Some optimization methods for non-monotonic reasoning in System **P**

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System **P**, introduced by Kraus, Lehman and Magidor [4], represents a core of various default systems. Reasoning in System **P** can be modeled by a logic with approximate conditional probabilities [7]. This probabilistic logic enriches classical propositional calculus with binary probabilistic operators which are applied to propositional formulas: $\mathrm{CP}_{\geqslant s}(\alpha, \beta)$, $\mathrm{CP}_{\leqslant s}(\alpha, \beta)$ and $\mathrm{CP}_{\approx s}(\alpha, \beta)$, with the intended meaning that the conditional probability of α given β is "at least s", "at most s" and "approximately s", respectively. It was shown that formulas $\mathrm{CP}_{\approx 1}(\alpha, \beta)$ can be used to model defaults of the form: "if β, then generally α".

Satisfiability problem for a set of defaults can be converted to a satisfiability problem for a probabilistic formula in a logic mention above. That problem can be reduced to a system of linear inequalities, and as such a number of different methods can be used for its solving. The main contributions of this paper are development of methodology for using optimization methods to solve the considered problem and presentation of the obtained results.

References

[1] S. Benferhat, A.Saffiotti and P. Smets, Belief functions and default reasoning, Artificial Intelligence **122**(1) (2000), 1–69.

[2] R. Fagin, J.Y. Halpern and N. Megiddo, A logic for reasoning about probabilities, Inform. and Comput. **87**(1) (1990), 78–128.

[3] D. Kavvadias and C. Papadimitriou, A linear programming approach to reasoning about probabilities, Ann. Math. Artif. Intell. **1**(1-4) (1990), 189–205.

[4] S. Kraus, D. Lehmann and M. Magidor, Nonmonotonic reasoning, preferential models and cumulative logics, Artificial intelligence **44**(1) (1990), 167–207.

[5] S. Krčevinac, M. Čangalović, V. Kovačevic-Vujčić, M. Martić and M. Vujošević, Operaciona istrazivanja, Fakultet Organizacionih Nauka, Beograd, 2004.

[6] J. A. Nelder and R. Mead, A simplex method for function minimization, The Computer Journal **7**(4) (1965), 308–313.

[7] M. Rašković, Z. Marković and Z. Ognjanović, A logic with approximate conditional probabilities that can model default reasoning, Internat. J. Approx. Reason. **49**(1) (2008), 52–66.

[8] T. Stojanović, T. Davidović and Z. Ognjanović, Bee colony optimization for the satisfiability problem in probabilistic logic, Applied Soft Computing **31** (2015), 339–347.