

# DAMLA SENOL CALI

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## RESEARCH INTERESTS

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My main research is in bioinformatics and computer architecture. My research focuses on:

- ◆ Hardware Acceleration of Bioinformatics Applications
- ◆ Genome Sequence Analysis and Assembly Tools
- ◆ Hardware/Software Co-Design
- ◆ Processing-in-Memory
- ◆ Memory Systems

## EDUCATION

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**Carnegie Mellon University**, Pittsburgh, PA *August 2021 (expected)*

**Ph.D.** in Electrical and Computer Engineering

**Advisors:** Prof. Onur Mutlu, Prof. Saugata Ghose

**Dissertation Title:** *Accelerating Genome Sequence Analysis  
via Efficient Hardware-Algorithm Co-Design*

**Carnegie Mellon University**, Pittsburgh, PA *December 2019*

**M.S.** in Electrical and Computer Engineering

**Advisors:** Prof. Onur Mutlu, Prof. Saugata Ghose

**Bilkent University**, Ankara, Turkey *June 2015*

**B.S.** in Computer Engineering

## WORK EXPERIENCE

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**Carnegie Mellon University**, Pittsburgh, PA, USA *August 2015 – Present*

Graduate Research Assistant

**Intel Labs**, Portland, OR, USA *May 2020 – December 2020*

Research Intern

**Carnegie Mellon University**, Pittsburgh, PA, USA *January 2019 – May 2020*

Teaching Assistant (18-240: *Structure and Design of Digital Systems*)

**Intel Labs**, Santa Clara, CA, USA *May 2018 – August 2018*

Research Intern

## AWARDS

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**Top 10 Best Student Presenter Award**, *TECHCON 2019*, Austin, TX, USA, September 2019.

*BitMAC: An In-Memory Accelerator for Bitvector-Based Sequence Alignment of Both Short and Long Genomic Reads*

Damla Senol Cali, Gurpreet S. Kalsi, Lavanya Subramanian, Can Firtina, Anant Nori, Jeremie S. Kim, Zulal Bingol, Rachata Ausavarungnirun, Mohammed Alser, Juan Gomez-Luna, Amirali Boroumand, Allison Scibisz, Can Alkan, Sreenivas Subramoney, Saugata Ghose, and Onur Mutlu.

**Best Poster Award**, *the Eighth RECOMB Satellite Workshop on Massively Parallel Sequencing (RECOMB-Seq) Poster Session*, Paris, France, April 2018.

*Accelerating Approximate Pattern Matching with Processing-In-Memory (PIM) and Single-Instruction Multiple-Data (SIMD) Programming*

Damla Senol Cali, Zulal Bingol, Jeremie S. Kim, Rachata Ausavarungnirun, Saugata Ghose, Can Alkan, and Onur Mutlu.

## PEER-REVIEWED PUBLICATIONS

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*GenASM: A High-Performance, Low-Power Approximate String Matching Acceleration Framework for Genome Sequence Analysis*

Damla Senol Cali, Gurpreet S. Kalsi, Zulal Bingol, Can Firtina, Lavanya Subramanian, Jeremie S. Kim, Rachata Ausavarungnirun, Mohammed Alser, Juan Gomez-Luna, Amirali Boroumand, Anant Nori, Allison Scibisz, Sreenivas Subramoney, Can Alkan, Saugata Ghose, and Onur Mutlu.

In *Proceedings of the 53rd International Symposium on Microarchitecture (MICRO)*, October 2020.

*Accelerating Genome Analysis: A Primer on an Ongoing Journey*

Mohammed Alser, Zulal Bingol, Damla Senol Cali, Jeremie S. Kim, Saugata Ghose, Can Alkan, and Onur Mutlu.

In *IEEE Micro*, 2020.

*Apollo: A Sequencing-Technology-Independent, Scalable, and Accurate Assembly Polishing Algorithm*

Can Firtina, Jeremie S. Kim, Mohammed Alser, Damla Senol Cali, A. Ercument Cicek, Can Alkan, and Onur Mutlu.

In *Bioinformatics*, February 2020.

*Demystifying Workload-DRAM Interactions: An Experimental Study*

Saugata Ghose, Tianshi Li, Nastaran Hajinazar, Damla Senol Cali, and Onur Mutlu.

In *ACM SIGMETRICS*, June 2019.

## ***GRIM-Filter: Fast Seed Location Filtering in DNA Read Mapping Using Processing-in-Memory Technologies***

Jeremie S. Kim, Damla Senol Cali, Hongyi Xin, Donghyuk Lee, Saugata Ghose, Mohammed Alser, Hasan Hassan, Oguz Ergin, Can Alkan, and Onur Mutlu.

In *BMC Genomics*, May 2018.

## ***Nanopore Sequencing Technology and Tools for Genome Assembly: Computational Analysis of the Current State, Bottlenecks and Future Directions***

Damla Senol Cali, Jeremie Kim, Saugata Ghose, Can Alkan, and Onur Mutlu.

In *Briefings in Bioinformatics*, April 2018.

## **TECHNICAL REPORTS (OTHERWISE UNPUBLISHED)**

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### ***AirLift: A Fast and Comprehensive Technique for Remapping Alignments between Reference Genomes***

Jeremie S. Kim, Can Firtina, Meryem Banu Cavlak, Damla Senol Cali, Nastaran Hajinazar, Mohammed Alser, Can Alkan, and Onur Mutlu.

*arXiv:1912.08735 [q-bio.GN]*, February 2021.

## **CONFERENCE & WORKSHOP PRESENTATIONS**

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### ***“GenASM: A High-Performance, Low-Power Approximate String Matching Acceleration Framework for Genome Sequence Analysis” or “BitMAC: An In-Memory Accelerator for Bitvector-Based Sequence Alignment of Both Short and Long Genomic Reads” or “Accelerating Approximate Pattern Matching with Processing-In-Memory (PIM) and Single-Instruction Multiple-Data (SIMD) Programming”***

- ◆ 53rd International Symposium on Microarchitecture (MICRO), Virtual, October 2020.
- ◆ Semiconductor Research Corporation (SRC), Artificial Intelligence Hardware Annual Review, Virtual, September 2020.
- ◆ ARM Research Summit, Virtual, September 2020.
- ◆ Carnegie Mellon University, PDL Spring Visit Day Poster Session, Virtual, June 2020.
- ◆ Carnegie Mellon University, CALCM Seminar, Virtual, April 2020.
- ◆ Semiconductor Research Corporation (SRC), System Level Design Annual Review, Austin, TX, USA, September 2019.
- ◆ TECHCON 2019, Austin, TX, USA, September 2019.
- ◆ 8th RECOMB Satellite Workshop on Massively Parallel Sequencing (RECOMB-Seq) Poster Session, Paris, France, April 2018.

### ***“Accelerating Genome Sequence Analysis via Efficient Hardware-Algorithm Co-Design”***

- ◆ Bilkent University, Computer Engineering Seminar, Ankara, Turkey, December 2019.

***“Nanopore Sequencing Technology and Tools for Genome Assembly: Computational Analysis of the Current State, Bottlenecks and Future Directions” or “Nanopore Sequencing Technology and Tools: Computational Analysis of the Current State, Bottlenecks and Future Directions”***

- ◆ 2<sup>nd</sup> HPCA Workshop on Accelerator Architecture in Computational Biology and Bioinformatics (AACBB), Washington, DC, USA, February 2019.
- ◆ Intelligent Systems for Molecular Biology (ISMB) / European Conference on Computational Biology (ECCB) Poster Session, Prague, Czech Republic, July 2017.
- ◆ Pacific Symposium on Biocomputing (PSB) Poster Session, Hawaii, USA, January 2017.

***“Genome Read In-Memory (GRIM) Filter: Fast Location Filtering in DNA Read Mapping with Emerging Memory Technologies”***

- ◆ 20th Annual International Conference on Research in Computational Molecular Biology (RECOMB) Poster Session, Santa Monica, CA, USA, April 2016.

## **MENTORING EXPERIENCE**

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- ◆ **CMU Undergraduate Research Students:** Allison Scibisz, Alisha Mayor, Ziyi Zuo.
- ◆ **ETH Zurich Undergraduate Research Students:** Linus Joos, Denis Buckingham, Rafael Wanner, Frederik Mohr.
- ◆ **ETH Zurich Master’s Research Students:** Joel Lindegger.
- ◆ **ETH Zurich Research Interns:** Akanksha Baranwal, Meryem Banu Cavlak, Sam Cheung.

## **PROJECTS**

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**iGarson, June 2015. Most Usable Senior Project Award.**

iGarson is a mobile application to ease your restaurant experience with reservation, ordering, and table selection functions. It is developed for both iOS and Android mobile devices.

**Transmission Patterns Discovery of Genome Structural Variations among Generations of a Family, May 2015.**

Detecting structural variations of the whole genomes of 17 family members by using different sequencing-based computational tools and discovering the transmission patterns of these variations among these 3 generations of the family.

## **MEMBERSHIPS**

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- ◆ IEEE and IEEE Computer Society
- ◆ IEEE Women in Engineering, IEEE Engineering in Medicine and Biology Society
- ◆ Semiconductor Research Corporation (SRC)
- ◆ International Society for Computational Biology (ISCB)
- ◆ Computer Architecture Lab at Carnegie Mellon (CALCM)
- ◆ Parallel Data Lab at Carnegie Mellon (PDL)
- ◆ Bilkent University Alumni Association
- ◆ TED Ankara College Alumni Association