

# Laxman Dhulipala

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<https://ldhulipala.github.io>

## Employment

- Sep 2020 - **Postdoctoral Researcher**, *Massachusetts Institute of Technology*, Cambridge, MA,  
Present Mentor: Julian Shun.
- Aug 2019 - **Student Researcher**, *Google Research*, New York City, NY,  
Aug 2020 Mentors: Jakub Lacki and Vahab Mirrokni.

## Education

- Aug 2015 - **Ph.D. in Computer Science**, *Carnegie Mellon University*, Pittsburgh, PA,  
Aug 2020 Thesis: *Provably Efficient and Scalable Shared-Memory Graph Processing*  
Advisor: Guy Blelloch  
Nominated for the ACM Doctoral Dissertation Award  
Honorable Mention in CMU SCS Doctoral Dissertation Award.
- Aug 2010 - **B.S. in Computer Science**, *Carnegie Mellon University*, Pittsburgh, PA,  
May 2014 Phi Beta Kappa, University Honors, and College Honors.

## Awards

- 2020 Nominated for the ACM Doctoral Dissertation Award
- 2020 Honorable Mention for the CMU SCS Doctoral Dissertation Award
- 2020 Memorable Paper Award Finalist at the *Non-Volatile Memories Workshop (NVMW'20)*
- 2019 Distinguished Paper Award at the *ACM SIGPLAN Symposium on Programming Language Design and Implementation (PLDI), 2019*
- 2018 Best Paper Award at the *ACM Symposium on Parallelism in Algorithms and Architectures (SPAA), 2018*
- 2014 Allen Newell Award for Excellence in Undergraduate Research
- 2014 Yahoo! Undergraduate Research Award
- 2014 Inducted into Phi Beta Kappa
- 2014 University Honors, College Honors, upon graduation from CMU SCS

## Publications

### Refereed Full Publications

- VLDB'21 **ConnectIt: A Framework for Static and Incremental Parallel Connectivity Algorithms**  
(to appear) *Laxman Dhulipala*, Changwan Hong, Julian Shun
- SIGMOD'21 **Parallel Index-Based Structural Graph Clustering and Its Approximation**  
(to appear) Tom Tseng, *Laxman Dhulipala*, Julian Shun
- APOCS'21 **Parallel Batch-Dynamic  $k$ -Clique Counting**  
(to appear) *Laxman Dhulipala*, Quanquan Liu, Julian Shun, Shangdi Yu
- APOCS'21 **The Read-Only Semi-External Model**  
(to appear) Guy E. Blelloch, *Laxman Dhulipala*, Phillip B. Gibbons, Yan Gu, Charlie McGuffey, Julian Shun

- VLDB'20 **Parallel Graph Algorithms in Constant Adaptive Rounds: Theory meets Practice**  
Soheil Behnezhad, *Laxman Dhulipala*, Hossein Esfandiari, Jakub Lacki, Vahab Mirrokni, Warren Schudy
- VLDB'20 **Sage: Parallel Semi-Asymmetric Graph Algorithms for NVRAMs**  
*Laxman Dhulipala*, Charlie McGuffey, Hongbo Kang, Yan Gu, Guy E. Blelloch, Phillip B. Gibbons, Julian Shun
- SODA'20 **Parallel Batch-Dynamic Graphs: Constant Round Algorithms and Lower Bounds**  
*Laxman Dhulipala*, David Durfee, Janardhan Kulkarni, Richard Peng, Saurabh Sawlani, Xiaorui Sun
- PACT'20 **Exploring the Design Space of Static and Incremental Graph Connectivity Algorithms on GPUs**  
Changwan Hong, *Laxman Dhulipala*, Julian Shun
- CGO'20 **Optimizing Ordered Graph Algorithms with GraphIt**  
Yunming Zhang, Ajay Brahmakshatriya, Xinyi Chen, *Laxman Dhulipala*, Shoaib Kamil, Saman Amarasinghe, Julian Shun
- ESA'20 **Parallel Batch-Dynamic Trees via Change Propagation**  
Umut Acar, Daniel Anderson, Guy Blelloch, *Laxman Dhulipala*, Sam Westrick
- FOCS'19 **Near-Optimal Massively Parallel Graph Connectivity**  
Soheil Behnezhad, *Laxman Dhulipala*, Hossein Esfandiari, Jakub Lacki, Vahab Mirrokni
- PLDI'19 **Low-Latency Processing on Graph Streams Using Purely-Functional Trees**  
*Laxman Dhulipala*, Guy Blelloch, Julian Shun  
**Distinguished Paper Award**
- SPAA'19 **Massively Parallel Computation via Remote Memory Access**  
Soheil Behnezhad, *Laxman Dhulipala*, Hossein Esfandiari, Jakub Lacki, Vahab Mirrokni, Warren Schudy  
**Invited to Special Issue**
- SPAA'19 **Parallel Batch-Dynamic Graph Connectivity**  
Umut Acar, Daniel Anderson, Guy Blelloch, *Laxman Dhulipala*
- ALENEX'19 **Batch Parallel Euler-Tour Trees**  
Thomas Tseng, *Laxman Dhulipala*, Guy Blelloch
- SPAA'18 **Theoretically Efficient Parallel Algorithms Can Be Fast and Scalable**  
*Laxman Dhulipala*, Guy Blelloch, Julian Shun  
**Best Paper Award**  
**Invited to Special Issue**
- SPAA'17 **Julienne: A Framework for Parallel Graph Algorithms using Work-efficient Bucketing**  
*Laxman Dhulipala*, Guy Blelloch, Julian Shun
- KDD'16 **Compressing Graphs and Indexes with Recursive Graph Bisection**  
*Laxman Dhulipala*, Igor Kabiljo, Brian Karrer, Guiseppe Ottiviano, Sergey Pupyrev, Alon Shalita
- DCC'15 **Smaller and Faster: Parallel Processing of Compressed Graphs with Ligma+**  
Julian Shun, *Laxman Dhulipala*, Guy Blelloch
- SPAA'14 **A Simple and Practical Linear-Work Parallel Algorithm for Connectivity**  
Julian Shun, *Laxman Dhulipala*, Guy Blelloch  
**Refereed Short Publications**
- GRADES-  
NDA'20 **The Graph Based Benchmark Suite**  
*Laxman Dhulipala*, Jessica Shi, Tom Tseng, Guy Blelloch, Julian Shun

NVMW'20 **Semi-Asymmetric Parallel Graph Algorithms for NVRAMs**  
*Laxman Dhulipala*, Charlie McGuffey, Hongbo Kang, Yan Gu, Guy E. Blelloch, Phillip B. Gibbons, Julian Shun  
**Memorable Paper Award Finalist**

SPAA'20 **ParlayLib - A Toolkit for Parallel Algorithms on Shared-Memory Multicore Machines**  
Guy Blelloch, Daniel Anderson, *Laxman Dhulipala*

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## Internships/Industry Experience

- 2019 **Visiting Researcher**, *Massachusetts Institute of Technology*, Cambridge, MA.
- Worked with Prof. Julian Shun at MIT CSAIL on parallel algorithms for parallel-dynamic graph algorithms including low-outdegree orientations, dynamic clique-counting, and dynamic graph frameworks. Internship resulted in two papers which have been accepted, and one paper which is currently in submission.
- 2018 **Research Intern**, *Google Research*, New York City, NY.
- Worked with Jakub Lacki on the Graph Mining (OMEGA) team. I worked on shared-memory clustering algorithms on large-memory, multicore machines. I also studied several theoretical problems in the MPC model with sublinear space per machine. Our results improved on prior work for fundamental graph problems including graph connectivity, and is conditionally optimal for a wide range of graphs, based on a well known conjecture.
- 2017 **Research Intern**, *Google Research*, Mountain View, CA.
- Worked with Zoya Svitkina on the Discrete Algorithms team. I studied load-balancing algorithms that maximize redundancy and minimize load-imbalance, both theoretically and in the context of algorithms deployed in Google data centers. Our algorithms led to significant improvements in load balance in practice while ensuring high redundancy.
- 2014–2015 **Software Engineer**, *Facebook*, Menlo Park, CA.
- Worked on the Infrastructure Optimization team on algorithms for partitioning, embedding and reordering massive graphs. My work during this year resulted in a publication in KDD.

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## Visits

- Aug 2019 **Dagstuhl Workshop on Algorithms for Big Data**, *Schloss Dagstuhl*, Wadern, Germany.
- Apr 2019 **Microsoft Research (Algorithms Group)**, Redmond, WA.  
Hosted for a week-long visit by Janardhan Kulkarni and Richard Peng

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## Patents

- 2018 Cache efficiency by social graph data ordering. **US Grant (US10025867B2)**.

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## Teaching Experience

### Workshops

- February 2020 **Tutorial Organizer and Presenter**, *PPoPP 2020*, San Diego, California,  
*Abstractions and Algorithms for Efficiently Programming NVRAMs*.
- March 2016 **Tutorial Organizer and Presenter**, *PPoPP 2016*, Barcelona, Spain,  
*Large-Scale Graph Processing in Shared Memory*.
- 2016–2018 **Graduate Teaching Assistant** for Algorithms in the Real World (15-853), Undergraduate Complexity Theory (15-455), Graduate Algorithms (15-750)

2012–2014 **Teaching Assistant** for Computational Geometry (15-456), Algorithm Design and Analysis (15-451), Parallel Data Structures and Algorithms (15-210), and Introduction to Functional Programming (15-150)

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## Invited Talks

- 2020 **Provably Efficient and Scalable Shared-Memory Graph Processing**, *CS Colloquium at UC Riverside*, Riverside, CA.
- 2020 **Parallel Semi-Asymmetric Graph Processing**, *Google Research (Algorithms and Optimization Group)*, New York City, NY.
- 2019 **Fast and Theoretically-Efficient Parallel Graph Processing on Static and Dynamic Graphs**, *Microsoft Research*, Redmond, WA.
- 2019 **Algorithms and Systems for Processing Massive Static and Evolving Graphs**, *MIT Fast Code Seminar*, Cambridge, MA.
- 2019 **Low-Latency Graph Processing using Compressed Purely-Functional Trees**, *Dagstuhl Workshop on Algorithms for Big Data*, Schloss Dagstuhl, Wadern, Germany.
- 2018 **Low-Latency Graph Processing using Compressed Purely-Functional Trees**, *Google Research (Algorithms and Optimization Group)*, New York City, NY.
- 2018 **Shared-Memory Parallelism at Google**, *Google Research (Graph Mining Group)*, New York City, NY.
- 2017 **Shared-Memory Parallel Graph Algorithms**, *Google Research (Algorithms Seminar)*, Mountain View, CA.

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## Professional Service

- 2020 **JMLR Editorial Board Reviewer**
- 2020 **PLDI'20 Artifact Evaluation Committee**
- 2020 **CMU CSD Faculty Hiring Committee** (one of two student members)
- 2016, 2020 **Parallel Reading Group Organizer** (seminar at CMU)
- Journal Reviewer.** JMLR {'20,'19,'18}, TOPC {'20,'19,'18,'17}, TPDS'16
- Reviewer.** VLDB'20, SODA'20, SIGMETRICS'20, SPAA {'20,'19,'18,'17,'16}, ESA {'20,'19}, DCC'18, SPIRE'18

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## Professional References

**Guy E. Blelloch** (guyb@cs.cmu.edu)  
Professor of Computer Science  
Carnegie Mellon University

**Julian Shun** (jshun@mit.edu)  
Assistant Professor  
MIT CSAIL

**Phillip B. Gibbons** (gibbons@cs.cmu.edu)  
Professor of Computer Science  
Carnegie Mellon University

**Vahab Mirrokni** (mirrokni@google.com)  
Distinguished Scientist and Research Director  
Google Research New York