Conceptual Graphs Based Modeling of Semi-Structured Data

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Due to the fast growing of data in the digital world, not only in volume but also in its variety (structured, un-structured or hybrid), traditional RDBMS are complemented with a rich set of systems, known as NoSQL. One of the main categories of NoSQL databases are document stores which are specifically designed to handle semi-structured data, for instance XML documents. In this paper, we present a modeling method for semi-structured data based on Conceptual Graphs and exemplify the method on an XML document. Conceptual Graphs are a particular system of logic based on the existential graphs of Ch. S. Peirce and the semantic networks of Artificial Intelligence. They express meaning in a logically precise form which is computer tractable and human readable. The expressive power of Conceptual Graphs makes them particularly suitable for conceptual modeling of semi-structured data.

References

[1] D. Braga, A. Campi, S. Ceri, XQBE (XQuery By Example): A Visual Interface to the Standard XML Query Language, *ACM Trans. Database Syst.* **30**, 2 (2005) 398–443.

[2] F. Dau, *The Logic System of Concept Graphs with Negation And Its Relationship to Predicate Logic*, Lecture Notes on Computer Science, **2892**, Springer Berlin, Heidelberg 2003.

[3] F. Dau, J. C. Hereth, Nested Concept Graphs: Mathematical Foundations and Applications for Databases. In: *B. Ganter, A. de Moor (eds.): Using Conceptual Structures. Contributions to ICCS. Shaker Verlag, Aachen*, 2003, 125-139.

[4] B. Ganter, R. Wille, *Formal concept analysis - mathematical foundations*, Springer, 1999.

[5] M. W. Guy, B. Moulin, J. Sowa (eds.), *Conceptual Graphs for Knowledge Representation*, Lecture Notes in AI, **699**, Springer, 1993.

[6] J. Lloret-Gazo, A Survey on Visual Query Systems in the Web Era, In: *Database and Expert Systems Applications: 27th International Conference, DEXA 2016, Porto, Portugal, September 5-8, 2016, Proceedings, Part II*, 343-351.

[7] F. Muntenescu, C. Sacarea, V. Varga, Conceptual Graphs Driven Design for Conceptual Digital Dossiers, *Studia Univ. Babes-Bolyai, ser. Informatica*, **55**, 1 (2010) 83–94.

[8] C. S. Peirce, *Collected Papers*, Harvard University Press, Cambridge, Massachusetts, 1931-1935.

[9] J. F. Sowa, Conceptual Graphs for a Data Base Interface, *IBM Journal of Research and Development*, **20**, 4 (1976) 336–357.

[10] J. F. Sowa, Conceptual Structures: Information Processing in Mind and Machine, *Addison Wesley Publishing Company Reading*, 1984.

[11] J. F. Sowa, *Knowledge Representation: Logical, Philosophical, and Computational Foundations*, Brooks Cole Publishing Co., Pacific Grove, CA., 2000.

[12] V. Varga, C. Sacarea, An FCA Driven Analysis of Mapping Conceptual Designs to XML, *Studia Univ. Babes-Bolyai, ser. Informatica*, **59**, 1 (2014) 46–57.

[13] V. Varga, C. Sacarea, A. Takacs, Conceptual Graphs Based Representation and Querying of Databases, In: *Proceedings of the 2010 IEEE International Conference on Automation, Quality and Testing, Robotics (AQTR)*, **3** (2010) 1–6.

[14] V. Varga, C. Sacarea, An FCA Driven Analysis of Mapping Conceptual Designs to XML Schemas, *Studia Univ. Babes-Bolyai, ser. Informatica*, **59**, 1 (2014), 46–57.

[15] V. Varga, K.T. Janosi-Rancz, B. Kalman, Conceptual Design of Document NoSQL Database with Formal Concept Analysis, *Acta Polytechnica Hungarica*, **13**, 2 (2016), 229–248.