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Consensus-based Application in Networked Systems: Privacy-Preserving Data Aggregation

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Abstract:

Privacy-preserving data aggregation in networked systems is a challenging problem, considering the distributed communication and control requirement, dynamic network topology, unreliable communication links, etc. The difficulty is exaggerated when there exist dishonest nodes, and how to ensure privacy, accuracy, and robustness against dishonest nodes remains an open issue. Different from the widely used cryptographic approaches, in this paper, we address this challenging problem by exploiting the distributed consensus technique. We first propose a secure consensus-based data aggregation (SCDA) algorithm that guarantees an accurate sum aggregation while preserving the privacy of sensitive data. Then, to mitigate the pollution from dishonest nodes, we propose an Enhanced SCDA (E-SCDA) algorithm that allows neighbours to detect dishonest nodes, and derive the error bound when there are undetectable dishonest nodes. We prove that both SCDA and E-SCDA have an exponentially fast convergence rate and both of them are -privacy algorithms. Extensive simulations have shown that the proposed algorithms have high accuracy and low complexity, and they are robust against network dynamics and dishonest nodes.

Biography:

Jianping He (M'15) received the Ph.D. degree in control science and engineering from Zhejiang University, Hangzhou, China, in 2013. He is currently a senior Research Fellow with the Department of Electrical and Computer Engineering, University of Victoria, Victoria, BC, Canada. He is a member of the Networked Sensing and Control Group, Zhejiang University. His current research interests include the control and optimization of cyber-physical systems, the scheduling and optimization in VANETs and social networks, and the investment decision in financial market and electricity market. Dr. He serves as an Associate Editor for the KSII Transactions on Internet and Information Systems. He is also a Guest Editor of the International Journal of Robust and Nonlinear Control and the International Journal of Distributed Senor Networks.