > conduct experiments > compare data with hypothesis > accept/reject theory
- **Computer Science** approach:
 - Find open problems to solve > form hypothesis how to solve the problem > experiment > evaluate > present new solution to the problem
- **Machine Learning** approach:
 - Setting up experiments to answer questions including:
How does model m perform on data from domain D ?
Which of these models have the best performance?
Much is feature engineering and precision and recall are your best friends!

- 1. Set goal (e.g. to bring paper into conference x or journal y) – write a preliminary (!) title and abstract
- 2. Study published work related to your topic
- 3. A good start is on the “future outlook” sections of published papers – outline intended work on one single page (birds eye view)
- 4. Start Writing! Discuss the related work and the theoretical background – leave gaps
- 5. Now bring in your ideas, experiments and results
- 6. Write Introduction, Conclusion, revise abstract, revise the title accordingly
- 7. Submit your paper
- 8. Carefully read the reviews, revise accordingly

- What is the problem? Is it challenging?
- How can the problem be solved – alternative methods, background, related work?
- How well is the problem solved (evaluation)?
- How useful is the result to the intended readers?
- Example:
 - We propose a method ... this is important because ... we solve this problem via ... finally we demonstrate that our method outperforms the state-of-the-art ...

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Reference Preview Attached PDFs

Holzinger, A., Plass, M., Holzinger, K., Crisan, G., Pintea, C. & Palade, V. 2016. Towards interactive Machine Learning (iML): Applying Ant Colony Algorithms to solve the Traveling Salesman Problem with the Human-in-the-Loop approach. *Springer Lecture Notes in Computer Science LNCS 9817*. Heidelberg, Berlin, New York: Springer, pp. 81-95, doi:10.1007/978-3-319-45507-56.

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  title = {Towards interactive Machine Learning (iML): Applying Ant Colony Algorithms to solve the Traveling Salesman Problem with the Human-in-the-Loop approach},
  booktitle = {Springer Lecture Notes in Computer Science LNCS 9817},
  publisher = {Springer},
  address = {Heidelberg, Berlin, New York},
  pages = {81-95},
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  doi = {10.1007/978-3-319-45507-56},
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Holzinger, A., Plass, M., Holzinger, K., Crisan, G., Pintea, C. & Palade, V. 2016. Towards interactive Machine Learning (iML): Applying Ant Colony Algorithms to solve the Traveling Salesman Problem with the Human-in-the-Loop approach. Springer Lecture Notes in Computer Science LNCS 9817. Heidelberg, Berlin, New York: Springer, pp. 81-95, doi:10.1007/978-3-319-45507-56.



Academic » Computer Science » Machine Learning & Pattern Recognition

Top conferences in machine learning & pattern recognition

1-90 of 90 results

All Years

Conferences	Publications	Citation
NIPS - Neural Information Processing Systems	4283	114207
ICML - International Conference on Machine Learning	2457	81514
IROS - International Conference on Intelligent Robots and Systems - IROS	11959	67570
ISNN - International Symposium on Neural Networks	16639	55741
ICPR - International Conference on Pattern Recognition	9571	52900
UAI - Uncertainty in Artificial Intelligence	1573	37148
COLT - Computational Learning Theory	937	20825
ICDAR - International Conference on Document Analysis and Recognition	2497	17022
ECML - The European Conference on Machine Learning and Principles and Practice of Knowledge Discovery in Databases	827	14200
ICANN - Int. Conference on Artificial Neural Networks	2342	9459
DAS - Document Analysis Systems	4300	6631
DAGM Symposium Symposium for Pattern Recognition	1921	5520
ICA - Independent Component Analysis	669	4860
ESANN - The European Symposium on Artificial Neural Networks	1041	4743
EuroCOLT - European Conference on Computational Learning Theory	84	4617
ICONIP - International Conference on Neural Information Processing	2738	4566
IJCNN - International Joint Conference on Neural Networks	632	3159
IWANN - International Work-Conference on Artificial and Natural Neural Networks	1676	3154

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Top journals in machine learning & pattern recognition

1–28 of 28 results

All Years

Journals	Publications	Citation
PAMI - IEEE Transactions on Pattern Analysis and Machine Intelligence	5377	346862
IEEE Transactions on Neural Networks	3498	114190
PR - Pattern Recognition	5795	106561
NECO - Neural Computation	2848	103716
ML - Machine Learning	1752	94665
PRL - Pattern Recognition Letters	4802	56711
JMLR - Journal of Machine Learning Research	1183	38836
JASSS - The Journal of Artificial Societies and Social Simulation	368	16374
IJPRAI - International Journal of Pattern Recognition and Artificial Intelligence	1318	9847
Advanced Robotics	1752	8142
IR - Information Research	426	7830
PAA - Pattern Analysis and Applications	494	3998
NCA - Neural Computing and Applications	1181	3757
ISF - Information Systems Frontiers	567	3684
IJDAR - International Journal on Document Analysis and Recognition	335	3354
EJIS - European Journal of Information Systems	395	2831
Internet Mathematics	284	2670
Cognition, Technology & Work	380	1716
Transactions on Rough Sets	221	1653

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***begin-of-Double-Blind-Review¶

¶

1) Title of the Paper:¶

¶

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¶

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¶

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¶

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4) Literature: Does the authors demonstrate an adequate understanding of the relevant related work? Are any relevant references missing? Please provide recommendations.¶

¶

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¶

5) Methodology: Is the paper's argument built on an appropriate base of theory and concepts? Are the methods used appropriately described?¶

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The methods x are...¶

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6) Results: Are the results presented clearly and appropriately? Do the conclusions adequately tie together the other elements of the paper?¶

¶

The results are...¶

¶

7) Quality of Communication: Is the paper well-written? Has attention been paid to the clarity of expression and readability, sentence structure, acronym explanation, etc.¶

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The paper is...¶

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¶

9) On a scale between 0 (rubbish) to 100 (excellent) -- how would you rate this paper:¶

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100%	90%	80%	70%	60%	50%	40%	30%	20%	10%	0%
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If you recommended a) b) or c) -- please outline how the authors can improve their paper: What should the authors do? What should they expand/remove etc.? What should they improve?¶

¶

(use additional space as you need it)¶

¶

¶

***end-of-double-blind-review¶

Review ~~XXXX~~ 3/2015 Thank you very much for your time and effort -- your help is most appreciated¶



Thank you!

