Parallel Machine Learning Approaches for Reverse Engineering Genome-Scale Networks

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Abstract

Reverse engineering whole-genome networks from large-scale gene expression measurements and analyzing them to extract biologically valid hypotheses are important challenges in systems biology. While simpler models easily scale to large number of genes and gene expression datasets, more accurate models are compute intensive limiting their scale of applicability. In this talk, I will present our research on the development of parallel mutual information and Bayesian network based structure learning methods to eliminate such bottlenecks and facilitate genome-scale network inference. As a demonstration, we reconstructed genome-scale networks of the model plant Arabidopsis thaliana from 11,700 microarray experiments using 1.57 million cores of the Tianhe-2 Supercomputer. Such networks can be used as a guide to predicting gene function and extracting context-specific subnetworks.

Biography

Srinivas Aluru is a professor in the School of Computational Science and Engineering at Georgia Institute of Technology. He co-directs the Georgia Tech Strategic Initiative in Data Engineering and Science, and co-leads the NSF South Big Data Regional Innovation Hub. Earlier, he held faculty positions at Iowa State University, Indian Institute of Technology, New Mexico State University, and Syracuse University. Aluru conducts research in high performance computing, bioinformatics and systems biology, combinatorial scientific computing, and applied algorithms. He pioneered the development of parallel methods in computational biology, and contributed to the assembly and analysis of complex plant genomes.

Aluru serves on the editorial boards of the IEEE Transactions on Big Data, IEEE Transactions on Parallel and Distributed Systems, Journal of Parallel and Distributed Computing, and the International Journal of Data Mining and Bioinformatics. He is currently serving as the Chair of the ACM Special Interest Group on Bioinformatics, Computational Biology and Biomedical Informatics (SIGBIO). Aluru is a recipient of the NSF Career award, IBM faculty award, Swarnajayanti Fellowship from the Government of India, the mid-career and outstanding research achievement awards from Iowa State University, and the College of Computing Dean’s award for faculty excellence at Georgia Tech. He is a Fellow of the American Association for the Advancement of Science (AAAS) and the Institute of Electrical and Electronics Engineers (IEEE).