Department of Computer Science
香港城市大學
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COMPUTER SCIENCE COLLOQUIUM

Adaptive Privacy-Preserving Coded Computing With Hierarchical Task Partitioning

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ABSTRACT

Distributed computing is known as an emerging and efficient technique to support various intelligent services, such as large-scale machine learning. However, random delays from straggling servers and concerns about privacy leakage pose significant challenges. To address these issues, coded computing, a promising solution that combines coding theory with distributed computing, recovers computation tasks with results from a subset of workers. In this talk, we introduce Adaptive Privacy-Preserving Coded Computing (APCC), a strategy that provides accurate or approximated computing results based on computation function types. APCC ensures complete data privacy preservation and achieves optimal encoding rates, defined as the ratio between the computation loads of tasks before and after encoding. To mitigate straggling effects and reduce delays, we incorporate hierarchical task partitioning and task cancellation into APCC, solved as Mixed-Integer Nonlinear Programming (MINLP) problems with our low-complexity Maximum Value Descent (MVD) algorithm. Simulation results demonstrate a 42.9% reduction in task completion delay compared to other SOTA coded computing strategies. Furthermore, we model the task assignment and computation process as an M/G/1(FCFS) queueing system, considering communication imperfections and computation heterogeneity. We formulate and simplify similar MINLP problems using Markov's inequality. Two near-optimal and low-complexity iterative update algorithms are proposed, which significantly reduce task completion delays.

BIOGRAPHY

Sheng Zhou, received the B.E. and Ph.D. degrees in electronic engineering from Tsinghua University, Beijing, China, in 2005 and 2011, respectively. In 2010, he was a Visiting Student with the Wireless System Lab, Department of Electrical Engineering, Stanford University, Stanford, CA, USA. From 2014 to 2015, he was a Visiting Researcher with the Central Research Lab, Hitachi Ltd., Japan. He is currently an Associate Professor with the Department of Electronic Engineering, Tsinghua University. His research interests include cross-layer design for multiple antenna systems, mobile edge computing, vehicular networks, and green wireless communications. He received the IEEE ComSoc Asia–Pacific Board Outstanding Young Researcher Award in 2017, and IEEE ComSoc Wireless Communications Technical Committee Outstanding Young Researcher Award in 2020.

All are welcome!

In case of questions, please contact Linqi Song at linqi.song@cityu.edu.hk, or visit the CS Departmental Seminar Web at https://www.cs.cityu.edu.hk/events/cs-seminars/recent-cs-colloquiums.