





Detecting the Tipping Points from Inflammation to Tumorigenesis Using A Multi-level Network Modeling Approach

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OBJECTIVES

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- 1. To detect tipping points by identifying "dynamical network biomarker" at molecular network level by analysing the 'omics' data.
- 2. To identify potential networks associated with tipping points by constructing multi-level regulatory networks from heterogeneous data sources and performing structural analysis on evolving networks
- 3. To conduct biological experiments for validating our findings of potential networks associated with the tipping points.

HIGHLIGHTS

Disease Progression in Inflammation-Induced Tumorigenesis

- Chronic inflammation plays an important role in the progression of inflammation-induced tumorigenesis (e.g., Hepatocellular carcinoma)
- Cancer patients with tumor status have poor prognoses (thus hard to control)
- Effective ways to detect the tipping points from inflammation to tumor are essential



Inflammation-Induced Tumorigenesis Progression

The Road Map and Our Current Results



- Currently, we are working on inferring multi-level regulatory networks from heterogeneous data sources.
- We collected microarray datasets for liver cancer progression at four different stages. We also collected the TF-gene interaction and proteinprotein interaction data.

GSE_ID	Platform	Normal	Hepatitis	Cirrhosis	Hepatocellular carcinoma
GSE42697	GPL570		12		
GSE19665	GPL570	10			5
GSE41804	GPL570	20			20
GSE14323	GPL96/GPL571	19		58	47
GSE62232	GPL570	5			9
GSE7123	GPL96		59		
GSE17548	GPL570			20	
Total (284)		54	71	78	81

 We proposed a matrix factorization approach for inferring gene regulatory networks at different stages



Ongoing Works

- Evaluate the performance of the proposed matrix factorization approach for inferring gene regulatory network from data at different stages of liver disease progression
- Explore and integrate deep learning methodologies for performance enhancement
- Develop methodologies to identify salient structural changes of the regulatory networks to signify the tipping point from Inflammation to Tumorigenesis