

Special Issue on Foundations of Information and Knowledge Systems (FoIKS) 2024

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1 Introduction

We are delighted to present this Special Issue on the Foundations of Information and Knowledge Systems (FoIKS) 2024 conference, which took place in Sheffield, United Kingdom, from 8 to 11 April 2024. FoIKS is a biennial conference that serves as a platform for researchers and practitioners to discuss the latest advancements in the fields of information systems, knowledge representation, and reasoning. This is the thirteenth conference in the series, which has been running since 2000, where it started with the first FoIKS in Burg (Spreevald), Germany.

2 Contents of the Special Issue

In this Special Issue, we have compiled a selection of extended papers that were presented at FoIKS 2024, showcasing the cutting-edge research and innovative ideas that were shared during the conference. The selected papers cover a wide range of topics, including temporal aspects, inference problems, causal laws, privatized beliefs, realizability, argumentation frameworks, and conditional belief bases. Each paper has been carefully reviewed and extended to provide a deeper insight into the associated research areas. We would like to express our gratitude to all the authors who contributed their work to this Special Issue.

We now provide a brief overview of each of the seven papers included in this Special Issue.

• Luciana Silo, Giuseppe De Giacomo, Macro Favorito: *Stochastic Service Composition for LTLf Reachability and Safety Tasks*

Service composition in the Roman model aims to realize a virtual service by suitably orchestrating a set of already available services. This work considers a variant where the available services are stochastic systems and the goal specification is expressed in linear temporal logic on finite traces (LTLf). The task is to synthesize a controller that maximizes the probability of achieving the temporal logic objective (reachability or safety) while minimizing the expected cost, combining methods from LTLf synthesis, reactive synthesis, and biobjective optimization of Markov decision processes.

• Christoph Beierle, Jonas Philipp Haldimann, Gabriele Kern-Isberner: *Inductive Inference from Weakly Consistent Belief Bases*

This work investigates nonmonotonic inferences from belief bases that include conditionals that render some possible worlds infeasible and thus entirely implausible, leading to what they call weakly consistent belief bases. They extend the established concepts of c-representations and c-inference—originally defined only for strongly consistent belief bases—to handle weak consistency by formulating an extended constraint satisfaction problem characterizing these new forms. This framework supports the implementation of extended c-inference, preserves key properties such as syntax splitting, and includes

extended definitions and characterizations of credulous and weakly skeptical c-inference.

• Fausto Barbero: *Axiomatizations of causal reasoning under indeterministic causal laws*

The author studied the generalization of causal models to indeterministic causal laws, as proposed by Halpern (2000), and implements generalized models inspired by the causal team semantics of Barbero and Sandu (2020). In these models, causal laws are represented by relations rather than functions, leading to key differences between indeterministic and deterministic settings in the axiomatization of counterfactuals and the definability of causal notions. He provides complete axiomatizations for both indeterministic causal models and their combined generalizations, analyzes important subclasses, and examines how small changes in model signatures affect definability in counterfactual languages.

• Thomas Schlögl, Roman Kuznets, Giorgio Cignarale: *Consistent Update Synthesis via Privatized Beliefs*

They address the challenge of modeling private communication in dynamic epistemic logic (DEL), where standard model-wide updates can cause unintended information leakage. To represent leak-free agent-to-agent communication, they propose a method for synthesizing an action model that partitions a Kripke model into private agent clusters, ensuring successful goal realization, belief consistency, and minimal change. They further introduce pointed updates, a new operation between pointed Kripke and action models that preserves only reachable world-event pairs, avoiding the model blow-up that is typical of DEL product updates.

• Anne-Marie Heine, Ringo Baumann: *Characterizing Conflict-free and Naive Labellings — Realizability, Uniqueness and Patterns of Redundancy*

These authors study realizability in abstract argumentation by characterizing the most fundamental labeling-based semantics, namely conflict-free and naive labelings. Since characterizations that are known for extension-based semantics do not transfer easily, they introduce new criteria such as L-tightness, reject-witnessing, reject-compositionality, and labeling downward-closure to determine realizability. They also analyze standard constructions and their uniqueness, investigate notions of ordinary and strong equivalence, and address the challenging characterization of stable labelings, revealing connections to the open problem of compact realizability in stable semantics.

• Yasir Mahmood, Jonni Virtama, Timon Barlag, Axel Ngonga: *Inconsistent Databases and Argumentation Frameworks with Collective Attacks*

These authors explore the relationship between subset-maximal repairs of inconsistent databases and extensions in argumentation frameworks, focusing on integrity constraints involving denial constraints and local-as-view tuple generating dependencies. Their results show that SET-based argumentation frameworks (SETAFs),

which allow collective attacks, are required to capture these repairs. Repairs under denial constraints correspond to naive, preferred, and stable extensions, whereas those under tuple-generating dependencies correspond to preferred extensions, with preprocessing yielding a unique stable and naive extension. When both constraint types are combined, only the preferred semantics remain adequate, and the authors also show that for functional and inclusion dependencies, standard argumentation frameworks without set-based attacks suffice.

• Marco Wilhelm, Gabriele Kern-Isberner, Christoph Beierle: *c-Core Closure and Syntax Splitting for Conditional Belief Bases*

The authors introduce core c-representations, a new class of ranking models for conditional belief bases that merge the strengths of c-representations and System Z. These models ensure high-quality inference while supporting a stratified, layer-by-layer construction that yields a unique minimal core representation. From this, they define the c-core closure operator, an inductive inference mechanism satisfying conditional syntax splitting, rational monotony, and inductive enforcement, thus avoiding the drowning problem and aligning with basic defeasible entailment operators.

3 Publisher transition

The publisher of the journal changed during the processing of this Special Issue. This is why the two papers listed below have already been published by the previous publisher, Cambridge University Press.

Haldimann JP, Beierle C, Kern-Isberner G. Inductive inference from weakly consistent belief bases. *The Knowledge Engineering Review*. 2025;40:e8. doi: [10.1017/S0269888925100088](https://doi.org/10.1017/S0269888925100088)

Baumann R, Heine A-M. Characterizing conflict-free and naive labellings—realizability, uniqueness and patterns of redundancy. *The*

Knowledge Engineering Review. 2025;40:e9. doi: [10.1017/S0269888925100064](https://doi.org/10.1017/S0269888925100064)

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Conflict of interest

The authors declare that they have no conflict of interest.

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