

# Kirshanthan Sundararajah

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## RESEARCH INTERESTS

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- Compilers, Programming Languages and High-Performance Computing

## EDUCATION

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Purdue University, West Lafayette, IN.	Aug 21, 2015 - Aug 04, 2023
Ph.D. in Electrical and Computer Engineering	Aug 04, 2023
<ul style="list-style-type: none"><li>• Dissertation: <i>Composable, Sound Transformations of Nested Recursion and Loops.</i></li><li>• Adviser: Milind Kulkarni</li></ul>	
M.S. in Electrical and Computer Engineering	Aug 05, 2022
University of Moratuwa, Katubedda, Sri Lanka.	Jul 21, 2009 - Mar 01, 2014
B.Sc.(Hons) in Electronics and Telecommunication Engineering	Aug 28, 2014

## PROFESSIONAL EXPERIENCE

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- **Assistant Professor of Computer Science @Virginia Tech** Aug 10, 2023 - Present
- **Graduate Research Assistant @Purdue University** Aug 21, 2015 - Jul 28, 2023  
*PLCL Group*
  - **(Poly/Uni)Rec**: Framework for composing irregular program transformations.[PLDI '19, OOPSLA '22]
  - **SparseLNR**: Framework for accelerating sparse tensor computation.[ICS '22]
  - **DARM/HyBF**: Framework for melding similar control-flow graphs.[CGO '22, CC '23]
  - **HACCLE**: Ecosystem for *Secure Multi-Party Computations*.[GPCE '21]
  - **TreeFuser/Grafter**: Framework for fusing general recursive traversals. [OOPSLA '17, PLDI '19]
  - **Treelogy**: Benchmark suite for tree traversals.[ISPASS '17]
  - **Recursion Twisting**: Optimizing nested recursive traversals.[ASPLOS '17]
- **Software Engineering Intern @Nvidia** Sep 21, 2020 - Dec 18, 2020  
*GPU Compiler Group*
  - **Diesel Compiler**: Warp specialization and pipelining for GPU kernels.
- **Software Engineering Intern @Reservoir Labs (Now Qualcomm AI Research)** Jun 01, 2020 - Aug 28, 2020  
*R-Stream Compiler Group*
  - **ParSEC Backend**: A task-based runtime backend for *R-Stream* polyhedral compiler.
- **Research Intern @Microsoft Research** Jun 11, 2018 - Sep 14, 2018  
*RiSE Group*
  - **Parallelizing Word2Vec**: Parallelizing and scaling *Word2Vec* training to execute on many cores.

- **Research Assistant @University of Moratuwa** Mar 02, 2014 - Jul 25, 2015  
Department of CSE
  - **Vectorization:** Model-based Input-adaptive Vectorization
- **Associate Electronic Engineer @Zone24x7 Inc.** May 14, 2012 - Oct 12, 2012  
Signs24x7 Group
  - **Image Compression Algorithm:** Implementation of memory efficient image compression algorithm, supposed to perform decompression on an *STM32 microcontroller* based system.
  - **Clock Synchronization Algorithm:** Implementation of real-time clock synchronization algorithm, deployed on an *ARM microprocessor* runs *embedded Linux*.
  - **Hardware Abstraction Layer:** Implementation of *Hardware Abstraction Layer (HAL)* for radio communication protocol stack of *Electronic Paper Display (EPD)*, driven by an *STM32 microcontroller*.

## AWARDS

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- *Best Paper Award* at International Conference on Supercomputing (ICS) 2022.
- *Bilsland Dissertation Fellowship* 2021-2022, Purdue University.
- *Silver Medal* in ACM Student Research Competition at *SPLASH* 2018.
- *Electrical and Computer Engineering Fellowship* 2015-2016, Purdue University.
- *V. K. Samaranayake Research Assistantship* 2014-2015, University of Moratuwa.
- *Mahapola Merit Scholarship* 2009-2014, University of Moratuwa.

## REFEREED PUBLICATIONS

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- A. Dias, L. Anderson, **K. Sundararajah**, A. Pelenitsyn, and M. Kulkarni. "SparseAuto: An Auto-Scheduler for Sparse Tensor Computations Using Recursive Loop Nest Restructuring" in *Object-Oriented Programming, Systems, Languages, and Applications*, OOPSLA 2024. [ACM DL]
- V. Sinhal, L. Sakka, **K. Sundararajah**, R.R. Newton, and M. Kulkarni. "Orchard: Heterogeneous Parallelism and Fine-grained Fusion for Complex Tree Traversals" in *Transactions on Architecture and Code Optimization*, TACO 2024. [ACM DL]
- R. C. O. Rocha, C. Saumya, **K. Sundararajah**, P. Petoumenos, M. Kulkarni, and M. F. P. O'Boyle "HyBF: A Hybrid Branch Fusion Strategy for Code Size Reduction" in *International Conference on Compiler Construction*, CC 2023. [ACM DL]
- **K. Sundararajah**, C. Saumya, and M. Kulkarni "UniRec: A Unimodular-Like Framework for Nested Recursions and Loops" in *Object-Oriented Programming, Systems, Languages, and Applications*, OOPSLA 2022. [ACM DL]
- A. Dias, **K. Sundararajah**, C. Saumya, and M. Kulkarni "SparseLNR: Accelerating Sparse Tensor Computations Using Loop Nest Restructuring" in *ACM International Conference on Supercomputing*, ICS 2022. [ACM DL] 🏆 **Best Paper Award**
- C. Saumya, **K. Sundararajah**, and M. Kulkarni "DARM: Control-Flow Melding for SIMT Thread Divergence Reduction" in *IEEE Symposium on Code Generation and Optimization*, CGO 2022. [IEEE Xplore]

- Y. Bao\*, **K. Sundararajah\***, R. Malik, Q. Ye, C. Wagner, N. Jaber, F. Wang, M. H. Ameri, D. Lu, A. Seto, B. Delaware, R. Samanta, A. Kate, C. Garman, J. Blocki, P. Letourneau, B. Meister, J. Springer, T. Rompf, and M. Kulkarni "HACCLE: Metaprogramming for Secure Multi-Party Computation" in *International Conference on Generative Programming: Concepts and Experiences*, GPCE 2021. [ACM DL]
- **K. Sundararajah** and M. Kulkarni "Composable, Sound Transformations of Nested Recursion and Loops" in *ACM SIGPLAN Conference on Programming Languages, Design and Implementation*, PLDI 2019. [ACM DL]
- L. Sakka, **K. Sundararajah**, R. R. Newton, and M. Kulkarni "Sound, Fine-Grained Traversal Fusion for Heterogeneous Trees" in *ACM SIGPLAN Conference on Programming Languages, Design and Implementation*, PLDI 2019. [ACM DL]
- L. Sakka, **K. Sundararajah** and M. Kulkarni "TreeFuser: A Framework for Analyzing and Fusing General Recursive Tree Traversals" in *Object-Oriented Programming, Systems, Languages, and Applications*, OOPSLA 2017. [ACM DL]
- N. Hegde, J. Liu, **K. Sundararajah**, and M. Kulkarni "Treelogy: A Benchmark Suite for Tree Traversals" in *IEEE International Symposium on Performance Analysis of Systems and Software*, ISPASS 2017. [IEEE Xplore]
- **K. Sundararajah**, L. Sakka, and M. Kulkarni "Locality Transformations for Nested Recursive Iteration Spaces" in *ACM International Conference on Architectural Support for Programming Languages and Operating Systems*, ASPLOS 2017. [ACM DL]
- **K. Sundararajah** and S. Jayasena, "Model-based Input-adaptive Vectorization" in *Moratuwa Engineering Research Conference*, MERCon 2016. [IEEE Xplore]
- **K. Sundararajah**, L. Logeswaran, P. N. D. Panagoda, L. P. Wijesinghe, D. V. S. X. De Silva, and A. A. Pasqual, "Layered Depth Image Based HEVC Multi-view Codec" in *Advances in Visual Computing: Proceedings of the International Symposium on Visual Computing*, ISVC 2014. [Springer]

## TEACHING EXPERIENCE

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- CS 5134 Programming Languages @Virginia Tech Fall 2024
- CS 6304 Advanced Topics in Language and Translator Design @Virginia Tech Spring 2024
- CS 4304/5304 Compiler Design @Virginia Tech Fall 2023
- ECE 368 Data Structures @Purdue University Summer 2021 and Summer 2022
- ECE 295 Introduction to Data Science [TA] @Purdue University Summer 2019, Fall 2020, and Summer 2023
- CS 1032 Programming Fundamentals [TA] @University of Moratuwa Mar 2014 - Jun 2015

## SERVICE

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- **Organizing**
  - Registration Chair for PPOPP 2023.
  - Member of Project for Inclusion in ECE (PIECE) Committee 2022.
  - Student volunteer for PLDI 2016, SPLASH 2018, PLDI 2019, and SPLASH 2021.
  - Co-organizer of PurPL weekly seminar (Fall 2017 - Spring 2021) and volunteer for PurPL Fest 2019.
- **Reviewing**

- Member of Program Committee (PC) for CGO 2025, PPOPP 2025, and PLDI 2025
- Member of Program Committee (PC) for PLDI 2024 Student Research Competition and CC 2024.
- Member of External Review Committee (ERC) for OOPSLA 2022.
- Member of Artifact Evaluation Committee (AEC) for OOPSLA 2022.
- Member of Artifact Evaluation Committee (AEC) for PLDI 2020.
- Member of Program Committee (PC) for Doctoral Symposium at ECOOP 2019.
- External collaborative reviewer for POPL 2019.

#### • Mentoring

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| – Yuze Li (PhD @VT)<br><i>Compilation Techniques for Tiered Memory Systems</i>                              | Sep 2023 - Present  |
| – Srinivasan Ramachandra Sharma (MS @VT)<br><i>Compiler Transformations for Improving Branch Prediction</i> | Jan 2024 - Present  |
| – Vidush Singhal (UG @Purdue → PhD @Purdue)<br><i>Building LLVM Compiler Backend for SoCET Processor</i>    | Aug 2020 - Jul 2021 |

## ACHIEVEMENTS

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#### • Grants

- ACM Travel Grant to Attend *PLDI 2019, SPLASH 2018, ASPLOS 2017, PLDI 2016, and CGO 2015.*

#### • Competitions

- Placed 25<sup>th</sup>, 34<sup>th</sup>, 29<sup>th</sup>, and 45<sup>th</sup> in *IEEEExtreme 7.0, 6.0, 5.0 and 4.0*, respectively.
- Placed 4<sup>th</sup> in *Sri Lanka Robot Competition (SLRC) 2012.*
- Champions of *Inter-University Statistics Quiz Competition 2010*, University of Colombo, Sri Lanka.
- Participated at *International Mathematics Olympiad Competition(IMO) 2009*, Bremen, Germany