

Second International Workshop on Hybrid AI for Human-Centric Personalization and Recommendation (HyPeR 2026)

Elisabeth Lex
Graz University of Technology
Graz, Austria
elisabeth.lex@tugraz.at

Markus Reiter-Haas
Graz University of Technology
Graz, Austria
reiter-haas@tugraz.at

Marko Tkalčič
University of Primorska
Koper, Slovenia
marko.tkalcic@famnit.upr.si

Dietmar Jannach
University of Klagenfurt
Klagenfurt, Austria
dietmar.jannach@aau.at

Markus Schedl
Johannes Kepler University Linz
Linz, Austria
markus.schedl@jku.at

Abstract

The increasing adoption of personalization and recommender systems in high-impact domains raises fundamental questions about how user models represent, reason about, and adapt to human behavior. While recent advances in machine learning have improved predictive accuracy, they offer limited support for explicit reasoning, interpretability, and the incorporation of cognitive and normative constraints. The Second International Workshop on Hybrid AI for Human-Centric Personalization and Recommendation (HyPeR 2026) focuses on hybrid AI as a methodological framework for user modeling, recommendations, and personalization, emphasizing the integration of learning-based approaches with symbolic knowledge, reasoning mechanisms, and cognition-informed representations. HyPeR brings together researchers and practitioners to examine architectures, methods, and evaluation strategies for hybrid user models. The workshop aims to stimulate exchange and to shape future research directions at the intersection of user modeling, hybrid AI, and human-centered recommender systems.

Keywords

Hybrid User Models, Hybrid AI, Symbolic AI, Sub-symbolic AI, Neuro-symbolic AI, Cognitive Models, Explainability, Interpretability, Evaluation, Human-Centered Recommender Systems

ACM Reference Format:

Elisabeth Lex, Markus Reiter-Haas, Marko Tkalčič, Dietmar Jannach, and Markus Schedl. 2026. Second International Workshop on Hybrid AI for Human-Centric Personalization and Recommendation (HyPeR 2026). In . ACM, New York, NY, USA, 4 pages. <https://doi.org/10.1145/nnnnnnn.nnnnnnn>

1 Workshop Overview and Rationale

Recommender systems increasingly mediate how people access information, make decisions, and interact with digital environments

Permission to make digital or hard copies of all or part of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. Copyrights for components of this work owned by others than the author(s) must be honored. Abstracting with credit is permitted. To copy otherwise, or republish, to post on servers or to redistribute to lists, requires prior specific permission and/or a fee. Request permissions from permissions@acm.org.
Conference'17, Washington, DC, USA

© 2026 Copyright held by the owner/author(s). Publication rights licensed to ACM.
ACM ISBN 978-x-xxxx-xxxx-x/YYYY/MM
<https://doi.org/10.1145/nnnnnnn.nnnnnnn>

in domains such as education, healthcare, and media consumption [11]. Many state-of-the-art recommendation approaches rely on data-driven machine learning models that lack interpretability [18] and support for explicit reasoning, and offer limited support for incorporating normative constraints or psychologically-informed models [13]. Hybrid AI has emerged as a promising paradigm to address these limitations by combining machine learning methods with symbolic reasoning and knowledge representations [6, 7, 9, 12]. In the context of personalization and recommendations, hybrid approaches learn from large-scale behavioral data while explicitly integrating reasoning [5, 14, 24], logical rules [4, 10, 26, 27], knowledge representations [3], or combinations thereof [16, 20, 21, 25], to model user goals, beliefs, constraints, and contextual factors. These integrations open new opportunities for explainable and trustworthy personalization and recommendations [1, 23], cognition-informed user models [17], and novel approaches to address biases and fairness [8].

Hybrid AI approaches for personalization and recommendation still face several challenges. These include the development of architectures that integrate discrete symbolic representations with data-driven learning components while supporting interpretability and adaptive behavior [15]. This integration is particularly challenging given the different representations, learning paradigms, and evaluation criteria underlying symbolic and sub-symbolic, data-driven approaches [7]. Addressing these challenges is essential for the development and evaluation of hybrid personalization and recommender systems in application domains central to the Conference on Information and Knowledge Management (CIKM), such as education, health informatics, and social networks.

The second edition of the HyPeR workshop explores how combining neural learning with symbolic representations such as knowledge graphs, fuzzy neural networks [10], and logic-based models can lead to more interactive personalization and more expressive recommendations. By aligning computational models more closely with human reasoning, social dynamics, and decision-making, HyPeR aims to advance methodology, system design and evaluation frameworks, and situate recent hybrid AI research within the broader context of human-centered personalization and recommendations.

HyPeR directly addresses core themes of CIKM by focusing on hybrid AI approaches that integrate data-driven learning with explicit knowledge and reasoning. The workshop responds to the growing demand for interpretable, trustworthy, and human-aligned

personalization and recommender systems. While CIKM is a premier venue for neurosymbolic integration approaches (e.g., [2, 19]) and recommender systems research (e.g., [28]), neurosymbolic recommender systems and personalization are less explored in the community (e.g., [22]). To that end, HyPeR complements the main CIKM conference by offering a dedicated venue for research on hybrid recommendation models, neuro-symbolic approaches, and knowledge-graph-based methods for personalization, with particular emphasis on methodological and evaluation challenges, as well as novel ideas, models, and architectures. HyPeR will be organized as a half-day mini-conference with research talks from participants.

Topics of interest include but are not limited to:

- Methods for **integrating symbolic knowledge and sub-symbolic learning** in recommendation systems
- Applications of **cognitive theories and behavioral insights** in hybrid AI models for personalization
- Techniques for **interpretability, explainability, and trust** in hybrid AI systems
- Methods for **detecting and mitigating biases and unfairness** in hybrid AI using symbolic approaches (e.g., counterfactual fairness)
- Mechanisms for **dynamic adaptation and symbolic reasoning** to handle evolving user preferences and context within hybrid architectures
- **Evaluation procedures and standardized benchmarks** for assessing the performance and robustness of hybrid AI in recommender systems
- **Behavioral data analysis and user studies** of cognition-informed and hybrid modeling approaches
- **Domain-specific implementations** of hybrid AI models in areas such as e-learning, healthcare, finance, and music
- **Real-world systems and case studies** demonstrating hybrid AI architectures for personalized recommendations

2 Organizers' Information

Elisabeth Lex (main contact, elisabeth.lex@tugraz.at, in-person attendance: sure) is a full professor at Graz University of Technology, Austria and heads the AI for Society Lab at the Institute of Human-Centred Computing. Her research focuses on user modeling, recommender systems, hybrid AI models for personalization, and trustworthy AI, with a particular emphasis on bias, fairness, privacy, and inclusion. She has extensive experience in organizing workshops, tutorials and conferences and serving in chair roles at conferences such as RecSys, UMAP, or WebConf. She is a key researcher in the Cluster of Excellence Bilateral AI¹, funded by the Austrian Science Fund (FWF), where she leads a work package on combining symbolic and sub-symbolic AI to create novel user modeling and recommender systems. She will be the leading organizer and responsible for all aspects of the workshop.

Markus Reiter-Haas (reiter-haas@tugraz.at, in-person attendance: likely) is a postdoctoral researcher at Graz University of Technology and a member of the AI for Society Lab. His research spans user modeling, natural language processing, machine learning, and

information retrieval with a particular focus on neuro-symbolic approaches for ethical recommender systems. In his previous PostDoc position at Duke University, he studied user behavior interventions with randomized field experiments using large language models. He has been chairing sessions at major events such as The Web Conference in the past. His involvement in the workshop organization comprises both administrative tasks, such as setting up the website, and the organization of the workshop program itself.

Marko Tkalcic (marko.tkalcic@famnit.upr.si, in-person attendance: unsure) is a full professor at the University of Primorska, Slovenia, specializing in affective computing, user modeling, psychology-informed user modeling, and hybrid AI methods. He has published extensively on the intersection of emotion recognition, personality, and personalization, as well as on the intersection of psychological models and recommender systems. He has extensive experience in organizing workshops on theory-guided personalization and user modeling and frequently takes chairing roles in conferences. He will serve as a scientific advisor to the workshop, and he will help coordinating the review and paper selection process.

Dietmar Jannach (dietmar.jannach@aau.at, in-person attendance: unsure) is a full professor of Computer Science at the University of Klagenfurt, Austria. He has worked on various topics in the area of recommender systems over the past twenty years, ranging from algorithm-related questions to aspects of human-computer interaction and the impact and value of recommender systems for various stakeholders. He is a co-founder of the ACM Transactions on Recommender Systems and has co-organized a number of scientific events, including several workshops and tutorials at different conferences. He will serve as a scientific advisor to the workshop, and he will help coordinating the review, paper selection and post-workshop publication process.

Markus Schedl (markus.schedl@jku.at, in-person attendance: very likely) is a full professor at the Johannes Kepler University Linz (JKU) and leads the Multimedia Mining and Search group. In addition, he heads the Human-centered AI group at the Linz Institute of Technology (LIT) AI Lab. His research interests include recommender systems, user modeling, information retrieval, machine learning, natural language processing, multimedia, and trustworthy AI. He has extensive experience in organizing workshops, tutorials and conferences, including serving as general co-chair of the ACM Recommender Systems Conference 2025. His roles include providing scientific advice, overseeing the reviewing process, and coordinating the workshop onsite.

3 Workshop Organization

The HyPeR workshop is proposed as a **half-day**, in-person event. The workshop will follow a mini-conference format that combines paper presentations with interactive discussion elements. We expect contributions in the form of full papers, short papers, and position papers. In addition, we will encourage participation from attendees without paper submissions who are interested in contributing to discussions on hybrid AI for personalization and recommendation.

¹<https://www.bilateral-ai.net/>

We anticipate approximately 20-30 participants from academia and industry. The workshop is designed to foster interaction and cross-disciplinary exchange with moderated discussions and a panel-style session.

4 Workshop Program

The workshop combines structured presentations with participatory discussion to support both knowledge exchange and community building. It will begin with a brief opening by the organizers, followed by an invited keynote from a senior researcher working in hybrid AI, user modeling, or human-centered AI. The keynote is intended to frame the workshop by outlining current research directions, open problems, and shared challenges in the field.

Contributed papers will be organized into thematic clusters and presented through oral talks. Each cluster will be followed by facilitated discussion to encourage reflection, comparison across contributions, and audience engagement. The workshop will close with a collective discussion or panel involving the organizers, keynote speaker, and attendees, aimed at summarizing insights from the day, identifying open research questions, and outlining opportunities for future collaboration.

5 Submission and Participation Process

The workshop will follow a paper-based submission model. Submissions will be reviewed in a single-blind peer-review process. Each paper will be evaluated by at least two members of the program committee based on relevance to the workshop themes, originality, technical quality, clarity, and potential to stimulate discussion.

We invite the following types of submissions in single-column format (page counts excluding references):

- Full research papers (up to 12 pages)
- Short papers or extended abstracts (up to 6 pages)
- Position papers of novel ideas or perspectives (up to 6 pages)

At least one author of each accepted contribution must attend the workshop in person and present the work. Accepted papers will be published in the joint CEUR-WS workshop proceedings volume.

Potential candidate members of the program committee include experts in user modeling, recommender systems, and hybrid AI methods. A list of potential PC members is given below:

- Bamshad Mobasher (DePaul University, USA)
- Robin Burke (University of Colorado Boulder, USA)
- Bart Knijnenburg (Clemson University, USA)
- Martijn Willemsen (Eindhoven University of Technology, Netherlands)
- Alan Said (University of Gothenburg, Sweden)
- Christine Bauer (University of Salzburg, Austria)
- Marco de Gemmis (University of Bari, Italy)
- Giuseppe Spillo (University of Bari, Italy)
- Cataldo Musto (University of Bari, Italy)
- Pasquale Lops (University of Bari, Italy)
- Giovanni Semeraro (University of Bari, Italy)
- Stephan Bartl (University of Klagenfurt, Austria)
- Kevin Innerebner (Graz University of Technology, Austria)
- Hannah Eckert (Johannes Kepler University Linz, Austria)
- Vedad Misirlic (Graz University of Technology, Austria)
- Gregor Mayr (Graz University of Technology, Austria)

6 Promotion and Dissemination

The workshop will be promoted through multiple channels, including relevant mailing lists, and social media platforms. The organizers will also leverage their professional networks to reach researchers and practitioners working on hybrid AI, user modeling, and human-centered AI.

After the workshop, presentations will be made available via the workshop website. Also, the organizers plan to prepare a post-workshop summary highlighting insights, open challenges, and emerging research directions discussed during the workshop. Furthermore, participants will be encouraged to submit their extended research to a planned special issue at ACM Transactions on Recommender Systems (TORS) on neuro-symbolic recommendations.

7 Workshop History

This is the second edition of the International Workshop on Hybrid AI for Human-Centric Personalization and Recommendation (HyPeR). The first edition [12] was held in conjunction with ACM UMAP 2025 as a half-day, in-person workshop. It attracted approximately 25 participants and featured a program of peer-reviewed long and short paper presentations. The workshop covered a broad range of hybrid AI for personalization topics, including neuro-symbolic models, cognitive architectures, and trust in AI systems.

Feedback from participants highlighted the value of a dedicated forum focused on hybrid AI approaches that explicitly integrate symbolic reasoning and sub-symbolic models into personalization approaches. Building on the diverse research directions established in the inaugural workshop, a second edition is well-positioned to sustain this momentum and further explore the rapidly evolving intersection of hybrid AI and human-centric personalization. While the first edition focused exclusively on personalization (i.e., it did not explicitly target recommendations), it became evident, from the submissions and discussions, that there is a strong need to expand the scope to hybrid AI in recommender systems.

Insights from the first edition inform the organization of the 2026 workshop, with increased emphasis on recommendations but also on interactive discussion formats and on connecting hybrid AI methods to key requirements such as trust, fairness, and alignment with human values.

Although earlier CIKM workshops have focused on methodological advancements in search and recommendations (e.g., MMGenSR for multimodal generative AI or DESERE for decentralization) and issues such as sustainability and trust (e.g., RS4SD, TrustKDD), HyPeR shifts the focus toward hybrid AI as a foundational methodology for human-centric personalization and recommendations.

Acknowledgments

This research was funded in whole or in part by the Austrian Science Fund (FWF): 10.55776/COE12, Cluster of Excellence [Bilateral Artificial Intelligence](#) and the doc.funds.connect project [Human-Centered Artificial Intelligence](#) (<https://doi.org/10.55776/DFH23>), and the FFG HybridAir project (project #FO999902654). Furthermore, the work presented here was supported also by the University of Primorska grant CogniCom and the Slovenian Research and Innovation Agency through grants BI-NO/25-27-007 and N2-0354 (C).

References

- [1] Qingyu Bing, Qiannan Zhu, and Zhicheng Dou. 2023. Cognition-aware Knowledge Graph Reasoning for Explainable Recommendation. In *Proceedings of the Sixteenth ACM International Conference on Web Search and Data Mining (WSDM '23)*. Association for Computing Machinery, New York, NY, USA, 402–410. doi:10.1145/3539597.3570391
- [2] Erik Cambria, Yang Li, Frank Z Xing, Soujanya Poria, and Kenneth Kwok. 2020. SenticNet 6: Ensemble application of symbolic and subsymbolic AI for sentiment analysis. In *Proceedings of the 29th ACM international conference on information & knowledge management*. 105–114.
- [3] Tommaso Carraro, Alessandro Daniele, Fabio Aioli, and Luciano Serafini. 2024. Mitigating data sparsity via neuro-symbolic knowledge transfer. In *European Conference on Information Retrieval*. Springer, 226–242.
- [4] Tommaso Carraro, Luciano Serafini, and Fabio Aioli. 2024. LTNtorch: PyTorch implementation of Logic Tensor Networks. *arXiv preprint arXiv:2409.16045* (2024).
- [5] Hanxiong Chen, Shaoyun Shi, Yunqi Li, and Yongfeng Zhang. 2021. Neural Collaborative Reasoning. In *Proceedings of the Web Conference 2021 (WWW '21)*. Association for Computing Machinery, New York, NY, USA, 1516–1527. doi:10.1145/3442381.3449973
- [6] Brandon Curtis Colelough and William Regli. 2024. Neuro-Symbolic AI in 2024: A Systematic Review. In *Proceedings of the First International Workshop on Logical Foundations of Neuro-Symbolic AI (LNSAI 2024) co-located with the 33rd International Joint Conference on Artificial Intelligence (IJCAI 2024), Jeju Island, South Korea, August 5, 2024 (CEUR Workshop Proceedings)*, Gianluca Cima, Marco Console, Victor Gutiérrez-Basulto, Pascal Hitzler, and Maurizio Lenzerini (Eds.). CEUR-WS.org. <https://ceur-ws.org/Vol-3819/paper3.pdf>
- [7] Brandon C Colelough and William Regli. 2025. Neuro-Symbolic AI in 2024: A Systematic Review. *arXiv preprint arXiv:2501.05435* (2025).
- [8] Hannah Eckert, Oleg Lesota, and Markus Schedl. 2026. Extending Logic Tensor Networks to Implicit Feedback for Representation-Aware Music Recommendation. In *European Conference on Information Retrieval*. Springer, 428–441.
- [9] Artur d'Avila Garcez and Luis C Lamb. 2023. Neurosymbolic ai: The 3rd wave. *Artificial Intelligence Review* 56, 11 (2023), 12387–12406.
- [10] Kevin Innerebner, Stephan Bartl, Markus Reiter-Haas, and Elisabeth Lex. 2026. Modeling Behavioral Patterns in News Recommendations Using Fuzzy Neural Networks. In *Proceedings of the 48th European Conference on Information Retrieval (ECIR 2026)*.
- [11] Dietmar Jannach, Markus Zanker, Alexander Felfernig, and Gerhard Friedrich. 2010. *Recommender systems: an introduction*. Cambridge University Press.
- [12] Elisabeth Lex, Kevin Innerebner, Marko Tkalcic, Dominik Kowald, and Markus Schedl. 2025. Hybrid AI for Human-Centric Personalization (HyPer). In *Adjunct Proceedings of the 33rd ACM Conference on User Modeling, Adaptation and Personalization*. 336–338.
- [13] Elisabeth Lex, Dominik Kowald, Paul Seitlinger, Thi Ngoc Trang Tran, Alexander Felfernig, and Markus Schedl. 2021. Psychology-informed Recommender Systems. *Foundations and Trends® in Information Retrieval* 15, 2 (2021), 134–242. <https://elizabethlex.info/docs/2021fntir-psychology.pdf>
- [14] Yinggang Li, Xiangrong Tong, and Zhongming Lv. 2025. Multi-dimensional requirements for reinforcement recommendation reasoning. *Applied Intelligence* 55, 7 (March 2025), 545. doi:10.1007/s10489-024-05854-8
- [15] Gary Marcus. 2020. The next decade in AI: four steps towards robust artificial intelligence. *arXiv preprint arXiv:2002.06177* (2020).
- [16] Markus Reiter-Haas and Elisabeth Lex. 2025. Towards Multi-Aspect Diversification of News Recommendations Using Neuro-Symbolic AI for Individual and Societal Benefit. In *INRA 2025: 13th International Workshop on News Recommendation and Analytics in Conjunction with ACM RecSys 2025 (CEUR Workshop Proceedings, Vol. Vol-4065)*. CEUR-WS.org, 1–10.
- [17] Markus Reiter-Haas, Emilia Parada-Cabaleiro, Markus Schedl, Elham Motamedi, Marko Tkalcic, and Elisabeth Lex. 2021. Predicting Music Relistening Behavior Using the ACT-R Framework. In *Proc. of ACM RecSys*. 702–707.
- [18] Markus Schedl, Vito Walter Anelli, and Elisabeth Lex. 2024. *Technical and Regulatory Perspectives on Information Retrieval and Recommender Systems: Fairness, Transparency, and Privacy*. Springer.
- [19] Shaoyun Shi, Hanxiong Chen, Weizhi Ma, Jiaxin Mao, Min Zhang, and Yongfeng Zhang. 2020. Neural logic reasoning. In *Proceedings of the 29th ACM International Conference on Information & Knowledge Management*. 1365–1374.
- [20] Giuseppe Spillo, Cataldo Musto, Marco De Gemmis, Pasquale Lops, and Giovanni Semeraro. 2022. Knowledge-aware Recommendations Based on Neuro-Symbolic Graph Embeddings and First-Order Logical Rules. In *Proceedings of the 16th ACM Conference on Recommender Systems (RecSys '22)*. Association for Computing Machinery, New York, NY, USA, 616–621. doi:10.1145/3523227.3551484
- [21] Giuseppe Spillo, Cataldo Musto, Marco De Gemmis, Pasquale Lops, and Giovanni Semeraro. 2024. Recommender systems based on neuro-symbolic knowledge graph embeddings encoding first-order logic rules. *User Modeling and User-Adapted Interaction* (2024), 1–45.
- [22] Rui Sun, Xuezhao Cao, Yan Zhao, Junchen Wan, Kun Zhou, Fuzheng Zhang, Zhongyuan Wang, and Kai Zheng. 2020. Multi-modal knowledge graphs for recommender systems. In *Proceedings of the 29th ACM international conference on information & knowledge management*. 1405–1414.
- [23] Xiang Wang, Xiangnan He, Fuli Feng, Liqiang Nie, and Tat-Seng Chua. 2018. TEM: Tree-enhanced Embedding Model for Explainable Recommendation. In *Proceedings of the 2018 World Wide Web Conference (WWW '18)*. International World Wide Web Conferences Steering Committee, Republic and Canton of Geneva, CHE, 1543–1552. doi:10.1145/3178876.3186066
- [24] Yikun Xian, Zuohui Fu, Handong Zhao, Yingqiang Ge, Xu Chen, Qiaoying Huang, Shijie Geng, Zhou Qin, Gerard de Melo, S. Muthukrishnan, and Yongfeng Zhang. 2020. CAFE: Coarse-to-Fine Neural Symbolic Reasoning for Explainable Recommendation. In *Proceedings of the 29th ACM International Conference on Information & Knowledge Management (CIKM '20)*. Association for Computing Machinery, New York, NY, USA, 1645–1654. doi:10.1145/3340531.3412038
- [25] Jing Yao, Xiting Wang, Jianxun Lian, Xiaoyuan Yi, and Xing Xie. 2025. Neural Recommendation Reasoning with Logic Rules. *ACM Trans. Inf. Syst.* 43, 5 (Aug. 2025), 133:1–133:28. doi:10.1145/3742856
- [26] Wei Zhang, Junbing Yan, Zhuo Wang, and Jianyong Wang. 2022. Neuro-Symbolic Interpretable Collaborative Filtering for Attribute-based Recommendation. In *Proceedings of the ACM Web Conference 2022 (WWW '22)*. Association for Computing Machinery, New York, NY, USA, 3229–3238. doi:10.1145/3485447.3512042
- [27] Xiaoyu Zhang, Shaoyun Shi, Yishan Li, Weizhi Ma, Peijie Sun, and Min Zhang. 2024. Feature-Enhanced Neural Collaborative Reasoning for Explainable Recommendation. *ACM Trans. Inf. Syst.* 43, 1 (Nov. 2024), 7:1–7:33. doi:10.1145/3690381
- [28] Wayne Xin Zhao, Shanlei Mu, Yupeng Hou, Zihan Lin, Yushuo Chen, Xingyu Pan, Kaiyuan Li, Yujie Lu, Hui Wang, Changxin Tian, et al. 2021. Recbole: Towards a unified, comprehensive and efficient framework for recommendation algorithms. In *proceedings of the 30th acm international conference on information & knowledge management*. 4653–4664.