Sara McAllister

PhD Candidate

Carnegie Mellon University

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Biography

I research sustainable datacenters from a computer systems perspective, and I am particularly interested in caching and storage systems. My work includes a focus on improving efficiency and sustainability through hardware-software co-design and grounding design choices in mathematical modeling. My work has appeared at OSDI and SOSP, including receiving a Best Paper Award at SOSP 2021. I am a 2021 NDSEG fellow, a 2023 EECS Rising Star, and a 2025 Siebel Scholar. I also strive to increase inclusion in computer science, including by creating a DEI course for CS PhD students. Due to these efforts, I was awarded CMU's Graduate Student Service Award in 2022 and a Best Paper Award at SIGCSE 2023.

Education

Carnegie Mellon University — *Pittsburgh, PA*

PhD in Computer Science, Advisors: Nathan Beckmann and Greg Ganger — *Aug 2019. - Summer 2025 (Expected)*

Carnegie Mellon University — *Pittsburgh, PA*

Masters in Computer Science Research — *Aug 2019. - May 2022*

Harvey Mudd College — *Claremont, CA*

B.S. in Computer Science, Graduated with High Distinction — *Aug. 2015 - May 2019*

Honors and Awards

2025 Siebel Scholar, for outstanding academic performance and leadership — *2024*

2023 Rising Star, in Electrical Engineering & Computer Science (EECS) — *2023*

NDSEG Exemplary Poster Presentation, in computer and computational sciences at NDSEG fellows conference — *2023*

SIGCSE Best Paper Award, for CS-JEDI paper — *2023*

CMU Graduate Student Service Award, for the development of 15-996 CS-JEDI — *2022*

SOSP Best Paper Award, for Kangaroo paper — *2021*

NDSEG Graduate Fellowship, DoD sponsored 3-year fellowship — *2021*

NSF Graduate Research Fellowship (GRFP), NSF sponsored 3-year fellowship — *2021*

Harvey Mudd Class of '94 Award, for an outstanding CS graduate in coursework, research, and service — *2019*

Harvey Mudd Computer Science Departmental Honors — *2019*

Harvey Mudd Clinic Team Award, for outstanding performance on an industry-sponsored team capstone project — *2019*

CRA Outstanding Undergraduate Researcher Award, Honorable Mention — *2019*

Publications

FairyWREN: A Sustainable Cache for Emerging Write-Read-Erase Flash Interfaces — *OSDI 2024*

Sara McAllister, Yucong Wang, Benjamin Berg, Daniel S. Berger, George Amvrosiadis, Nathan Beckmann, Gregory R. Ganger — *Acceptance Rate: 18%*

A Call for Research on Storage Emissions — *HotCarbon 2024*

Sara McAllister, Fiodar Kazhamiaka, Daniel S. Berger, Rodrigo Fonseca, Kali Frost, Aaron Ogus, Maneesh Sah, Ricardo Bianchini, George Amvrosiadis, Nathan Beckmann, Gregory R. Ganger — *Acceptance Rate: 46%*

DéjàVu: KV-cache Streaming for Fast, Fault-tolerant Generative LLM Serving — *ICML 2024*

Fonteini Strati, Sara McAllister, Amar Phanishayee, Jakub Tarnawski, Ana Klimovic — *Acceptance Rate: 27.5%*

Towards Understanding the Carbon Impact in End-to-end Sensing Pipelines — *HotEthics 2024*

Harsh Desai*, Sara McAllister*, Nathan Beckmann, Brandon Lucia (* = co-first author)

CS-JEDI: Required DEI Education, by CS PhD Students, for CS PhD Students — *SIGCSE 2023*

Bailey Flanigan, Ananya Joshi, Sara McAllister, Catalina Vajiac — *Acceptance Rate: 35%*

Kangaroo: Theory and Practice of Caching Billions of Tiny Objects on Flash — *ACM TOS*

Sara McAllister, Benjamin Berg, Julian Tutuncu-Macias, Juncheng Yang, Sathya Gunasekar, Jimmy Lu, Daniel S. Berger, Nathan Beckmann, Gregory R. Ganger — *August 2022*

Kangaroo: Caching Billions of Tiny Objects on Flash — *SOSP 2021*
Sara McAllister, Benjamin Berg, Julian Tutuncu-Macias, Juncheng Yang, Sathya Gunasekar, Jimmy Lu, Daniel S. Berger, Nathan Beckmann, Gregory R. Ganger — *Acceptance Rate: 16%*

External-memory Dictionaries in the Affine and PDAM Models — *ACM ToPC*
Michael A. Bender, Alex Conway, Martin Farach-Colton, William Jannen, Yizheng Jiao, Rob Johnson, Eric Knorr, **Sara McAllister**, Nirjhar Mukherjee, Prashant Pandey, Donald E. Porter, Jun Yuan, Yang Zhan — *September 2021*

The CacheLib Caching Engine: Design and Experiences at Scale — *OSDI 2020*
Benjamin Berg, Daniel S. Berger, **Sara McAllister**, Isaac Grosof, Sathya Gunasekar, Jimmy Lu, Michael Uhlar, Jim Carrig, Nathan Beckmann, Mor Harchol-Balter, Gregory R. Ganger — *Acceptance Rate: 18%*

Small Refinements to DAM Can Have Big Consequences for Data-Structure Design — *SPAA 2019*
Michael A. Bender, Alexander Conway, Martin Farach-Colton, William Jannen, Yizheng Jiao, Rob Johnson, Eric Knorr, **Sara McAllister**, Nirjhar Mukherjee, Prashant Pandey, Donald E. Porter, Jun Yuan, Yang Zhan — *Acceptance Rate: 40%*

Talks

Scaling the bandwidth-per-TB wall with Declarative Storage Interfaces
PDL Retreat – *Presented to a large group of industry attendees* — *15 Oct 2024*
PDL Retreat – *Presented to a large group of industry attendees* — *6 Nov 2023*

A Call for Research on Storage Emissions
PDL Retreat – *Presented to a large group of industry attendees* — *15 Oct 2024*
Western Digital (Remote) – *Hosted by Toshiki Hirano* — *5 Sep 2024*
HotCarbon — *9 July 2024*

FairyWREN: A Sustainable Cache for Write-Read-Erase Interfaces
OSDI — *12 July 2024*
PDL Retreat – *Presented to a large group of industry attendees* — *7 Nov 2023*
PDL Retreat – *Presented to a large group of industry attendees* — *7 Nov 2022*

Towards Understanding the Carbon Impact in End-to-end Sensing Pipelines
HotEthics – *Co-presented with Harsh Desai* — *29 Apr 2024*

Overcoming Write Limitations to achieve Sustainable Flash Caching
AMD (Remote) – *Research and Advance Development (RAD) and Xilinx Labs* — *29 Mar 2024*
Salesforce (Remote) – *Database Reading Group* — *27 Mar 2024*
UC Berkeley – *Hosted by Natacha Crooks* — *25 Jan 2024*
Stanford – *Hosted by Keith Winstein* — *24 Jan 2024*
UC Santa Cruz – *Hosted by Andrew Quinn* — *11 Jan 2024*
McGill (Remote) – *Hosted by Oana Balmau* — *16 Nov 2023*
Microsoft Pittsburgh – *Hosted by Jeff Butler* — *2 Nov 2023*
MIT – *Hosted by Frans Kaashoek* — *10 Oct 2023*
NDSEG 2021 Fellows Conference – *Recieved best poster-presentation award* — *31 July 2023*
University of Toronto – *Hosted by Bianca Schroeder* — *20 Mar 2023*

CS-JEDI: DEI education by PhD students, for PhD students
McGill (Remote) – *Hosted by Oana Balmau* — *31 Oct 2023*

Caching on Flash: Kangaroo and Beyond
Meta (Remote) – *Core Data Tech Talk* — *11 Mar 2022*

Kangaroo: Caching Billions of Objects on Flash
Microsoft Research (Remote) – *Hosted by Daniel Berger* — *22 Nov 2021*
SOSP (Remote) — *27 Oct 2021*
Cache@Scale (Remote) – *Industry Caching Meetup hosted by Meta* — *4 Mar 2021*

Building a Stronger, More Just Academic Community Through Mandatory Anti-bias Learning
University of Pittsburgh Diversity Forum (Remote) – *Co-presented w/ Bailey Flanigan and Catalina Vajiac* — *28 July 2021*

Teaching

Carnegie Mellon University

Storage Systems (15-746/18-746) — *TA, Fall 2023*
Parallel Computer Architecture and Programming (15-418/618) — *TA, Spring 2022*
Diversity, Equity, and Inclusion in Computer Science and Society (15-996) — *Co-Creator and TA, Spring 2021*

Harvey Mudd College

Programming Languages (CS131) — *Grader and Tutor, Spring 2019*
Introduction to Computer Systems (CS105) — *Grader and Tutor, Fall 2018*
Introduction to Computer Systems (CS105) — *Grader and Tutor, Spring 2018*
Data Structures and Programming Development (CS70) — *Grader and Tutor, Fall 2017*
Principles of Computer Science (CS60) — *Grader and Tutor, Spring 2017*
Introduction to Biology and Computer Science (CS5 Green) — *Grader and Tutor, Fall 2016*

Guest Lecturer

Storage Systems – Overcoming Flash's Write Limitations to Achieve Sustainable Caching (CMU 15/18-746) — *Fall 2023*
Graduate Computer Architecture – Sustainable Computing (CMU 15-740) — *Fall 2023*
Computer Systems – Kangaroo: Caching Billions of Tiny Objects on Flash (CMU 18-213/613) — *Fall 2022*
Data Center Computing – Kangaroo Discussion (CMU 18-847C) — *Spring 2022*
CS-JEDI – Panel on Allyship (CMU 15-996) — *Spring 2022*
Computer Systems – Kangaroo: Caching Billions of Tiny Objects on Flash (CMU 18-213) — *Fall 2021*
Storage Systems – Kangaroo: Caching Billions of Tiny Objects on Flash (CMU 18-746) — *Fall 2021*

Mentoring

Yiwei Chen. CMU ECE masters student — *Fall 2024 - Present*
Lucy Wang. CMU ECE undergraduate student — *Spring 2024 - Present*
Suhas Thalanki. CMU computational data science masters capstone — *Spring 2024 - Present*
Sriya Ravi. CMU computational data science masters capstone — *Spring 2024 - Present*
Yu Liu. CMU computational data science masters capstone — *Spring 2024 - Present*
Sophia (Qingyang) Cao. CMU CS undergraduate student — *Fall 2023 - Present*
Sarvesh Tandon. CMU ECE masters student — *Fall 2023 - Present*
Sherry (Yucong) Wang. CMU ECE undergraduate student, After degree: Salesforce — *Fall 2022 - Spring 2024*
Akshath Karanam. CMU ECE masters student, After degree: Salesforce — *Fall 2022*
Priyal Suneja. Univesity of Washington CS PhD student — *Fall 2021 - Summer 2022*
Julian Tutuncu-Macias. CMU CS undergraduate student, After degree: Goldman Sachs — *Fall 2019 - Spring 2021*
Sheng Xu. CMU CS masters student, After degree: Amazon Web Services — *Spring 2020*
Karina Mejia. Ontario High School — *Summer 2016*

Service

Reviewer

Transactions on Storage (TOS) — *2024*

External Review Committee Member

USENIX Annual Technical Conference (ATC) — *2024*

Faculty Hiring Committee

Carnegie Mellon University, Computer Science Department — *2024*
Harvey Mudd College, Computer Science Department — *2019*

PhD Admissions

Carnegie Mellon University, Computer Science Department — *2022*

Student Organizer

DEI initiatives in CMU's CS Department – *Informal Survey, CS-JEDI course, advisor-advisee feedback form* — *2020-2023*
Parallel Data Lab (PDL) Meeting Coordinator — *2021*
PhD Orientation Committee – *CMU CS Department's Introductory Course (IC)* — *2020*

Community Outreach

TechNights volunteer – *CS program for middle school girls* *2019-2020*

AP CS Remote Talk at Eagan High School – *On CS career opportunities* *2021*

Science Bus Volunteer and Treasurer – *Teaching 4/5th graders at under-resourced schools science lessons* *2015 - 2018*

STEAM:coders Site Coordinator and Instructor – *CS program for students from disadvantaged communities* *2016*

Professional Experience

Graduate Research Assistant — *Carnegie Mellon University*

Advisors: Nathan Beckmann and Greg Ganger — *Aug. 2019 - Present*

Researched reducing IO to create sustainable caching and storage systems at scale

Research Intern — *Microsoft Research*

Mentor: Amar Phanishayee — *Summer 2022*

Researched serving LLMs more efficiently especially under failure

Research Intern — *Microsoft Research*

Mentor: Daniel Berger — *Summer 2021*

Researched in-kernel disaggregated CXL memory solutions

Software Engineering Intern — *Yelp*

Database Team — *Summer 2019*

Designed, implemented, and rolled out a library to manage MySQL database permissions

Clinic (Capstone) Project — *Harvey Mudd College*

Sponsored by Pure Storage — *Aug. 2018 - May 2019*

Technical lead for team of 4 designing failover mechanisms for NFS VMs running on a two-controller system

Undergraduate Research Assistant — *UNC Chapel Hill*

Advisor: Don Porter — *May 2018 - Aug. 2018*

Researched theoretical and experimental analysis of write-optimized dictionaries

Software Engineering Intern — *Facebook*

Developer Experience Team — *Summer 2017*

Developed a Python library to restart and repair development servers

Research Assistant — *Harvey Mudd College*

Advisor: Anna Ahn — *May. 2016 - Jun. 2017*

Researched three-legged walking and led data analysis of wearable devices