

A Categorical View At Generalized Concept Lattices

Stanislav Krajčí

Abstract: We continue in the direction of the ideas from the Zhang's paper [14] about a relationship between Chu spaces and Formal Concept Analysis. We modify this categorical point of view at a classical concept lattice to a generalized concept lattice (in the sense of Krajčí [7]): We define generalized Chu spaces and show that they together with (a special type of) their morphisms form a category. Moreover we define corresponding modifications of the image / inverse image operator and show their commutativity properties with mapping defining generalized concept lattice as fuzzifications of Zhang's ones.

Keywords: fuzzy concept lattice; Chu space; category theory;

AMS Subject Classification: 03G10; 18D35; 06D72;

References

- [1] R. Bělohlávek: Fuzzy concepts and conceptual structures: induced similarities. In: Proc. Joint Conference Inform. Sci. '98, Durham (U.S.A.) 1998, Vol. I, pp. 179–182.
- [2] R. Bělohlávek: Concept lattices and order in fuzzy logic. *Ann. Pure Appl. Logic* 128 (2004), 277–298.
- [3] R. Bělohlávek, V. Sklenář, and J. Zaczal: Crisply generated fuzzy concepts. In: ICFA 2005 (B. Ganter and R. Godin, eds., *Lecture Notes in Computer Science* 3403), Springer–Verlag, Berlin–Heidelberg 2005, pp. 268–283.
- [4] R. Bělohlávek and V. Vychodil: Reducing the size of fuzzy concept lattices by hedges. In: Proc. FUZZ–IEEE 2005, The IEEE Internat. Conference Fuzzy Systems, Reno 2005, pp. 663–668.
- [5] S. Ben Yahia and A. Jaoua: Discovering knowledge from fuzzy concept lattice. In: *Data Mining and Computational Intelligence* (A. Kandel, M. Last, and H. Bunke, eds.), Physica–Verlag, Heidelberg 2001, pp. 169–190.
- [6] B. Ganter and R. Wille: *Formal Concept Analysis, Mathematical Foundation*. Springer–Verlag, Berlin 1999.
- [7] S. Krajčí: A generalized concept lattice. *Logic J. of the IGPL* 13 (2005), 5, 543–550.

- [8] S. Krajčí: The basic theorem on generalized concept lattice. In: Proc. 2nd Internat. Workshop CLA 2004 (V. Snášel and R. Bělohlávek, eds.), Ostrava 2004, pp. 25–33.
- [9] S. Krajčí: Every concept lattice with hedges is isomorphic to some generalized concept lattice. In: Proc. 3rd Internat. Workshop CLA 2004 (R. Bělohlávek and V. Snášel, eds.), Olomouc 2005, pp. 1–9.
- [10] S. Krajčí: Cluster based efficient generation of fuzzy concepts. *Neural Network World* 13 (2003), 5, 521–530.
- [11] S. Pollandt: *Fuzzy Begriffe*. Springer–Verlag, Berlin 1997.
- [12] S. Pollandt: Datenanalyse mit Fuzzy–Begriffen. In: *Begriffliche Wissensverarbeitung, Methoden und Anwendungen* (G. Stumme and R. Wille, eds.), Springer–Verlag, Heidelberg 2000, pp. 72–98.
- [13] A. Shostak: Fuzzy categories versus categories of fuzzily structured sets: Elements of the theory of fuzzy categories. In: *Mathematik–Arbeitspapiere N 48: Categorical Methods in Algebra and Topology* (A collection of papers in honor of Horst Herrlich, Hans-E. Porst, ed.), Bremen 1977, pp. 407–438.
- [14] G. Q. Zhang: Chu spaces, concept lattices, and domains. In: *Proc. Nineteenth Conference on the Mathematical Foundations of Programming Semantics, Montreal 2003*, *Electronic Notes in Theoretical Computer Science* 83, 2004.