

DEBAJYOTI BERA, PH.D.

Assistant Professor, Computer Sc. Department
B508 New Academic Block
Indraprastha Institute of Information Technology
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INTERESTS Quantum Computing, Algorithms Engineering for Data Mining & Network Analysis, Theoretical Computer Science

EDUCATION

- **Ph.D.** in Computer Science, Boston University, Boston, Massachusetts, USA. August 2009
Thesis: *Quantum Circuits: Power and Limitations (Advisor: Prof. Steve Homer)*
- **B.Tech.** in Computer Science & Engineering, Indian Institute of Technology, Kanpur, India. 2002

WORK EXPERIENCE

- Asst. Professor, IIIT-Delhi, New Delhi. Since Jan 2010.
- Teaching Assistant & Research Assistant, Dept. of Computer Science, Boston University, USA. 2003-2009.
- Summer Internships: ITA Software, Inc., MA, USA (Summer 2009), VMware, Inc., CA, USA (Summer 2006), GMD-IPSI, Darmstadt, Germany (Summer 2001).
- Mentor, Google Summer of Code for Beagle project. Summer 2007.
- Software Developer, Adobe Systems India Pvt. Ltd. 2002.

JOURNAL PUBLICATIONS

- | | |
|------|---|
| 2010 | 1. Debajyoti <u>Bera</u> , Stephen Fenner, Frederic Green, and Steven Homer. Efficient universal quantum circuits. <i>Quantum Information & Computation</i> , 10(1):16–28, 2010 |
| 2011 | 2. Debajyoti <u>Bera</u> . A lower bound method for quantum circuits. <i>Information Processing Letters</i> , 111(15):723–726, 2011 |
| | 3. Flavio Esposito, Ibrahim Matta, Debajyoti <u>Bera</u> , and Pietro Michiardi. On the impact of seed scheduling in peer-to-peer networks. <i>Computer Networks</i> , 55(15):3303–3317, 2011 |
| 2015 | 4. Debajyoti <u>Bera</u> . A different Deutsch–Jozsa. <i>Quantum Information Processing</i> , 14(6):1777–1785, 2015 |
| | 5. Khalique Newaz, K Sriram, and Debajyoti <u>Bera</u> . Identification of major signaling pathways in prion disease progression using network analysis. <i>PloS one</i> , 10(12):e0144389, 2015 |
| 2017 | 6. Siddharth Dawar, Vikram Goyal, and Debajyoti <u>Bera</u> . A hybrid framework for mining high-utility itemsets in a sparse transaction database. <i>Applied Intelligence</i> , 47(3):809–827, Oct 2017 |
| 2018 | 7. Debarshi Dutta, Meher Chaitanya, Kishore Kothapalli, and Debajyoti <u>Bera</u> . Applications of ear decomposition to efficient heterogeneous algorithms for shortest path/cycle problems. <i>International Journal of Networking and Computing</i> , 8(1):73–92, January 2018 |
| | 8. Debajyoti <u>Bera</u> . Detection and diagnosis of single faults in quantum circuits. <i>IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems (IEEE TCAD)</i> , 37(3):587–600, March 2018 |
| 2019 | 9. Anuj S. Saxena, Debajyoti <u>Bera</u> , and Vikram Goyal. Modeling location obfuscation for continuous query. <i>Journal of Information Security and Applications</i> , 44:130 – 143, 2019 |
| | 10. Debajyoti <u>Bera</u> and Tharmashastha P. V. Error reduction of quantum algorithms. <i>Phys. Rev. A</i> , 100:012331, Jul 2019 |
| 2021 | 11. Debajyoti <u>Bera</u> and SAPV Tharmashastha. Quantum and randomised algorithms for non-linearity estimation. <i>ACM Transactions on Quantum Computing</i> , 2(2), July 2021 |
| | 12. Debajyoti Bera, Rameshwar Pratap, Bhisham Dev Verma, Biswadeep Sen, and Tanmoy Chakraborty. Quint: Node embedding using network hashing. <i>IEEE Transactions on Knowledge and Data Engineering</i> , pages 1–1, 2021 |

REFEREED CONFERENCE AND WORKSHOP PUBLICATIONS

- 2009 1. Debajyoti Bera, Stephen Fenner, Frederic Green, and Steve Homer. Efficient universal quantum circuits. In *Computing and Combinatorics (COCOON)*, pages 418–428, Berlin, Heidelberg, 2009. Springer Berlin Heidelberg
- 2011 2. Anuj S Saxena, Mayank Pundir, Vikram Goyal, and Debajyoti Bera. Preserving location privacy for continuous queries on known route. In *International Conference on Information Systems Security (ICISS)*, pages 265–279. Springer Berlin Heidelberg, 2011
- 2013 3. Anuj Shanker Saxena, Vikram Goyal, and Debajyoti Bera. Efficient enforcement of privacy for moving object trajectories. In *International Conference on Information Systems Security (ICISS)*, pages 360–374. Springer Berlin Heidelberg, 2013
- 2015 4. Pankaj Sahu, Prachi Agrawal, Vikram Goyal, and Debajyoti Bera. Finding rknn set in directed graphs. In *International Conference on Distributed Computing and Internet Technology (ICDCIT)*, pages 162–173. Springer International Publishing, 2015
- 2016 5. Anuj S Saxena, Vikram Goyal, and Debajyoti Bera. Mintra: Mining anonymized trajectories with annotations. In *Proceedings of the 20th International Database Engineering & Applications Symposium, IDEAS 2016, Montreal, QC, Canada, July 11-13, 2016*, pages 105–114, 2016
6. Jyoti Leeka, Srikanta Bedathur, Debajyoti Bera, and Medha Atre. Quark-x: An efficient top-k processing framework for rdf quad stores. In *Proceedings of the 25th ACM International on Conference on Information and Knowledge Management (CIKM)*, pages 831–840. ACM, 2016
7. Debajyoti Bera and Rameshwar Pratap. Frequent-itemset mining using locality-sensitive hashing. In *International Computing and Combinatorics Conference (COCOON)*, pages 143–155. Springer International Publishing, 2016
8. Charudatt Pachorkar, Meher Chaitanya, Kishore Kothapalli, and Debajyoti Bera. Efficient parallel ear decomposition of graphs with application to betweenness-centrality. In *High Performance Computing (HiPC), 2016 IEEE 23rd International Conference on*, pages 301–310. IEEE, 2016 (**Best paper award**)
- 2017 9. *Workshop*: Debarshi Dutta, Meher Chaitanya, Kishore Kothapalli, and Debajyoti Bera. Applications of ear decomposition to efficient heterogeneous algorithms for shortest path/cycle problems. In *2017 IEEE International Parallel and Distributed Processing Symposium Workshops (IPDPSW)*, pages 864–873, May 2017
- 2018 10. Debajyoti Bera. Amplitude amplification for operator identification and randomized classes. In *Computing and Combinatorics - 24th International Conference, COCOON 2018, China, Proceedings*, pages 579–591, Cham, 2018. Springer International Publishing
11. Debajyoti Bera, Flavio Esposito, and Meghana Pendyala. Maximal labelled-clique and click-biclique problems for networked community detection. In *IEEE Global Communications Conference, GLOBECOM 2018, Abu Dhabi, Proceedings*, pages 1–6, 2018
- 2019 12. Debajyoti Bera, Subhamoy Maitra, Dibyendu Roy, and Pantelimon Stanica. Limitations of the blr testing in estimating nonlinearity. In *WCC 2019: The Eleventh International Workshop on Coding and Cryptography*, 2019
13. Debajyoti Bera, Subhamoy Maitra, and Sapv Tharrmashastha. Efficient quantum algorithms related to autocorrelation spectrum. In Feng Hao, Sushmita Ruj, and Sourav Sen Gupta, editors, *Progress in Cryptology – INDOCRYPT 2019*, pages 415–432, Cham, 2019. Springer International Publishing
14. Rameshwar Pratap, Debajyoti Bera, and Karthik Revanuru. Efficient sketching algorithm for sparse binary data. In *2019 IEEE International Conference on Data Mining (ICDM)*, pages 508–517, 2019
- 2020 15. Debajyoti Bera. Maximal labeled-cliques for structural-functional communities. In Rosa M. Benito, Chantal Cherifi, Hocine Cherifi, Esteban Moro, Luis Mateus Rocha, and Marta Sales-Pardo, editors, *Complex Networks & Their Applications IX*, pages 112–123, Cham, 2021. Springer International Publishing
16. Baani Leen Kaur Jolly, Lavina Jain, Debajyoti Bera, and Tanmoy Chakraborty. Unsupervised anomaly detection in journal-level citation networks. In *Proceedings of the ACM/IEEE Joint Conference on Digital Libraries in 2020, JCDL '20*, page 27–36, New York, NY, USA, 2020. Association for Computing Machinery
- 2021 17. Dawar Siddharth, Vikram Goyal, and Debajyoti Bera. SMIM framework to generalize high-utility itemset mining. In *Accepted in 17th International Conference on Advanced Data Mining and Applications (ADMA'21)*, 2021

OTHER PUBLICATIONS

1. *Invited Article*: Debajyoti Bera, Frederic Green, and Steven Homer. Small depth quantum circuits. *ACM SIGACT News*, 38(2):35–50, 2007
2. *Monograph*: Quantum Circuit Complexity: Low Depth Quantum Circuits: Power and Limitations. ISBN: 978-3-8383-8348-4. Lambert Academic Publishing.
3. *Poster*: Sapv Tharrmashastha, Mayank Aneja and Debajyoti Bera. Finding linear structures on a quantum computer. In *Student Research Symposium (poster) at High Performance Computing (HiPC), 2018*

4. *Short paper*: Sagnik Chatterjee Debajyoti Bera. Applying the quantum alternating operator ansatz to the graph matching problem. In *Proceedings of 20th Asian Quantum Information Science Conference (AQIS '20)*, 2020
5. *Poster*: Sagnik Chatterjee Debajyoti Bera. Applying the quantum alternating operator ansatz to the graph matching problem. In 24th annual conference on Quantum Information Processing (QIP '21), 2021. (poster)
6. *Poster*: SAPV Tharmashastha Debajyoti Bera. Space efficient quantum algorithms for mode, min-entropy and k-distinctness. In 16th Conference on the Theory of Quantum Computation, Communication and Cryptography (TQC '21), 2021. (poster)
7. *Book*: Tharmashastha SAPV, Debajyoti Bera, Arpita Maitra, and Subhamoy Maitra. *Quantum Algorithms for Cryptographically Significant Boolean Functions*. SPRINGER Singapore, 1st edition, 2021
8. *Under submission (major review)*: Debajyoti Bera, Rameshwar Pratap, Bhisham Dev Verma. Dimensionality Reduction for Categorical Data. In *IEEE Transactions on Knowledge and Data Engineering*.
9. *Under submission (major review)*: Bhisham Dev Verma, Rameshwar Pratap, Debajyoti Bera. Efficient Binary Embedding of Categorical Data. In *Data Mining and Knowledge Discovery*.

TEACHING EXPERIENCE

Courses taught and designed at IIT-Delhi (since January 2010):

- *CSE222*: Analysis and Design of Algorithms (Undergraduate Algorithms) (**jointly designed**). Taught in Winter 2010 (jointly with Vikram Goyal), Winter 2011, Winter 2012, Winter 2013 (jointly with Rajiv Raman).
- *CSE322*: Theory of Computation. Taught in Winter semesters of 2016–2021.
- *CSE320/CSE520*: Advanced Algorithms (**designed by me**). Taught in Monsoon 2010, Monsoon 2012.
- *CSE523*: Randomised Algorithms (**designed by me**). Taught in Monsoon 2011, Winter 2014, Winter 2016.
- *CSE524*: Theory of Modern Cryptography (**jointly designed**). Taught in Winter 2012.
- *CSE525*: Graduate Algorithms (for M.Tech.) (**designed by me**). Taught in Monsoon semesters of 2013–2020.
- *CSE526A*: P vs NP (**designed by me**). Taught in Monsoon 2013.
- *CSE421/CSE621*: Complexity Theory (**designed by me**). Taught in Winter 2015, Monsoon 2018.
- *CSE622*: Introduction to Quantum Computing (**designed by me**). Taught in Winter 2015, Winter 2017, Winter 2018.

SPONSORED RESEARCH PROJECTS

1. Successfully completed a 15-month project titled “Feasibility Study for Design of a Quantum based Random Number Generator (QRNG) and it’s Detailed Analysis” of amount ₹9,60,000.00 funded by DRDO, Govt. of India.

PhD SUPERVISIONS:

1. Siddharth Dawar, *High-utility Itemset Mining*. Defended in 2021. (co-advisor: Vikram Goyal)
2. Anuj Saxena, *Privacy of Location Based Services*. Defended in 2019. (co-advisor: Vikram Goyal)

M.TECT./M.Sc. THESIS/MASTERS PROJECT SUPERVISIONS

- 2014 1. Pankaj Sahu. *Finding Top-k Influential Set in Directed Graphs* (co-advisor : Vikram Goyal)
 2. Siddharth Dawar. *Privacy Preserving Reverse Spatial and Textual Nearest Neighbour Query* (co-advisor : Vikram Goyal)
- 2015 3. Khaliq Newaz. *Network analysis of prion disease*. Mtech thesis, IIIT-Delhi, 2015. Advisor : Debajyoti Bera (co-advisor : K. Sriram)
- 2016 4. Shubham Srivastava. *Utility and privacy guarantees of differential privacy*. Mtech thesis, IIIT-Delhi, 2016. Advisor : Debajyoti Bera
 5. (capstone project) Amitesh Pandey. *Universal Turing Machine Simulator*
- 2017 6. Venkatesh Guntakindapalli. *Design and analysis of LSH based techniques for inner product*. Mtech thesis, IIIT-Delhi, 2017. Advisor : Debajyoti Bera
- 2018 7. Ankit Sharma. *Protein classification on the basis of thermal stability using supervised learning*. Mtech thesis, IIIT-Delhi, 2018. Advisor : Debajyoti Bera (co-advisor : Ganesh Bagler)
 8. Biswadeep Khan. *Application of pattern mining on data of flavor molecules, their percepts and molecular features*. Mtech thesis, IIIT-Delhi, 2018. Advisor : Debajyoti Bera (co-advisor : Ganesh Bagler)
 9. Shanu. *Quantum algorithms for distinguishing unitary operators*. Mtech thesis, IIIT-Delhi, 2018. Advisor : Debajyoti Bera
 10. (external student) SAPV Tharmashastha. *Quantum Algorithm for Computation of Auto-Correlation Spectrum of Boolean Functions* for 5-year integrated MSc, Integrated Science Education and Research Center, Visva Bharati
- 2019 11. Akshita Sawhney. *Stage classification of clear cell renal cancer based on gene expressions*. Mtech thesis, IIIT-Delhi, 2019. Advisor : Debajyoti Bera
- 2020 12. Sudatta Bhattacharya. *Upper and Lower bounds of various Centrality Measures on Planar and Sparse Graphs*. Mtech thesis, IIIT-Delhi, 2020. Advisor : Debajyoti Bera
 13. (external student) Mayank Kharbanda. *Analysis of Random Number Generator & Test Suites* for MSc, Delhi University.

UNDERGRADUATE B.T.P. SUPERVISIONS

- Pranav Raj, Akash Vanjani (2013)
- Divyanshu Bansal, Ishan Goel (2014)
- Kshitij Jain, Sahil Mahajan (2015)
- Alakh Dhruv Chopra (2017)
- Gautam Gupta, Parth Mittal (2018)
- Porvil, Zubair Aslam (2021)

SELECTED INVITED LECTURES and TUTORIALS

1. *Introduction to Quantum Computing*: video lecture as part of MHRD project recorded at IIT-Delhi, New Delhi (August 2011)
2. *Computational Complexity of the Quantum Circuit model*: Invited talk at QANSAS, DEI, Agra (December 2010 and December 2015), TCS Innovation Labs, Kolkata (April 2015)
3. *Cryptography and Complexity Theory*: Lectures in summer schools at ISI Kolkata in 2016, 2017, 2018.
4. *Workshop for Computer Science School Teachers*: Lectures in 2015
5. *INOI Preparatory Workshop*: Lectures in 2014
6. Invited seminar at Ashoka University, Trinity Institute of Professional Studies (Dwarka, New Delhi), CDAC Pune, IndoQuant 2018, IETE Golden Jubilee Mid Term Symposium at NSUT (New Delhi)
7. FDP (Faculty Development Program) lectures at JNTUA College of Engineering (Andhra Pradesh), Vardhman College of Engineering (Hyderabad), IIIT Kottayam (Kerala).

SOFTWARE DEVELOPMENT

1. Mentor for Algoizer, an Android app for teaching data structures and algorithms.
2. Developed Drupal libraries, plugins and themes for IIIT-Delhi website.
3. Developed online forms for PG admissions at IIIT-Delhi.

4. Mentored Courserepo, a webservice for managing all courses at IIT-Delhi.
5. Lead developer and maintainer of open source desktop-search engine Beagle project (included in all major Linux distros) from 2007-2009.
6. Developer of kio-beagle & kBeagleBar, two open-source KDE frontends to Beagle (included in some Linux distros) from 2007-2009.
7. Developer of mGet, an open-source multi-threaded command line download manager (included in some Linux distros), 2001.

SELECTED PROFESSIONAL ACTIVITIES

- External Expert for curriculum design, examination paper moderation, etc. for Computer Science UG, PG and Ph.D. programs at Indira Gandhi National Open University, New Delhi.
- Book and Book Proposal Reviewer for many publishers including Springer, Tata McGraw Hill.
- Reviewer of papers for journals and conference in areas of theoretical computer science and quantum computing.
- Proposal evaluation committee and project monitoring committee, invited by TDB, DST, Govt. of India
- Member of TPC of *International Conference on Contemporary Computing (IC3)* 2015, IC3 2016. Co-chair of Algorithms track, IC3 2018.

SELECTED INSTITUTE SERVICE

- Member of Senate at IIT-Delhi (2011-2013)
- In-charge and management of IIT-Delhi website (2010-2014)
- Committee member for Ph.D. admission at IIT-Delhi (2011, 2012) and developer of online admission system
- Faculty in-charge of FooBar (student competitive programming club) since 2013
- Faculty in-charge of institute ERP system
- Member of various other academic and institute committees at IIT-Delhi: Computing Infrastructure and Lab committee, Purchase committee, UG Committee, PG Committee, Ethics committee, PhD(CSE) coordinator, Seminar committee

ACHIEVEMENTS

1. Recipient of National Talent Search Examination scholarship awarded by National Council of Education, Research and Training, India (1996)
2. All India Rank 2 (among SC/ST category) in IIT-JEE examination (1998)
3. Within top 30 in West Bengal Higher Secondary examination
4. Best Teaching Fellow Award by Graduate School of Arts & Sciences, Boston University (2007)
5. Letter of Teaching Excellence at IIT-Delhi for several semesters
6. Best paper award in 2016 IEEE 23rd International Conference on High Performance Computing (HiPC).