

Rybakov, Vladimir

Inference rules in multi-agents' temporal logics. (English) [Zbl 1216.68273](#)

Nguyen, Ngoc Thanh (ed.), Transactions on Computational Collective Intelligence IV. Berlin: Springer (ISBN 978-3-642-21883-5/pbk). Lecture Notes in Computer Science 6660. Lecture Notes in Artificial Intelligence. Journal Subline, 160-176 (2011).

Summary: The aim of this paper is to work out a framework for computational inference rules valid in agents temporal logics. Coordinated, rational actions of agents use logical reasoning – derivations (in order to predict results). As a tool describing the human reasoning procedure, we suggest valid inference rules (valid semantically, in Kripke-like frames generating logic). Our paper studies inference rules valid in temporal agents logics admitting various representations of time, in particular, we consider logics with linear and branching intransitive time. We suggest algorithms which allow one to compute valid inference rules in agents liner time logics \mathcal{LTL}_K and $\mathcal{LTL}_K(Z)$, agents logic with branching intransitive time \mathcal{L}_{TA_i} , and the logic with branching transitive time \mathcal{L}_{TA_t} .

For the entire collection see [\[Zbl 1217.68015\]](#).

MSC:

[68T27](#) Logic in artificial intelligence

[68T42](#) Agent technology and artificial intelligence

Keywords:

[multi-agents logic](#); [temporal logic](#); [linear temporal logic](#); [inference rules](#); [valid inference rules](#)

Full Text: [DOI](#)

References:

- [1] van Benthem, J.: The Logic of Time.- A Model-Theoretic Investigation into the Varieties Temporal Ontology and Temporal Discourse. Kluwer, Dordrecht (1991) · [Zbl 0758.03012](#)
- [2] van Benthem, J.: Modality, bisimulation and interpolation in infinitary logic. Ann. Pure Appl. Logic~96 (1999) · [Zbl 0923.03048](#) · [doi:10.1016/S0168-0072\(98\)00029-3](#)
- [3] Gabbay, D.M., Schlechta, K.: A theory of hierarchical consequence and conditionals. Journal of Logic, Language and Information~19(1), 3–32 (2010) · [Zbl 1193.03037](#) · [doi:10.1007/s10849-009-9096-7](#)
- [4] Gabbay, D.M., Rodrigues, O., Pigozzi, G.: Connections between belief revision, belief merging and social choice. J. Log. Comput.~19(3), 445–446 (2009) · [doi:10.1093/logcom/exn013](#)
- [5] Gabbay, D., Kurucz, A., Wolter, F., Zakharyashev, M.: Stud. Logic Found. Math. Elsevier Sci. Publ, Noth-Holland (2003)
- [6] Hodkinson, I., Montanari, A., Sciavicco, G.: Non-finite axiomatizability and undecidability of interval temporal logics with C, D, and T. In: Kaminski, M., Martini, S. (eds.) CSL 2008. LNCS, vol.~5213, pp. 308–322. Springer, Heidelberg (2008) · [Zbl 1156.03321](#) · [doi:10.1007/978-3-540-87531-4_23](#)
- [7] Hodkinson, I.M.: Complexity of monodic guarded fragments over linear and real time. Ann. Pure Appl. Logic~138(1-3), 94–125 (2006) · [Zbl 1093.03009](#) · [doi:10.1016/j.apal.2005.06.007](#)
- [8] Hodkinson, I., Woter, F., Zakharyashev, M.: Undecidable fragments of first-order branching time logic. In: LICS 2002, pp. 393–402 (2002)
- [9] Hodkinson, I.: Temporal logic and automata. In: Temporal Logic: Math. Found. and Comp. Asp., vol.~2, ch. 2, pp. 30–72. Clarendon Press, Oxford (2000)
- [10] Fagin, R., Halpern, J., Moses, Y., Vardi, M.: Reasoning About Knowledge. The MIT Press, Cambridge (1995) · [Zbl 0839.68095](#)
- [11] Halpern, J., Shore, R.: Reasoning about common knowledge with infinitely many agents. Information and Computation~191(1), 1–40 (2004) · [Zbl 1078.03014](#) · [doi:10.1016/j.ic.2004.01.003](#)
- [12] Schmidt, R., Tishkovsky, D.: Multi-agent dynamic logics with informational test. Annals of Mathematics and Artificial Intelligence~42(1-3), 5–36 (2004) · [Zbl 1059.68131](#) · [doi:10.1023/B:AMAI.0000034521.22009.8d](#)
- [13] Hintikka, J., Vandamme, F.: Logic of Discovery and Logic of Discourse. Springer, Heidelberg (1986)
- [14] Pnueli, A.: The temporal logic of programs. In: Proc. of the 18th Annual Symp. on Foundations of Computer Science, pp. 46–57. IEEE, Los Alamitos (1977)

- [15] Manna, Z., Pnueli, A.: Temporal Verification of Reactive Systems: Safety. Springer, Heidelberg (1995) · Zbl 1288.68169 · doi:10.1007/978-1-4612-4222-2
- [16] Manna, Z., Pnueli, A.: The Temporal Logic of Reactive and Concurrent Systems: Specification. Springer, Heidelberg (1992) · Zbl 0753.68003 · doi:10.1007/978-1-4612-0931-7
- [17] Clarke, E., Grumberg, O., Hamaguchi, K.P.: Another look at ltl model checking. In: Dill, D.L. (ed.) CAV 1994. LNCS, vol. 7818. Springer, Heidelberg (1994) · doi:10.1007/3-540-58179-0_72
- [18] Daniele, M., Giunchiglia, F., Vardi, M.Y.: Improved automata generation for linear temporal logic. In: Halbawachs, N., Peled, D.A. (eds.) CAV 1999. LNCS, vol. 1633, pp. 249–260. Springer, Heidelberg (1999) · Zbl 1046.68588 · doi:10.1007/3-540-48683-6_23
- [19] Vardi, M.: An automata-theoretic approach to linear temporal logic. In: Proceedings of the Banff Workshop on Knowledge Acquisition, Banff 1994 (1994)
- [20] van Benthem, J.: The Logic of Time. Kluwer, Dordrecht (1991) · Zbl 0758.03012 · doi:10.1007/978-94-015-7947-6
- [21] van Benthem, J., Bergstra, J.: Logic of transition systems. Journal of Logic, Language and Information 3(4), 247–283 (1994) · Zbl 0827.03019 · doi:10.1007/BF01160018
- [22] Goldblatt, R.: Logics of Time and Computation. CSLI Lecture Notes, vol. 7 (1992) · Zbl 0635.03024
- [23] Gabbay, D., Hodkinson, I.: An axiomatisation of the temporal logic with until and since over the real numbers. Journal of Logic and Computation 1(2), 229–260 (1990) · Zbl 0744.03018 · doi:10.1093/logcom/1.2.229
- [24] Hodkinson, I.: Temporal Logic. In: Gabbay, D.M., Reynolds, M.A., Finger, M. (eds.) Temporal Logic and Automata, vol. 2, ch. II, pp. 30–72. Clarendon Press, Oxford (2000)
- [25] Rybakov, V.: Logical consecutions in discrete linear temporal logic. Journal of Symbolic Logic 70(4), 1137–1149 (2005) · Zbl 1110.03010 · doi:10.2178/jsl/1129642119
- [26] Rybakov, V.: Logical consecutions in intransitive temporal linear logic of finite intervals. Journal of Logic Computation 15(5), 633–657 (2005) · Zbl 1091.03002 · doi:10.1093/logcom/exi025
- [27] Rybakov, V.: Until-Since Temporal Logic Based on Parallel Time with Common Past. Deciding Algorithms. In: Artemov, S., Nerode, A. (eds.) LFCS 2007. LNCS, vol. 4514, pp. 486–497. Springer, Heidelberg (2007) · Zbl 1132.03324 · doi:10.1007/978-3-540-72734-7_34
- [28] Bordini, R.H., Fisher, M., Visser, W., Wooldridge, M.: Model checking rational agents. IEEE Intelligent Systems 19, 46–52 (2004) · Zbl 05095446 · doi:10.1109/MIS.2004.47
- [29] Dix, J., Fisher, M., Levesque, H., Sterling, L.: Editorial. Annals of Mathematics and Artificial Intelligence 41(2-4), 131–133 (2004) · doi:10.1023/B:AMAI.0000031230.18901.7b
- [30] van der Hoek, W., Wooldridge, M.: Towards a logic of rational agency. Logic Journal of the IGPL 11(2), 133–157 (2003) · Zbl 1029.03014 · doi:10.1093/jigpal/11.2.133
- [31] Fisher, M.: Temporal development methods for agent-based systems. Journal of Autonomous Agents and Multi-Agent Systems 10(1), 41–66 (2005) · Zbl 05387381 · doi:10.1007/s10458-004-3140-4
- [32] Hendler, J.: Agents and the semantic web. IEEE Intelligent Systems 16(2), 30–37 (2001) · Zbl 05094542 · doi:10.1109/5254.920597
- [33] Kacprzak, M.: Undecidability of a multi-agent logic. Fundamenta Informaticae 45(2-3), 213–220 (2003) · Zbl 1041.03024
- [34] Wooldridge, M.J., Weiß, G., Ciancarini, P. (eds.): AOSE 2001. LNCS, vol. 2222. Springer, Heidelberg (2002) · Zbl 0983.68771
- [35] Fagin, R., Geanakoplos, J., Halpern, J., Vardi, M.J.: The hierarchical approach to modeling knowledge and common knowledge. International Journal of Game Theory 28(3), 331–365 (1999) · Zbl 1061.68556 · doi:10.1007/s001820050114
- [36] Babenyshv, S., Rybakov, V.: A framework to compute inference rules valid in agents’ temporal logics. In: Setchi, R., Jordanov, I., Howlett, R.J., Jain, L.C. (eds.) KES 2010. LNCS (LNAI), vol. 6276, pp. 230–239. Springer, Heidelberg (2010) · Zbl 05821636 · doi:10.1007/978-3-642-15387-7_27
- [37] Rybakov, V.: Logic of discovery in uncertain situations—deciding algorithms. In: Apolloni, B., Howlett, R.J., Jain, L. (eds.) KES 2007, Part II. LNCS (LNAI), vol. 4693, pp. 950–958. Springer, Heidelberg (2007) · doi:10.1007/978-3-540-74827-4_119
- [38] Babenyshv, S., Rybakov, V.: Decidability of hybrid logic with local common knowledge based on linear temporal logic LTL. In: Beckmann, A., Dimitracopoulos, C., Löwe, B. (eds.) CiE 2008. LNCS, vol. 5028, pp. 32–41. Springer, Heidelberg (2008) · Zbl 1142.03323 · doi:10.1007/978-3-540-69407-6_4
- [39] Babenyshv, S., Rybakov, V.: Describing evolutions of multi-agent systems. In: Velásquez, J.D., Ríos, S.A., Howlett, R.J., Jain, L.C. (eds.) KES 2009. LNCS (LNAI), vol. 5711, pp. 38–45. Springer, Heidelberg (2009) · Zbl 05611578 · doi:10.1007/978-3-642-04595-0_5
- [40] Rybakov, V.: Linear temporal logic K extended by multi-agent logic K_n with interacting agents. J. of Logic Computation 19, 989–1017 (2009) · Zbl 1208.03023 · doi:10.1093/logcom/exp027
- [41] Rybakov, V.: Rules of inference with parameters for intuitionistic logic. Journal of Symbolic Logic 57(3), 912–923 (1992) · Zbl 0788.03007 · doi:10.2307/2275439
- [42] Rybakov, V.: Admissible Logical Inference Rules. Studies in Logic and the Foundations of Mathematics, vol. 136. Elsevier Sci. Publ., North-Holland (1997) · Zbl 0872.03002

This reference list is based on information provided by the publisher or from digital mathematics libraries. Its items are heuristically matched to zbMATH identifiers and may contain data conversion errors. It attempts to reflect the references listed in the original paper as accurately as possible without claiming the completeness or perfect precision of the matching.