

DIKSHA GUPTA

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CURRENT POSITION

National University of Singapore, Republic of Singapore
Research Fellow, Advisor: Seth Gilbert

November, 2020 - Present

EDUCATION

University of New Mexico, Albuquerque, NM, USA

2015 - 2020

Ph.D. in Computer Science (with Distinction), Advisor: Jared Saia

Dissertation: Sybil Defense using Efficient Resource Burning

University of New Mexico, Albuquerque, NM, USA

2015 - 2018

M.S. in Computer Science, GPA: 3.87/4

Indian Institute of Technology, Roorkee, India

2013 - 2015

M.Tech. in Computer Science & Engineering, Advisor: Durga Toshniwal

Thesis: Anomaly Detection in Textual Data, GPA: 7.67/10

Guru Gobind Singh Indraprastha University, New Delhi, India

2009 - 2013

B.Tech. in Computer Science & Engineering (with Distinction)

SELECTED PROJECTS

Asymmetric Churn Commensurate DHT

- Designed and analyzed a decentralized reconfiguration algorithm for Distributed Hash Table (DHT) - LAZY CUCKOO RULE (LCR), which maintains an honest majority of peers in every $\Theta(\log n)$ neighbourhood, in the presence of constant fraction of malicious peers.

Asymmetric Proof-of-Work based Sybil defense

- Obtain lower bounds for class of algorithms that use Proof-of-Work as defense mechanism against Sybil attacks in open networks.
- Designed and analyzed algorithms matching the lower bound - GEOMETRIC MEAN COMPUTATION (GMCOM) and TOTAL OVER GOOD COMPUTATION (TOGCOM).
- Simulated and evaluated the performance of our algorithms alongside prior defenses, and proposed heuristics that further improved performance.

Analysis of Foraging Techniques

- Analyzed performance of three Central-place Foraging Algorithms (CPFAs) - Spiral-based, Rotating-based, and Random-ballistic.
- Proposed a new metric to better understand the efficacy of foraging - PRICE OF IGNORANCE.
- Analyzed the impact of site fidelity on the three CPFAs.

Computationally Resource Competitive Sybil Defense

- Designed, analyzed and simulated a decentralized Proof-of-Work based resource-competitive Sybil defense technique for dynamic systems - COMMENSURATE COMPUTATION (CCOM).
- Reduced the state requirements for CCOM using sampling, and analyzed under bounded communication latency.

PUBLICATIONS

Note: In theory conference and journals, author names appear in alphabetical order.

CONFERENCE/JOURNAL PAPERS

1. V Dani, **D Gupta**, T Hayes. *On the Power of Choices for k -Colorability Threshold*. Under preparation.
2. **D Gupta**, J Saia, M Young. *Bankrupting Sybil Despite Churn*. Submitted for review.
3. **D Gupta**, J Saia, M Young. *Resource Burning for Permissionless Systems*. To appear in Proceedings of the 27th International Colloquium on Structural Information and Communication Complexity (SIROCCO 2020). **Invited Submission**.
4. **D Gupta**, J Saia, M Young. *TOGCOM: An asymmetric Sybil Defense*. ArXiv preprint - arXiv:1911.06462.
5. **D Gupta**, J Saia, M Young. *Resource-Competitive Sybil Defense*. ArXiv preprint - arXiv:1911.06462. Submitted for review.
6. A Aggarwal, **D Gupta**, WF Vining, GM Fricke, ME Moses. *Ignorance is not bliss: An analysis of central-place foraging algorithms*. Proceedings of 2019 IEEE International Conference on Intelligent Robots and Systems (IROS'19).
7. A Aggarwal, WF Vining, **D Gupta**, J Saia, ME Moses. *A Most Irrational Foraging Algorithm*. Proceedings of the 2019 Biological Distributed Algorithms (BDA'19) Workshop.
8. A Aggarwal, GM Fricke, **D Gupta**, ME Moses. *Brief Announcement: On site fidelity and the price of ignorance in swarm robotic central place foraging algorithms*. Proceedings of the 2019 ACM Symposium on Principles of Distributed Computing (PODC'19).
9. **D Gupta**, J Saia, M Young. *Peace through superior puzzling: An asymmetric sybil defense*. Proceedings of the 2019 IEEE International Parallel and Distributed Processing Symposium (IPDPS'19).
10. **D Gupta**, J Saia, M Young. *Proof of Work without all the Work*. Proceedings of the 2018 2nd Workshop on Storage, Control, Networking in Dynamic Systems (SCNDS'18).
11. **D Gupta**, J Saia, M Young. *Proof of Work without all the Work*. Proceedings of the 19th International Conference on Distributed Computing and Networking (ICDCN'18).
12. **D Gupta**, J Saia, M Young. *Proof of Work Without All the Work: Computationally Efficient Attack-Resistant Systems*. arXiv:1708.01285 (2018).

TECHNICAL REPORTS

1. A Aggarwal, JA Castellanos Joo, **D Gupta**. *Beating the Multiplicative Weights Update Algorithm*. arXiv:1708.04668 (2017).
2. **D Gupta**. *How Infections Spread on Networks* (2016) <https://dikshagupta.blog/infections/>
3. **D Gupta**, D Toshniwal. *Anomaly Detection in Textual Data* (2015). <https://dikshagupta.blog/mtech-thesis/>

POSTERS

1. *Puzzling Sybil into Bankruptcy: An Asymmetric Sybil Defense*. D Gupta, J Saia, M Young. Rocky Mountain Celebration of Women in Computing, Denver, CO (2018).
2. *GreenCoins*. D Gupta. Shared Knowledge Conference, Albuquerque, NM (2017).

AWARDS & HONORS

- **Travel Awards:** Symposium on Principles of Distributed Computing (PODC'19), TCPP Student Travel Grant (IPDPS'19), Rocky Mountain Celebration of Women in Computing 2018.
- **Graduate Fellowship:** Ministry of Human Resource Development (MHRD), India (2013-2015)
- **GATE Rank:** Graduate Aptitude Test in Engineering (GATE'13) - AIR 188 (99.98 percentile)
- **Distinction, B.Tech.** Guru Gobind Singh Indraprastha University, Delhi, India (2013)
- **Director's Merit Award:** Guru Gobind Singh Indraprastha University, Delhi, India (2009 - 2013)

TALKS

- *Beating Sybil with Resource Burning.* UNM CS Colloquium, University of New Mexico, USA (September 2020).
- *Sybil Defense via Resource Burning.* Aalto CS Theory Seminar, Aalto University, Finland (July 2020).
- *Towards a Lazy yet Efficient Dynamic DHT.* STEM Symposium, University of New Mexico, USA (February 2020).
- *A Scalable Algorithm for Multiparty Interactive Communication with Private Channels.* International Conference on Distributed Computing and Networking (ICDCN), Jadavpur University-Kolkata, India (January 2020).
- *On Computationally-Efficient Sybil Defense.* Workshop on Security of Permissionless Systems (Collocated with PODC'19), Toronto, Canada (August 2019).
- *Peace through Superior Puzzling: An asymmetric Sybil Defense.* IPDPS'19, Brazil (May 2019).
- *Proof-of-Work Without all the Work: Computationally Efficient Sybil Defense Techniques.* IIT Delhi, India (January 2019).
- *Puzzling Sybil into Bankruptcy.* 3rd Winter School on Blockchains, IIAS, Hebrew University, Israel (December 2018).
- *Proof-Of-Work Based Sybil Defense.* Workshop on Competitive Economics of Cybersecurity, Sandia National Labs, USA (November 2018).
- *Proof-of-Work Without all the Work.* International Conference on Distributed Computing and Networking (ICDCN), IIT BHU, India (January 2018).
- *Stumping Sybil with Computational Puzzles.* Mid-South Theory Day, Louisiana State University, USA (December 2016).

SKILLS

Programming Languages	C/C++ (expert), MATLAB (expert), Haskell (prior experience)
Distributed Systems	Peer-to-Peer, Byzantine Fault tolerant Protocols, Dynamic Systems
Database Systems	Relational Design, MySQL, PostgreSQL

TEACHING EXPERIENCE

- *Grader*, CS 542: Introduction to Parallel Processing, UNM Computer Science (Fall 2020).
- *Guest Lecturer*, CS 527: Introduction to Artificial Intelligence, UNM Computer Science (Spring, 2018).
- *Guest Lecturer*, CS 561: Algorithms & Data Structures, UNM Computer Science (Fall 2017).

- *Teaching Assistant*, CS 261: Mathematical Foundations of CS, UNM Computer Science (Fall 2015).
- *Teaching Assistant*, CSN 501: Advanced Algorithms, IITR CSE (Fall 2014).
- *Teaching Assistant*, CSN 515: Data Mining & Warehousing, IITR CSE (Spring 2014).

INDUSTRIAL INTERNSHIPS

MathWorks Inc., Natick, MA

Summer 2019

EDG Intern, Contributed to tools incorporated in future version of the MATLAB-Simulink Software.

Defense Research & Development Organization, New Delhi, India

Summer 2012

Software Engineering Intern, Contributed to tools for use by Centre for Personnel Talent Management (CEPTAM) Division.

SERVICES

- **Conference Reviewer**: International Conference on Distributed Computing and Networking (ICDCN 2020), SIAM Symposium on Simplicity in Algorithms (SOSA 2021), Conference on Principles of Distributed Systems (OPODIS 2020)
- **Co-Organizer**, Security of Permissionless Systems (SPS) Workshop, Co-located with PODC, 2019.
- **Co-Organizer**, UNM Women in Computing Lecture Series, 2017-2018
- **President**, UNM Computer Science Graduate Student Association (CSGSA), 2017-2018
- **Graduate Representative**, UNM Computer Science Advisory Board, 2017 - 2020.
- **Co-Organizer**, New Mexico Student Conference, UNM, 2017

MENTORSHIP

- **Abigail Soward**, University of New Mexico, Summer 2018
- **Aayush Gupta**, University of New Mexico, Summer 2020