CHAKRA: Common Hierarchical Abstract Knowledge Representation for Anything

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Overview

Motivation

- **Sharing and reuse** of research knowledge.
- Technical and conceptual **interoperability** between research tools.
- **Reasoning** across heterogeneous data sources.

Contribution

- A General-purpose hierarchical **knowledge model**.
- A **formal description language** for hierarchical knowledge structures.
- **Tools** for integrating and accessing research data.

Constituent Hierarchies

Conceptual Structure

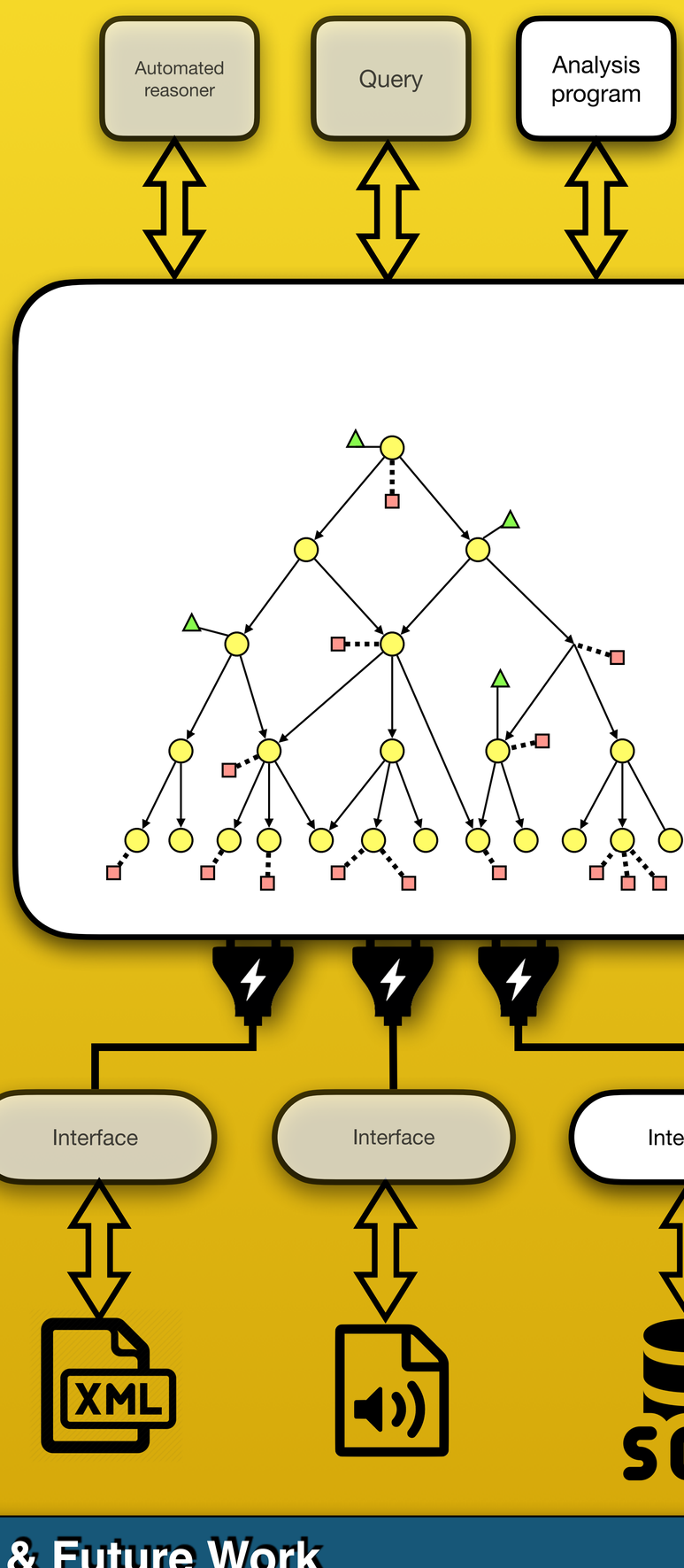
- **Constituents**: the unique entities of the representation.
- **Associations**: directed relationships between constituents.
- **Attributes**: key-value pairs associated with constituents and associations.
- **Properties**: formal descriptions of constituents and associations.

Computational Behaviour

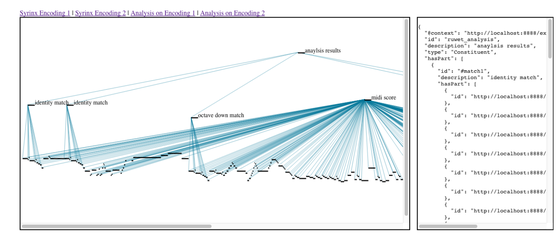
- Functional specification.
- Small number of core operations.
- Modular and extensible.
- Supports domain specific languages.

CHAKRA

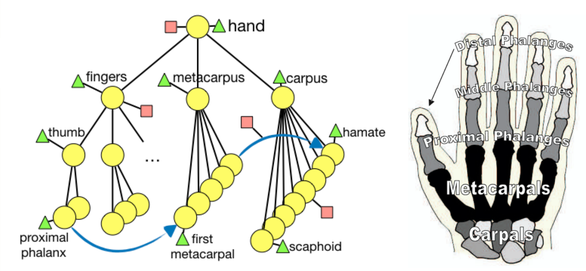
- CHAKA is a **general-purpose knowledge representation** framework [1,2,3].
- It allows for the **technical and conceptual federation** of heterogenous information sources.
- It provides a **logical foundation for reasoning** across knowledge in distributed environments.



- Research tools are built using only the core CHAKRA operations.



- Rich hierarchal knowledge structures can be represented and axiomatised.



- Data sources are integrated using dedicated implementations of the CHAKRA interface.
- High-level programs **automatically generate code** appropriate for a specific concrete data source.

Conclusions & Future Work

Conclusions

- AI Flanders use case: AI-Assisted Operator.
- Integration of data sources affords greater reasoning capabilities.
- Data abstraction affords greater interoperability between research tools.

Future Work

- Integration of AI-Assisted Operator data
- Automated reasoning and querying of constituent hierarchies.
- Hybrid AI: statistical learning of knowledge structures from low-level data.

References

1. Harley, N. 2019. *Abstract Representation of Music: A type-based knowledge representation framework*. Ph.D. Dissertation. Queen Mary University of London. Available at: https://github.com/n-harley/phd-thesis/.
2. Harris, M., A. Smaill, and G. Wiggins. 1991. Representing Music Symbolically. In *IX Colloquio di Informatica Musicale*, Pp. 55–69.
3. Smaill, A., G. A. Wiggins, and M. Harris. 1993. Hierarchical Music Representation for Composition and Analysis. *Journal of Computing and the Humanities*, 27:7–17.

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