

Payel Santra

SENIOR RESEARCH FELLOW

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Research Interest

My research focuses on building reliable and adaptive retrieval-centric systems in information retrieval (IR) and natural language processing (NLP). I am interested in understanding how retrieval and generation decisions should be made at a per-query level, and how these principles can be applied to reliability-critical NLP tasks. My work focuses on three key directions:

- **Query-Adaptive RAG Systems:** Designing retrieval-augmented generation systems that adapt retriever, corpus, and generation choices per query, recognizing that no single configuration is optimal across varying information needs, ambiguity, and evidence redundancy.
- **Query Performance Prediction (QPP):** Extending QPP to multi-ranker and stochastic settings to enable per-query selection, fusion, and robustness in both retrieval and LLM-driven ranking systems.
- **Reliability-Aware NLP Applications:** Developing unsupervised and weakly supervised methods for fact verification and correction, emphasizing evidence quality, minimal edits, and generalizable architectures.

Education

Indian Association for the Cultivation of Science

Pursuing PhD

• **Course works:** Big Data Analytics, Advanced Machine Learning

• **CGPA:** 9.0

• **Thesis Topic:** Bridging the Gap between Misinformation and Correction using Multimodal Neural Network

• **Thesis Advisor:** Dr. Partha Basuchowdhuri

Kolkata, India

Sep 2021 - Current

Govt. College of Education, University of Burdwan

Bachelor Of Education (B.Ed)

• CGPA 9.09

Burdwan, India

2019-21

Indian Institute of Engineering Science and Technology, Shibpur

Master of Science in Applied Mathematics

• Percentage 93.4%

Kolkata, India

2017-19

University of Burdwan (Chandernagore College)

BSc (Hons) in Mathematics

• Percentage 75.0%

Hooghly, India

2014-17

Chinsurah Balika Bani Mandir

Higher Secondary Examination

• Percentage 74.8%

Hooghly, India

2014

Chinsurah Balika Bani Mandir

Secondary Examination

• Percentage 76.0%

Hooghly, India

2012

Teaching & Supervision

Tutorial

Presented

- **Unleashing the Power of Large Language Models: A Hands-On Tutorial.** Payel Santra, Madhusudan Ghosh, Shrimon Mukherjee, Debasis Ganguly, Partha Basuchowdhuri, Sudip Kumar Naskar. **FIRE'2023:** In Proceedings of the 15th Annual Meeting of the Forum for Information Retrieval Evaluation.
- **Tutorial on introduction to Machine learning and Deep learning.** Payel Santra, Madhusudan Ghosh, Sudip Kumar Naskar. Calcutta Electric Supply Corporation Limited (CESC), Kolkata, 2024

Teaching Assistantship

Kolkata, India

Indian Association for the Cultivation of Science

- MCS 2101B: Data Structures & Algorithms (Autumn Semester 2023)
- COM 5203: Social and Complex Networks (Spring Semester 2023)
- COM 1101: Introduction to Computing (Autumn Semester 2024)
- **Technical Skills:** C, DSA, NetworkX, Gephi
- **Soft Skills:** Leadership, Time Management, Communication

PhD mentorship

Research-oriented

2024

- Jiajie Chen, University of Glasgow, with Dr. Debasis Ganguly.
- Lavisha Sharma, Indian Association for the Cultivation of Science, with Dr. Partha Basuchowdhuri.
- V. Shanmukha Sai, IIIT Dharwar (SRFP Fellow).
- Yucong Lai, University of Glasgow, with Dr. Debasis Ganguly.

Project Works

Ecotourism and fishing under the common ground of two interacting species

IIST, Shibpur, India

Masters Thesis Work under the supervision of Prof. Tapan Kumar Kar

2019 (6 months)

- In this project we have formulated a prey-predator model with ecotourism and fishing based on realistic assumptions and learned to analyze that mathematical model systematically to achieve some significant outcomes.

Topology of Metric Space

IISER, Kolkata, India

Project Work under the supervision of Dr. Saugata Bandhopadhyay

2018 (2 months)

- In this study efforts have been made to understand the nature and characterisation Metric Spaces in relation to space measure, consequences and generalization in the area of connectedness, compactness of the topology of metric space.

Publications

- **Payel Santra**, Lavisha Sharma, Madhusudan Ghosh, and Partha Basuchowdhuri. **Mask-to-Correct⁺: Leveraging Retriever Diversity for Masking-guided Faithful Fact Correction**. In *Proceedings of the 64th Annual Meeting of the Association for Computational Linguistics (Volume 1: Long Papers)*, San Diego, California, July 2026. Association for Computational Linguistics
- **Payel Santra**, Partha Basuchowdhuri, and Debasis Ganguly. **Breaking Flat: A Generalised Query Performance Prediction Evaluation Framework**. In *Advances in Information Retrieval - 48th European Conference on Information Retrieval, ECIR 2026, Delft, The Netherlands, March 30-April 1, 2026, Proceedings, Part I*. Springer, 2026
- **Payel Santra**, Partha Basuchowdhuri, and Debasis Ganguly. **Beyond Correlations: A Downstream Evaluation Framework for Query Performance Prediction**. In *Advances in Information Retrieval - 48th European Conference on Information Retrieval, ECIR 2026, Delft, The Netherlands, March 30-April 1, 2026, Proceedings, Part I*. Springer, 2026
- **Payel Santra**, Madhusudan Ghosh, Debasis Ganguly, Partha Basuchowdhuri, and Sudip Kumar Naskar. **HF-RAG: Hierarchical Fusion-based RAG with Multiple Sources and Rankers**. In *Proceedings of the 34th ACM International Conference on Information and Knowledge Management*. Association for Computing Machinery, 2025
- **Payel Santra**, Madhusudan Ghosh, Debasis Ganguly, Partha Basuchowdhuri, and Sudip Kumar Naskar. **The “Curious Case of Contexts” in Retrieval-Augmented Generation With a Combination of Labeled and Unlabeled Data**. *Wiley Interdisciplinary Reviews: Data Mining and Knowledge Discovery*, 15(2):e70021, 2025
- **Payel Santra**, Madhusudan Ghosh, Debasis Ganguly, Partha Basuchowdhuri, and Sudip Kumar Naskar. **“The Absence of Evidence is Not the Evidence of Absence”: Fact Verification via Information Retrieval-Based In-Context Learning**. In *International Conference on Big Data Analytics and Knowledge Discovery*, pages 381–387. Springer, 2024
- **Payel Santra**. **Leveraging llms for detecting and modeling the propagation of misinformation in social networks**. In *Proceedings of the 47th International ACM SIGIR Conference on Research and Development in Information Retrieval*, pages 3073–3073, 2024
- Madhusudan Ghosh, Shrimon Mukherjee, **Payel Santra**, Girish, and Partha Basuchowdhuri. **BLINK_{LSTM}: Bio Link BERT and LSTM based approach for extraction of PICO frame from Clinical Trial Text**. In *7th International Conference Data Science and Management of Data*, IIIT Bangalore, India, January 2024
- **Payel Santra**, Madhusudan Ghosh, Shrimon Mukherjee, Debasis Ganguly, Partha Basuchowdhuri, and Sudip Kumar Naskar. **Unleashing the Power of Large Language Models: A Hands-On Tutorial**. In *15th edition of the annual meeting of Forum for Information Retrieval Evaluation*, Goa University, India, December 2023
- **Payel Santra**, Madhusudan Ghosh, Debasis Ganguly, Partha Basuchowdhuri, and Sudip Kumar Naskar. **Analyzing the Efficacy of LLM-Generated Evidences for Fact Verification: An In-depth Analysis**. In *1st Workshop on Large Language Models’ Interpretability and Trustworthiness (LLMIT) at CIKM’23*, University of Birmingham and Eastside Rooms, UK, Oct 2023
- Madhusudan Ghosh, **Payel Santra**, Sk Asif Iqbal, and Partha Basuchowdhuri. **Astro-mT5: Entity Extraction from Astrophysics Literature using mT5 Language Model**. In *Proceedings of the 1st Workshop on Information Extraction from Scientific Publications AACL-IJCNLP*, Taipei, Taiwan, Nov 2022. Association for Computational Linguistics

Achievements

- Received the SIGWEB Travel Grant for attending **CIKM 2025**
- Attended **Google Deepmind Research symposium**, 2025
- Attended **Pingala Interactions in Computing (PIC) 2025**
- Attended **ACM-ARCS 2025**
- Received the Travel Grant for attending **SIGIR 2024**
- Attended **CODS-COMAD' 2024, IIIT Bangalore**.
- Presented a poster on “**Solving Inverse Problems with Deep Learning Models for Modeling Disease Spread**” at **IndoML symposium 2022**.
- Received Travel Grant for attending **IndoML 2022**
- Winner of **DEAL: Detecting Entities in the Astrophysics Literature SharedTask Competition, 2022**.
- Attended Seminar on **Non-Linear Dynamics and Applications (NLDA 2020)** during March, 2020.
- Attended Webinar on **Application of Mathematics** during August, 2020.
- Attended Webinar on **Scope of Mathematical Modelling: Theory of Application** during July, 2020.
- Successfully qualified **GATE 2021 (Mathematics)** and **GATE 2022 (Mathematics)**.
- Successfully qualified **SET 2022 (Mathematics)**.

Skills

Programming	FORTRAN, C, Python, JAVA
Technical Domains	Deep Learning, Machine Learning, Information Retrieval, Natural Language Processing, Large Language Model, Mathematical Biology, Epidemiology, Ordinary and Partial Differential Equations
Technologies	Pytorch, Tensorflow, Keras, Mathematica, Numpy, Spacy, Stanford Parsers, Matplotlib, t-SNE, Seaborn, Lucene and Pyterior

Languages

English	Professional proficiency
Hindi	Bilingual proficiency
Bengali	Native proficiency

Referees

Dr. Partha Basuchowdhuri

Assistant Professor

School of Mathematical and Computational Sciences (Computer Science Unit)

Indian Association for the Cultivation of Science, Kolkata, India

partha.basuchowdhuri@iacs.res.in

Dr. Debasis Ganguly

Assistant Professor

School of Computing Science

University of Glasgow

Debasis.Ganguly@glasgow.ac.uk

Dr. Sudip Kumar Naskar

Associate Professor

Department of Computer Science & Engineering

Jadavpur University, Kolkata, India

sudipkumar.naskar@jadavpuruniversity.in

Dr. Prasenjit Mitra

Research Consultant

Qatar Computing Research Institute

Doha, Qatar

pum10@psu.edu