UNIVERSITY of GUELPH

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SCHOOL OF COMPUTER SCIENCE

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Privacy Sensitive Environment Decomposition for Hypertree Agent Organization Construction

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ABSTRACT:

Cooperative multiagent systems form an active area of research and practice in AI and software engineering. Decentralized probabilistic reasoning, constraint reasoning, and decision-theoretic reasoning are essential tasks of cooperative multiagent systems. Several frameworks for these tasks organize agents into a junction tree (JT). The JT agent organization has a number of computational advantages, including agent privacy during inference computation. During construction of the JT organization, however, many existing frameworks utilize construction algorithms that leak the agent privacy, which typically involves proprietary knowledge of the agent developer, including private variables, variables shared between pairs of agents, and agent identities and adjacencies. One exception is the HTBS algorithm, which constructs a JT organization if one exists without disclosing such private information. A limitation of the HTBS algorithm is that if no JT exists in the given agent environment decomposition, it can only recognize the non-existence. A novel algorithm suite DAER (Distributed Agent Environment Re-decomposition) is proposed to overcome the limitation of HTBS by re-decomposing the environment to construct a JT agent organization. The existing algorithms that construct a JT agent organization when no JT exist in the given decomposition incur privacy loss in all types of agent privacy while DAER suffers no loss of privacy on private variables. Moreover, DAER has been evaluated in comparison with the existing algorithms demonstrating significantly lower privacy loss.