Self-organized criticality models with ever expressed genes for gene regulatory networks

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Abstract

Based on Bornholdt-Roehlf model [1, 2] and three experimental ingredients [3, 4, 5, 6, 7, 8, 9, 10]: the fraction r of ever expressed genes(EEG), hierarchical levels of gene regulatory networks (GRN) and co-regulation from both EEG and local genes, we propose a more realistic model of GRN. Large scale simulations on N nodes with different initial degrees or configurations reveal the convergence of the model with both average degrees $< k >$ and degree distributions $p(k)$ which cover empirical data not reachable by the model of [1, 2]. Moreover, $< k(r) >$ increases with the observable r, which outperforms the dropping of $< k(N) >$ from SOC, and r determines the universality of it by variable power-law exponents of $< k(N) >$ and critical degrees k_c.

Keyword: self-organized criticality, gene regulatory network, ever expressed genes

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