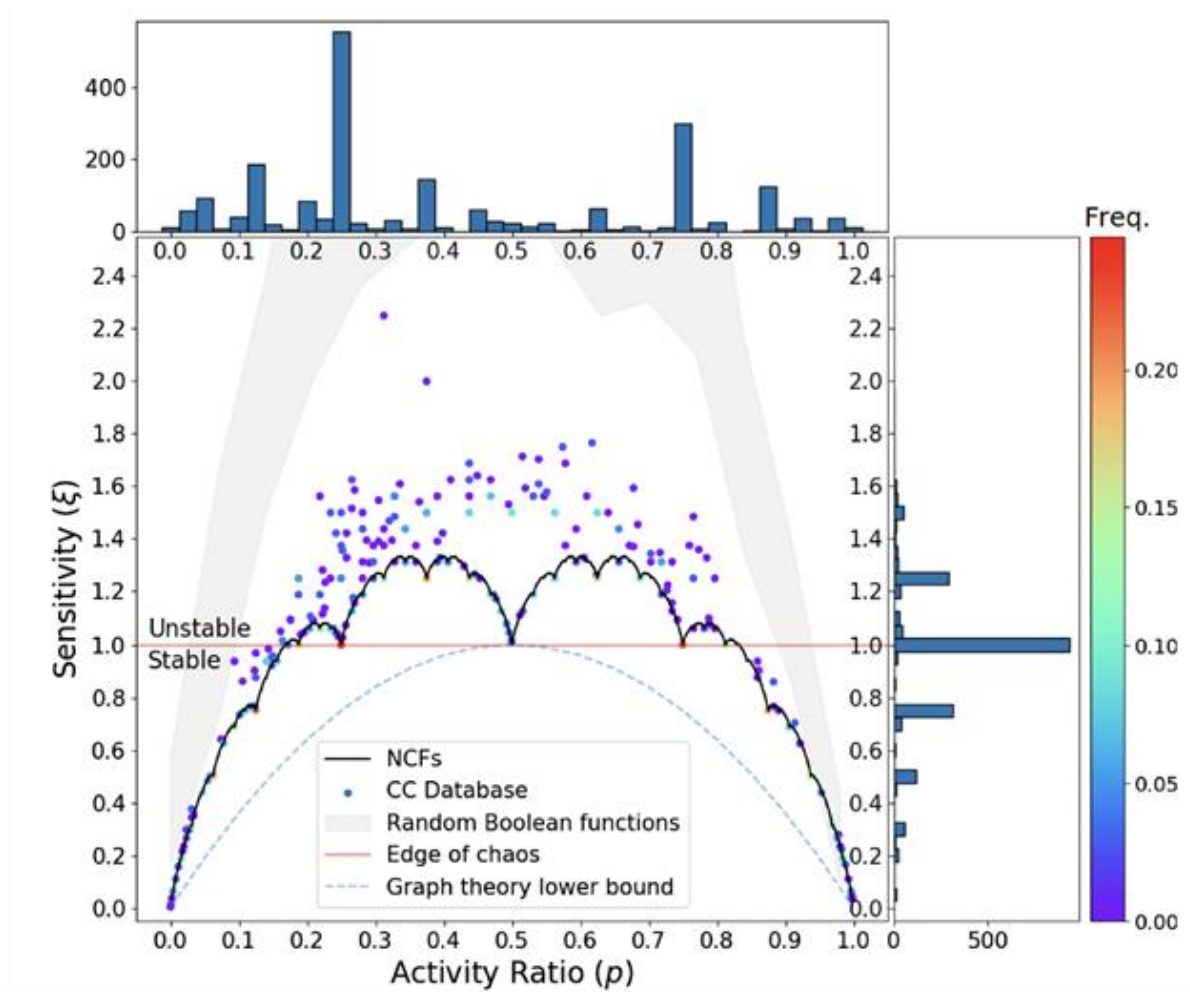


Criticality of gene regulation networks and an exact bound on stability of Boolean systems

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We prove that nested canalizing functions are the minimum-sensitivity Boolean functions for any activity ratio and we determine the functional form of this boundary which has a nontrivial fractal structure. We further observe that the majority of the gene regulatory functions found in known biological networks (submitted to the Cell Collective database) lie on the line of minimum sensitivity which paradoxically remains largely in the unstable regime. Our results provide a quantitative basis for the argument that an evolutionary preference for nested canalizing functions in gene regulation (e.g., for higher robustness) and for plasticity of gene activity are sufficient for concentration of such systems near the “edge of chaos.”



References

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