Perspectives on Humanities-Centred AI and Formal & Cognitive Reasoning

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Abstract

Under the joint heading Perspectives on Humanities-Centred AI (CHAI 2025) and Formal & Cognitive Reasoning (FCR-2025), the two workshops CHAI and FCR were organised together for the first time. The joint event brought into dialogue two complementary perspectives on artificial intelligence (AI). On the one hand, CHAI explored how AI, as the science of agents acting in the world, can support research in the Humanities by enhancing efficiency and effectiveness. With a Humanities-centred approach, AI methods can be tailored to the specific challenges of interpreting cultural traditions, working with written artefacts, and applying techniques such as text mining and linguistic analysis in ways that optimize human–machine interaction. On the other hand, FCR addressed issues of reasoning under uncertainty and change, emphasizing the need for non-classical systems to capture both real-life Large Language Model (LLM)-based applications and the characteristics of human reasoning. Topics included incomplete knowledge, inconsistent beliefs, and diverse reasoning mechanisms such as analogical and defeasible reasoning, as well as their integration with machine learning approaches. This volume contains the accepted contributions and corresponding presentations from the joint workshop.

1. Thread I: Fifth Workshop on Humanities-Centred Artificial Intelligence (CHAI 2025)

The CHAI workshop is celebrating its fifth anniversary. This milestone will be celebrated in 2025. Since its inception, the workshop has provided an international platform for researchers interested in the

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interface between AI and the humanities. The guiding principle is to explore how AI, understood as the science of actors operating in the world, can be adapted and tailored to the specific challenges of humanities research. These challenges range from the interpretation of cultural artefacts to the optimisation of language and text analysis.

1.1. Workshop Organisation of CHAI 2025

The CHAI 2025 Workshop was held as part of KI 2025, the 48th German Conference on Artificial Intelligence, which took place from 16–19 September 2025 in Potsdam, Germany. All workshops and tutorials were scheduled on 16 September, providing a dedicated forum for in-depth discussion and exchange.

1.1.1. Organisers

- Sylvia Melzer, University of Hamburg, Germany
- Stefan Thiemann, University of Hamburg, Germany
- Hagen Peukert, University of Hamburg, Germany
- Magnus Bender, Aarhus University, Denmark

1.2. Programme Committee of CHAI 2025

- Thomas Asselborn, University of Hamburg, Germany
- Magnus Bender, Aarhus University, Denmark
- Mahdi Jampour, University of Hamburg, Germany
- Meike Klettke, University of Regensburg, Germany
- Sylvia Melzer, University of Hamburg, Germany
- Hagen Peukert, University of Hamburg, Germany
- Stefan Thiemann, University of Hamburg, Germany

1.3. Overview of papers

Three papers will be presented at the workshop.

The first paper *Linking vocational archive data using an occupations and educations centric ontology* presents a new workflow to detect, annotate and link occupation and education data. The aim is to understand how people were trained in a wide variety of occupations from around 1930 to the present day. To achieve a comprehensive picture, it is helpful to link semantically identical content in order to obtain better IR results.

The second paper *Publishing a Chatbot: Opportunities and Challenges* discusses, on the one hand, the technical infrastructure required to use and publish a chatbot, and, on the other hand, the ethical and legal requirements involved. This article demonstrates that, alongside technical and humanities-related challenges, legal considerations must also be taken into account when operating chatbots outside of a research-only environment.

The third paper *Label the Invisible: AI-Aided Label Enhancement and Ink Residue Exposure* presents a study on how to recover ink iteratively using a human-in-the-loop approach with a Transformer-based vision model and deep learning. The approach demonstrates that precise, track-based annotations, when combined with repeated training cycles, lead to a significant increase. The paper also demonstrates the necessity of interdisciplinary cooperation between computer scientists and humanities scholars to achieve positive outcomes.

2. Thread II: Formal & Cognitive Reasoning (FCR-2025)

Information for real-life AI applications is usually pervaded by uncertainty and subject to change, and thus requires the investigation and design of systems going beyond classical knowledge representation and reasoning. At the same time, psychological findings indicate that human reasoning cannot be completely described by classical logical systems. Sources of explanations are incomplete knowledge, incorrect beliefs or inconsistencies. A wide range of reasoning mechanisms has to be considered, such as analogical or defeasible reasoning, possibly in combination with machine learning methods. The field of knowledge representation and reasoning offers a rich palette of methods for uncertain reasoning both to describe human reasoning and to model AI approaches.

The aim of this series of workshops is to address recent challenges and to present novel approaches to uncertain reasoning and belief change in their broad senses, and in particular provide a forum for research work linking different paradigms of reasoning. A special focus is on papers that provide a base for connecting formal-logical models of knowledge representation and cognitive models of reasoning and learning, addressing formal and experimental or heuristic issues. Previous events of the Workshop on "Formal and Cognitive Reasoning" and joint workshops took place in Dresden (2015), Bremen (2016), Dortmund (2017), Berlin (2018), Kassel (2019), Bamberg (2020, online), Berlin (2021, online), Trier (2022, online), Berlin (2023), and Würzburg (2024).

2.1. Workshop Organisation of FCR-2025

The 11th Workshop on Formal and Cognitive Reasoning (FCR 2025) was held as part of the 48th German Conference on Artificial Intelligence (KI 2025), which took place from 16–19 September 2025 in Potsdam, Germany. As in the past, the workshop Formal and Cognitive Reasoning (FCR-2025) at KI 2025 was organized jointly by the GI special interest group *Wissensrepräsentation und Schließen* and by the GI special interest group *Kognition*. This year, the organisation was coordinated with the team that organised the CHAI 2025 workshop. The FCR workshop series emerged from two separate workshop series, namely Dynamics of Knowledge and Belief (DKB) and KI & Kognition (KIK). Next to the papers of the CHAI thread, this volume contains the papers presented at the FCR-2025 thread held on 16 September 2025. The KI 2025 conference and all its workshops took place in Potsdam, Germany. At least three programme committee members reviewed each of the four FCR submissions. The committee decided to accept all papers for presentation.

2.1.1. Organisers

- Özgür Lütfü Özçep, University of Hamburg, Germany
- Nele Russwinkel, Universität zu Lübeck, Germany
- Kai Sauerwald, FernUniversität in Hagen, Germany
- Diedrich Wolter, Universität zu Lübeck, Germany

2.2. Programme Committee of FCR-2025

- Torben Bräuner, Roskilde University, Denmark
- Martin Butz, University of Tübingen, Germany
- Marcel Gehrke, University of Hamburg, Germany
- Laura Giordano, Universita del Piemonte Orientale, Italy
- Jesse Heyninck, Open Universiteit Heerlen, the Netherlands
- Haythem O. Ismail, German University in Cairo, Egypt
- Gabriele Kern-Isberner, TU Dortmund, Germany
- Oliver Kutz, University of Bozen-Bolzano, Italy
- Jean-Guy Mailly, Université Paris Cité, France
- Ute Schmid, Universität Bamberg, Germany

- Claudia Schon, Hochschule Trier, Germany
- Frieder Stolzenburg, Hochschule Harz, Germany
- Ingo Timm, University Trier, Germany
- Johannes P. Wallner, Graz University of Technology, Austria
- Christoph Wernhard, Technische Universität Potsdam, Germany

2.3. Overview of papers

The paper *Towards Explainability of Approximate Lifted Model Construction: A Geometric Perspective* studies recent advances in algorithms for efficient probabilistic inference, focusing on methods that balance accuracy and computational efficiency. It introduces a new geometric perspective for approximations that helps make these methods more transparent and interpretable.

The paper *Beyond LLM-Guided Common-Sense Reasoning for Natural Language Understanding* investigates efficient algorithms for exploiting large repositories with common-sense knowledge for the purpose of natural language understanding. Building on recent work using large language models to guide axiom selection, the authors reproduce earlier results with theorem provers E and Vampire and introduce a new heuristic that further improves reasoning performance.

The paper *Personalized Interactions With a Social Robot Based on Recollections From a Cognitive Model* presents a system that combines a cognitive architecture with a large language model to enhance social robots' memory and interaction abilities. Using an ACT-R model, experiences from human-robot interaction are stored and later retrieved to personalize conversations, build person-specific models, and support richer, more context-aware dialogues. The approach is demonstrated in practice with the humanoid social robot Navel.

The paper *Cognitive Modeling of Agents: Integrating Emotions, Goals, Needs, and Decision-Making* introduces a cognitive agent framework for crowd simulation that goes beyond physical movement to include emotional states, physiological needs, and personal factors. In a simulated train station, agents make context-sensitive decisions—such as re-routing or interrupting plans—based on evolving needs and knowledge, resulting in more realistic and diverse behaviours than traditional models.

3. Presentations

Abstracts and presentations are available at: https://doi.org/10.25592/uhhfdm.17945

3.1. Presentations - CHAI 2025

Magnus Bender
Aarhus University, Denmark
Welcome

Thomas Reiser[1], Jens Dörpinghaus[1,2,3], Petra Steiner[2], Michael Tiemann[1,2]
[1] *University of Koblenz, Germany;* [2] *Federal Institute for Vocational Education and Training (BIBB), Germany;* [3] *Linnaeus University, Sweden*
Linking Vocational Archive Data using an Occupations and Educations centric Ontology

Thomas Asselborn[1], Magnus Bender[2], Ralf Möller[1], Sylvia Melzer[1]
[1] *University of Hamburg, Germany;* [2] *Aarhus University, Denmark*
Publishing a Chatbot: Opportunities and Challenges

Nadiia Duiunova[1], Mariia Halchynska[1], Johannes Römisch[1], Hannes Kahl[2], Holger Essler[3], Frank Deinzer[1]
[1] *Technical University of Applied Sciences Wuerzburg-Schweinfurt, Germany;* [2] *University Trier, Germany,*

[3] *Julius Maximilian University of Würzburg, Germany*
Label the Invisible: AI-Aided Label Enhancement and Ink Residue Exposure

3.2. Presentations - FCR-2025

Jan Speller[1], Malte Luttermann[2], Marcel Gehrke[3], Tanya Braun[1]
[1] *University of Münster, Germany;* [2] *DFKI Lübeck, Germany;* [3] *University of Hamburg, Germany*
Towards Explainability of Approximate Lifted Model Construction: A Geometric Perspective

Moritz Bayerkuhnlein, Julian Britz, Diedrich Wolter
University of Lübeck, Germany
Beyond LLM-Guided Common-Sense Reasoning for Natural Language Understanding

Thomas Sievers, Nele Russwinkel
University of Lübeck, Germany
Personalized Interactions With a Social Robot Based on Recollections From a Cognitive Model

Mohammad Khodaygani, Aliyu Tanko Ali, Timon Dohnke, Tobias Groth, Edgar Baake, Martin Leucker, Nele Russwinkel
University of Lübeck, Germany
Cognitive Modeling of Agents: Integrating Emotions, Goals, Needs, and Decision-Making

Kai Sauerwald
FernUniversität in Hagen, Germany
Farewell

3.2.1. Acknowledgments

The organisers of the FCR-2025 and of the CHAI 2025 threads of the joint workshop would like to thank the organisers of the KI 2025 conference in Potsdam for their excellent support. We also would like to thank the members of the programme committee for their help in carefully evaluating and selecting the submitted papers and all participants of the workshop for their contributions. We wish that new inspirations and collaborations between the contributing disciplines will emerge from this workshop.

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Declaration on Generative AI

During the preparation of this work, the authors used DeepL in order to: Grammar and spelling check. After using these tool(s)/service(s), the authors reviewed and edited the content as needed and take(s) full responsibility for the publication's content.