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Department of Mathematics

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**A framework for scalable parameter estimation of gene circuit
models using structural information**

By

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Date: 22 July 2015 (Wednesday)

Time: 10:30 a.m. - 11:30 a.m.

Venue: E11- 1006

Abstract

Systematic and scalable parameter estimation is a key to construct complex gene regulatory models and to ultimately facilitate an integrative systems biology approach to quantitatively understand the molecular mechanisms underpinning gene regulation. We propose a novel framework for efficient and scalable parameter estimation that focuses specifically on modeling of gene circuits. Exploiting the structure commonly found in gene circuit models, this framework decomposes a system of coupled rate equations into individual ones and efficiently integrates them separately to reconstruct the mean time evolution of the gene products. The accuracy of the parameters is refined by iteratively increasing the accuracy of numerical integration using the model structure. Since it avoids a computationally expensive search in a global parameter space, this framework can make the parameter estimation of large-scale gene circuit models feasible. As a case study, we applied our framework to four gene circuit models with complex dynamics and found that the quality and the efficiency of estimates were substantially improved with the use of the new framework. We compared our framework to three of the state-of-the-art parameter estimation methods and found that it generated more accurate and consistent estimates. While many general-purpose parameter estimation methods have been applied for modeling of gene circuits, our results suggest that the use of more tailored approaches to employ domain specific information may be a key to reverse-engineering of complex biological systems.

Biography

Dr. Gao is an assistant professor in Computer, Electrical and Mathematical Sciences and Engineering Division at King Abdullah University of Science and Technology (KAUST), and an adjunct faculty member at University of Waterloo. He leads the Structural and Functional Bioinformatics group at KAUST. Before he moved to KAUST, he was a Lane Fellow in Lane Center for Computational Biology in School of Computer Science at Carnegie Mellon University, US. He received the Ph.D. degree in Computer Science from the University of Waterloo in 2009, and the B.Sc. degree in Computer Science from Tsinghua University, China in 2004. His research interests are to build computational models, design efficient and effective algorithms, and develop machine learning techniques to solve key open problems in structural biology and synthetic biology.

All are Welcome!

FST Seminar - MAT - “A framework for scalable parameter estimation of gene circuit models using structural information” at 10:30am on 22 July 2015 (Wednesday), E11-1006