Complexity of regulatory logic and dynamics of Boolean models of biological networks

By

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As members of the Viva Voce Committee, we certify that we have read the dissertation prepared by **Priyotosh Sil** entitled: "*Complexity of regulatory logic and dynamics of Boolean models of biological networks*" and recommend that it may be accepted as fulfilling the dissertation requirement for the Degree of Doctor of Philosophy.

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Declaration

I, hereby declare that the investigation presented in this thesis has been carried out by me. The work is original and has not been submitted earlier as a whole or in part for a degree or diploma at this or any other Institution or University.

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Oral or Poster presentations

1. Poster presentation titled *Critical assessment of measures to quantify relative stability of states in Boolean models of developmental gene regulatory networks* at the Conference on Nonlinear Systems and Dynamics (CNSD) 2022 held at the Indian Institute of Science Education and Research (IISER) Pune, India, from 15-18 December 2022.
2. Poster presentation titled *Leveraging developmental landscapes for model selection in Boolean gene regulatory networks* at the IMSc60 - Celebrating 60 Years of Creative Science held at the Institute of Mathematical Sciences (IMSc), Chennai, India, from 2-5 January 2023.
3. Poster presentation titled *Leveraging developmental landscapes for model selection in Boolean gene regulatory networks* at the Big Data Algorithms for Biology (BD-Bio) 2023 held at the Indian Institute of Science (IISc), Bengaluru, India, from 2-3 June 2023.
4. Poster presentation titled *Leveraging developmental landscapes for model selection in Boolean gene regulatory networks* at the Network Biology Day held at the Institute of Mathematical Sciences (IMSc), Chennai, India, on 20 July 2023.
5. Poster presentation titled *Biologically meaningful regulatory logic enhances the convergence rate in Boolean networks and bushiness of their state transition graphs* at the Perspectives in Nonlinear Dynamics (PNLD) 2023 held at the Indian Institute of Technology (IIT) Madras, India, from 1-4 August 2023.
6. Oral presentation titled *Adapting concepts from cellular automata to explore bushiness and convergence in Boolean network dynamics* and poster presentation titled *Biologically meaningful regulatory logic enhances the convergence rate in Boolean networks and bushiness of their state transition graph* at the Modelling and Tackling Complex Biological Systems held at the Institute of Mathematical Sciences (IMSc), Chennai, India, from 13-14 October 2023.
7. Poster presentation titled *Biologically meaningful regulatory logic enhances the*

convergence rate in Boolean networks and bushiness of their state transition graphs at the Stochasticity and Plasticity in living Systems held at Sakleshpur, Karnataka, India (organized by National Centre for Biological Sciences (NCBS), Bengaluru), from 14-18 November 2023.

8. Poster presentation titled *Biologically meaningful regulatory logic enhances the convergence rate in Boolean networks and bushiness of their state transition graphs* at the Contemporary Perspectives in Computational Biology held at the Institute of Mathematical Sciences (IMSc), Chennai, India, from 19-20 February 2024.
9. Oral presentation titled *Adapting concepts from cellular automata to explore bushiness and convergence in Boolean network dynamics* and poster presentation titled *Biologically meaningful regulatory logic enhances the convergence rate in Boolean networks and bushiness of their state transition graphs* at the Theoretical Approaches in Cancer Progression and Treatment held at the International Centre for Theoretical Sciences (ICTS), Bengaluru, India, from 11-22 March 2024.
10. Oral presentation titled *Effect of biologically meaningful functions on the bushiness and convergence of Boolean state transition graphs* at the Symposium on Synthetic and Systems Biology (BioSynSys) 2024 held at the University of Montpellier, Montpellier, France, from 5-7 June 2024.
11. Poster presentation titled *Biologically meaningful regulatory logic enhances the convergence rate in Boolean networks and bushiness of their state transition graphs* at the European Conference on Mathematical and Theoretical Biology (ECMTB'24) held at the University of Castilla La Mancha (UCLM), Toledo, Spain, from 22-26 July 2024.
12. Oral presentation titled *Biologically meaningful regulatory logic enhances the convergence rate in Boolean networks and bushiness of their state transition graphs* at the NetSciX 2025 International School and Conference on Network Science held at the Indian Institute of Technology (IIT) Indore, Indore, India, from 15-17 January 2025.

13. Flash talk titled *Not all logic rules are equal: Biologically meaningful rules shape dynamics differently from random ones* and poster presentation titled *Biologically meaningful regulatory logic enhances the convergence rate in Boolean networks and bushiness of their state transition graph* at the 47^{th} Indian Biophysical Society Meeting (IBS 2025) held at the Indian Institute of Technology (IIT) Madras, India, from 6-9 March 2025. (**Received a Flash talk prize**).
14. Poster presentation titled *Simple Threshold-based Boolean Rules Fall Short in Capturing Biological Regulatory Network Dynamics* at Modelling and Tackling Complex Biological Systems 2.0 held at he Institute of Mathematical Sciences (IMSc), Chennai, India, from 16-18 February 2026.
15. Poster presentation titled *Biologically Meaningful Regulatory Logic Enhances the Convergence Rate in Boolean Networks and Bushiness of Their State Transition Graph* at 2nd Bonn Conference on Mathematical Life Sciences held at Bonn Center for Mathematical Life Sciences (BCML), Bonn, Germany, from 16-19 March 2026.
16. Oral presentation titled *Biologically meaningful regulatory logic enhances the convergence rate in Boolean networks and bushiness of their state transition graphs* at 4th International Conference on Recent Advances in Applied Mathematics held at the Indian Institute of Technology (IIT) Hyderabad, India, from 6-8 July 2026.

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