

Saptarshi Biswas

Ph.D. Candidate, Department of Computer Science, Iowa State University
Graduate Student Contributor, Ames National Laboratory

sbiswas@iastate.edu | [Website](#) | [Google Scholar](#) | [GitHub](#) | [LinkedIn](#)

RESEARCH PROFILE

Ph.D. Candidate in Computer Science at Iowa State University working at the intersection of theoretical computer science, molecular programming, analog computation, theoretical AI, optimization, machine learning, and scientific discovery. My research interests include computability and complexity theory, chemical reaction networks, Oracle pointer machines, storage modification machines, analog computing, reversible computation, molecular memory, learning-rate optimization, and AI-driven scientific modeling.

RESEARCH AREAS AND INTERESTS

- Computability and Complexity Theory
- Molecular Programming and Chemical Reaction Networks
- Theoretical AI and Optimization
- Molecular Memory and DNA Data Storage
- Cryptography and Reversible Computing
- Analog Computing and Dynamical Systems
- Oracle Pointer Machines and Storage Modification Machines
- Machine Learning and Deep Learning
- Quantum Computing and Information Theory
- Scientific Machine Learning and Materials Informatics

EDUCATION

Ph.D. in Computer Science Jan 2021 – Present
Department of Computer Science, Iowa State University, Ames, IA

M.S. in Computer Science May 2024 – May 2025
Department of Computer Science, Iowa State University, Ames, IA
GPA: 3.95 / 4.00
Major Professor: Dr. Jack Lutz
Thesis: *Oracle Pointer Machines*

B.Tech. in Computer Science and Engineering Aug 2016 – Sep 2020
Meghnad Saha Institute of Technology, Kolkata, India
GPA: 8.87 / 10.00
Advisor: Dr. Subhpratik Nath

RESEARCH AND PROFESSIONAL EXPERIENCE

Graduate Research Assistant Summer 2021 – Summer 2025
Department of Computer Science, Iowa State University, Ames, IA
Research assistant of Dr. Jack Lutz and Dr. Hongyang Gao

- Investigated computability and complexity of real numbers and real functions.
- Studied theoretical models stronger than Turing machines for computing real functions.
- Developed and analyzed Oracle pointer machine models.
- Explored connections between analog computation, chemical reaction networks, and real-time simulation.
- Studied learning-rate optimization effects on meta-learning models.

Graduate Student Contributor Fall 2024 – Present
Ames National Laboratory, Ames, IA
Student researcher advised by Dr. Prashant Singh

- Investigating machine learning and clustering approaches for magnetocaloric materials.
- Developing reliable AI/ML practices for magnetocalorimetry.
- Designing visualizations and presentations for scientific communication.

Decision Scientist Intern

Sep 2024 – Jan 2025; May 2025 – Jan 2026; May 2026 – Jul 2026

SoilSerdem, Ames, IA

- Worked on environmental, agronomic, geospatial, and remote-sensing data science.
- Developed machine learning models and software applications for agronomic problems.
- Analyzed Landsat-8/9 imagery, digital elevation models, soil data, and environmental datasets.

Data Science Intern

May 2024 – Aug 2024

SoilSerdem, Ames, IA

- Validated environmental data models using spatial and non-spatial datasets.
- Applied supervised and unsupervised learning for environmental modeling.
- Produced reports and visualizations summarizing model performance and findings.

Undergraduate Student Researcher

Spring 2018 – Summer 2020

Meghnad Saha Institute of Technology, Kolkata, India

- Developed metaheuristic frameworks for rectilinear Steiner minimal tree problems.
- Investigated extended nucleic acid memory and non-standard nucleotide-based data storage.
- Contributed to research on Varibox encryption and EMBA authentication models.

SELECTED PUBLICATIONS

1. **Biswas, S.**, “Computability of Real Functions with Oracle Pointer Machines Implies Real-Time Simulation of Chemical Reaction Networks,” *Crossroads of Computability and Logic: Insights, Inspirations, and Innovations*, LNCS, Springer, pp. 175–190, 2025.
2. Nachnani, A., Li-Caldwell, K., **Biswas, S.**, Sharma, P., Ouyang, G., and Singh, P., “Interpretable machine learning-guided design of Fe-based soft magnetic alloys,” *Physical Review Materials*, vol. 9, no. 8, 2025.
3. **Biswas, S.**, Dey, S., and Nath, S., “Learning Rate Tuner with Relative Adaptation (LRT-RA): Road to Sustainable Computing,” *AppliedMath*, vol. 5, no. 1, article 8, 2025.
4. **Biswas, S.**, Dey, S., Nath, P., and Nath, S., “Cipher constrained encoding for constraint optimization in extended nucleic acid memory,” *Computational Biology and Chemistry*, vol. 99, 2022.
5. **Biswas, S.**, Nath, S., Dey, S., and Majumdar, U., “Tangent-cut optimizer on gradient descent: an approach towards Hybrid Heuristics,” *Artificial Intelligence Review*, vol. 55, no. 2, pp. 1121–1147, 2022.
6. Dey, S., Nath, P., **Biswas, S.**, Nath, S., and Ganguly, A., “Malaria detection through digital microscopic imaging using Deep Greedy Network with transfer learning,” *Journal of Medical Imaging*, vol. 8, no. 5, 2021.
7. **Biswas, S.**, Nath, S., Sing, J. K., and Sarkar, S. K., “Extended nucleic acid memory as the future of data storage technology,” *International Journal of Nano and Biomaterials*, vol. 9, no. 1–2, pp. 2–17, 2020.
8. **Biswas, S.**, Ghosh, T., and Nath, S., “Selective Run-Length Constrained Encoding Scheme on Extended Nucleic Acid Memory,” *IEEE VLSI Device Circuit and System*, pp. 148–153, 2022.
9. **Biswas, S.**, Nath, S., Sing, J. K., and Sarkar, S. K., “Storing Digital Data in Nucleic Acid Memory with Extended Genetic Alphabet,” *Devices for Integrated Circuit*, pp. 236–239, 2019.
10. Dey, S., Pal, R., and **Biswas, S.**, “Deep Learning Algorithms for Efficient Analysis of ECG Signals to Detect Heart Disorders,” in *Biosignal Processing*, IntechOpen, 2022.

Full publication list available at: <https://Sapi98.github.io/research.html>

TEACHING EXPERIENCE

Graduate Teaching Assistant

Spring 2021 – Spring 2023; Fall 2025 – Spring 2026

Department of Computer Science, Iowa State University

- COM S 531 / COM S 5310: Theory of Computation.
- COM S 4020 / 5990: Undergraduate Senior Design / M.S. Capstone.

- COM S 106: Introduction to Web Programming.

Guest Lecturer

2023 – 2026

Department of Computer Science, Iowa State University

- Guest lectures in Theory of Computation, Computational Randomness, and Computational Models of Nanoscale Self-Assembly.

ACADEMIC SERVICE AND ACTIVITIES

- Vice President, IEEE-HKN Nu Chapter, Iowa State University, 2026–Present.
- Lifetime Member, IEEE-HKN Eta Kappa Nu Honor Society, 2025–Present.
- Member, International Society for Nanoscale Science, Computation and Engineering, 2026–Present.
- Member, IEEE, IEEE Computer Society, and ACM.
- Reviewer for journals including *IEEE Transactions on Artificial Intelligence*, *SoftwareX*, *Artificial Intelligence Review*, *Scientific Reports*, *Knowledge and Information Systems*, and *Discover Applied Sciences*.
- Reviewer for IEEE conferences including DevIC, EDKCON, and IEEE VLSI DCS.
- Invited speaker on Oracle pointer machines, chemical reaction networks, and extended nucleic acid memory.

SELECTED HONORS, CERTIFICATIONS, AND PROFESSIONAL DEVELOPMENT

- Preparing Future Faculty Associate, Iowa State University, 2024.
- CIRTL Associate Level Certificate, Iowa State University, 2024.
- ISU Center for Communication Excellence Ambassador, 2024.
- Certificate in Quantum Computing Fundamentals, LinkedIn Learning, 2025.
- Certificate in Programming Foundations: Design Pattern, LinkedIn Learning, 2024.
- Deep Learning Specialization, DeepLearning.AI / Coursera, 2019.
- Machine Learning, Stanford Online / Coursera, 2018.
- Programming, Data Structures and Algorithms using Python, NPTEL / IIT Madras, 2018.

TECHNICAL SKILLS

Programming: Python, C, Java, C++, MATLAB, HTML, CSS, JavaScript, jQuery, SQL

Libraries and Tools: NumPy, Matplotlib, PyTorch, Seaborn, Pandas, Scikit-learn, SHAP, XGBoost, Qiskit

Software and Production Tools: GitHub, Visual Studio Code, Cursor, LaTeX

GIS and Remote Sensing: GDAL, GRASS, SAGA, rasterio, shapely, QGIS, GeoPandas, Digital Elevation Models, Digital Terrain Analysis

Instructional Tools: Canvas, Gradescope, Microsoft Suite, Google Classroom