Stanford

Fredrik Kjolstad

Assistant Professor of Computer Science

Bio

BIO

Fredrik Kjolstad is an Assistant Professor in Computer Science at Stanford University. He works on topics in compilers, programming models, and systems, with an emphasis on compiler techniques that make high-level languages portable. He has received the NSF CAREER Award, the MIT EECS Sprowls PhD Thesis Award in Computer Science, the Tau Beta Phi 2024 Teaching Honor Roll, the Google ML and Systems Junior Faculty Awards, and several distinguished paper awards.

ACADEMIC APPOINTMENTS

- Assistant Professor, Computer Science

HONORS AND AWARDS

- Google ML and Systems Junior Faculty Award, Google (2025)
- Distinguished Artifact Award, ISCA (2024)
- Teaching Honor Roll, Stanford Tau Beta Pi (2024)
- Distinguished Paper Award, PLDI (2023)
- NSF CAREER Award, NSF (2022)
- Distinguished Paper Award, OOPSLA (2021)
- Google Research Scholar, Google (2021)
- First Place MIT EECS George M. Sprowls PhD Thesis Award in Computer Science, MIT EECS (2020)
- Robert N. Noyce Faculty Fellow, Stanford University School of Engineering (2020)
- Distinguished Paper Award, OOPSLA (2017)
- Adobe Fellowship, Adobe (2016)
- Best Paper Award, EuroMPI (2013)
- Rosing Prize for best Norwegian IT-related student work., The Norwegian Computer Society (2006)

PROGRAM AFFILIATIONS

- Stanford SystemX Alliance

LINKS

- Academic website: https://fredrikbk.com/
- Google Scholar: https://scholar.google.com/citations?user=bCCxZ28AAAAJ&hl=en&oi=ao

Teaching

COURSES

2025-26

- Compilers: CS 143 (Spr)
- Domain-Specific Programming Models and Compilers: CS 343D (Win)

2024-25

- Compilers: CS 143 (Spr)
- Domain-Specific Programming Models and Compilers: CS 343D (Win)

2023-24

- Compilers: CS 143 (Spr)
- Domain-Specific Programming Models and Compilers: CS 343D (Win)

2022-23

- Compilers: CS 143 (Spr)
- Domain-Specific Programming Models and Compilers: CS 343D (Win)

STANFORD ADVISEES

Doctoral Dissertation Reader (AC)

Bo Wun Cheng, Konstantin Hossfeld, Gedeon Nyengele, Ritvik Sharma, Gina Sohn, Maxwell Strange

Doctoral Dissertation Advisor (AC)

Scott Kovach, Alexander Root, Haoran Xu

Orals Evaluator

Rohan Yadav

Master's Program Advisor

Zhang Bai-han, Rahul Chand, Ashley Dai, Bryce Goldman, Aniket Gupta, Churan He, Elijah Kim, Mina Ky, Devanshu Ladsaria, Alisha Nanda, Usman Tariq

Doctoral Dissertation Co-Advisor (AC)

Rubens Lacouture, Rohan Yadav

Doctoral (Program)

James Dong, Chris Gyurgyik, Alexander Root, Shiv Sundram, Haoran Xu, Bobby Yan

Publications

PUBLICATIONS

- **Ember: A Compiler for Embedding Operations on Decoupled Access-Execute Architectures** *International Symposium on Code Generation and Optimization (CGO)*
  Siracusa, M., Hsu, O., Soria-Pardos, V., Randall, J., Grasset, A., Biscondi, E., Joseph, D., Allen, R., Kjolstad, F., Planas, M., Armejach, A. 2026: 150-163

- **FuseFlow: A Fusion-Centric Compilation Framework for Sparse Deep Learning on Streaming Dataflow** *International Conference on Architectural Support for Programming Languages and Operating Systems*
  Lacouture, R., Zhang, N., Sharma, R., Siracusa, M., Kjolstad, F., Olukotun, K., Hsu, O.

2026: 798 - 820

- **Fast Autoscheduling for Sparse ML Frameworks** *International Symposium on Code Generation and Optimization (CGO)*
  Yan, B., Root, A. J., Gale, T., Broman, D., Kjolstad, F.
  2026: 28-43
- **Stardust: Compiling Sparse Tensor Algebra to a Reconfigurable Dataflow Architecture** *ACM/IEEE International Symposium on Code Generation and Optimizatio*
  Olivia Hsu, O., Rucker, A., Zhao, T., Desai, V., Olukotun, K., Kjolstad, F.
  2025: 16
- **REPTILE: Performant Tiling of Recurrences** *Proceedings of the ACM on Programming Languages*
  Tariq, M., Sundram, S., Kjolstad, F.
  2025; 9 (OOPSLA2): 670 - 696
- **A Probabilistic Perspective on Tiling Sparse Tensor Algebra** *IEEE/ACM International Symposium on Microarchitecture*
  Sharma, R., Xue, Z., Zhang, N., Lacouture, R., Kjolstad, F., Achour, S., Horowitz, M.
  2025: 795 - 808
- **Onyx: A 12-nm Programmable Accelerator for Dense and Sparse Applications** *IEEE Journal of Solid-State Circuits*
  Koul, K., Hsu, O., Mei, Y., Ravipati, S., Strange, M., Melchert, J., Carsello, A., Kong, T., Chen, P., Ke, H., Zhang, K., Liu, Q., Nyengele, et al
  2025; Early access: 1 - 13
- **Designing Programmable Accelerators for Sparse Tensor Algebra** *IEEE Micro*
  Koul, K., Xie, Z., Strange, M., Ravipati, S., Cheng, B., Hsu, O., Chen, P., Horowitz, M., Kjolstad, F., Raina, P.
  2025; 45 (3): 58 - 65
- **Automatic Tracing in Task-Based Runtime Systems** *ACM International Conference on Architectural Support for Programming Languages and Operating Systems*
  Yadav, R., Bauer, M., Broman, D., Garland, M., Aiken, A., Kjolstad, F.
  2025: 16
- **Composing Distributed Computations Through Task and Kernel Fusion** *ACM International Conference on Architectural Support for Programming Languages and Operating Systems*
  Yadav, R., Sundram, S., Lee, W., Garland, M., Bauer, M., Aiken, A., Kjolstad, F.
  2025: 16
- **Compilation of Shape Operators on Sparse Arrays** *PROCEEDINGS OF THE ACM ON PROGRAMMING LANGUAGES-PACMPL*
  Root, A. J., Yan, B., Liu, P., Gyurgyik, C., Bik, A. J. C., Kjolstad, F.
  2024; 8 (OOPSLA)
- **Compiler Support for Sparse Tensor Convolutions** *PROCEEDINGS OF THE ACM ON PROGRAMMING LANGUAGES-PACMPL*
  Liu, P., Root, A. J., Xu, A., Li, Y., Kjolstad, F., Bik, A. J. C.
  2024; 8 (OOPSLA)
- **Compilation of Modular and General Sparse Workspaces**
  Zhang, G., Hsu, O., Kjolstad, F.
  ASSOC COMPUTING MACHINERY.2024
- **Revet: A Language and Compiler for Dataflow Threads** *International Symposium on High-Performance Computer Architecture*
  Rucker, A., Sundram, S., Smith, C., Vilim, M., Prabhakar, R., Kjolstad, F., Olukotun, K.
  2024: 14
- **The Dataflow Abstract Machine Simulator Framework**
  Zhang, N., Lacouture, R., Sohn, G., Mure, P., Zhang, Q., Kjolstad, F., Olukotun, K., IEEE COMPUTER SOC
  IEEE COMPUTER SOC.2024: 532-547
- **Onyx: A 12nm 756 GOPS/W Coarse-Grained Reconfigurable Array for Accelerating Dense and Sparse Applications** *IEEE Symposium on VLSI Technology & Circuits (VLSI)*
  Koul, K., Strange, M., Melchert, J., Carsello, A., Mei, Y., Hsu, O., Kong, T., Chen, P., Ke, H., Zhang, K., Liu, Q., Nyengele, G., Balasingam, et al
  2024: 1-2

- **Compiling Recurrences over Dense and Sparse Arrays** *Proceedings of the ACM on Programming Languages*
  Sundram, S., Tariq, M. U., Kjolstad, F.
  2024; 8: 26
- **AHA: An Agile Approach to the Design of Coarse-Grained Reconfigurable Accelerators and Compilers** *ACM Transactions on Embedded Computing Systems*
  Koul, K., Melchert, J., Sreedhar, K., Truong, L., Nyengele, G., Zhang, K., Liu, Q., Setter, J., Chen, P., Mei, Y., Strange, M., Daly, R., Donovick, et al
  2023; 22 (2)
- **BaCO: A Fast and Portable Bayesian Compiler Optimization Framework** *International Conference on Architectural Support for Programming Languages and Operating Systems*
  Hellsten, E. O., Souza, A., Lenfers, J., Lacouture, R., Hsu, O., Ejjeh, A., Kjolstad, F., Steuwer, M., Olukotun, K., Nardi, L.
  2023: 24
- **Legate Sparse: Distributed Sparse Computing in Python** *International Conference for High Performance Computing, Networking, Storage and Analysis*
  Yadav, R., Lee, W., Elibol, M., Papadakis, M., Lee-Patti, T., Garland, M., Aiken, A., Kjolstad, F., Bauer, M.
  2023: 13
- **Indexed Streams: A Formal Intermediate Representation for Fused Contraction Programs** *Proceedings of the ACM on Programming Languages*
  Kovach, S., Kolichala, P., Gu, T., Kjolstad, F.
  2023; 7 (PLDI): 25
- **Mosaic: An Interoperable Compiler for Tensor Algebra** *Proceedings of the ACM on Programming Languages*
  Bansal, M., Hsu, O., Olukotun, K., Kjolstad, F.
  2023; 7 (PLDI): 26
- **The Sparse Abstract Machine** *International Conference on Architectural Support for Programming Languages and Operating Systems*
  Hsu, O., Strange, M., Sharma, R., Won, J., Olukotun, K., Emer, J. S., Horowitz, M. A., Kjolstad, F.
  2023: 17
- **Looplets: A Language for Structured Coiteration** *Proceedings of the 21st ACM/IEEE International Symposium on Code Generation and Optimization*
  Ahrens, W., Donenfeld, D., Kjolstad, F., Amarasinghe, S.
  Association for Computing Machinery.2023: 14
- **Unified Buffer: Compiling Image Processing and Machine Learning Applications to Push-Memory Accelerators** *ACM Transactions on Architecture and Code Optimization*
  Liu, Q., Setter, J., Huff, D., Strange, M., Feng, K., Horowitz, M., Raina, P., Kjolstad, F.
  2023: 26
- **Autoscheduling for sparse tensor algebra with an asymptotic cost model** *43rd ACM SIGPLAN International Conference on Programming Language Design and Implementation*
  Ahrens, P., Kjolstad, F., Amarasinghe, S.
  2022: 17
- **SpDISTAL: Compiling Distributed Sparse Tensor Computations** *International Conference on High Performance Computing, Networking, Storage and Analysis*
  Yadav, R., Aiken, A., Kjolstad, F.
  2022: 15
- **Compiler Support for Sparse Tensor Computations in MLIR** *ACM Transactions on Architecture and Code Optimization*
  Bik, A., Koanantakool, P., Shpeisman, T., Vasilache, N., Zheng, B., Kjolstad, F.
  2022; 19 (4): 1-25
- **DISTAL: The Distributed Tensor Algebra Compiler** *43rd ACM SIGPLAN International Conference on Programming Language Design and Implementation*
  Yadav, R., Aiken, A., Kjolstad, F.
  2022: 15

- **Compilation of Sparse Array Programming Models** *PROCEEDINGS OF THE ACM ON PROGRAMMING LANGUAGES-PACMPL*
  Henry, R., Hsu, O., Yadav, R., Chou, S., Olukotun, K., Amarasinghe, S., Kjolstad, F.
  2021; 5
- **Copy-and-Patch Compilation A Fast Compilation Algorithm for High-Level Languages and Bytecode** *PROCEEDINGS OF THE ACM ON PROGRAMMING LANGUAGES-PACMPL*
  Xu, H., Kjolstad, F.
  2021; 5
- **Creating an Agile Hardware Design Flow** *2020 57th ACM/IEEE Design Automation Conference (DAC)*
  Bahr, R., Barrett, C., Bhagdikar, N., Carsello, A., Daly, R., Donovick, C., Durst, D., Fatahalian, K., Feng, K., Hanrahan, P., Hofstee, T., Horowitz, M., Huff, et al
  2020
- **Automatic Generation of Efficient Sparse Tensor Format Conversion Routines** *Proceedings of the 41st ACM SIGPLAN Conference on Programming Language Design and Implementation*
  Chou, S., Kjolstad, F., Amarasinghe, S.
  2020: 16
- **Sparse Tensor Transpositions** *Proceedings of the 32nd ACM Symposium on Parallelism in Algorithms and Architectures*
  Mueller, S., Ahrens, P., Chou, S., Kjolstad, F., Amarasinghe, S.
  2020: 3
- **A Sparse Iteration Space Transformation Framework for Sparse Tensor Algebra** *Proceedings of the ACM on Programming Languages*
  Senanayake, R., Hong, C., Wang, Z., Wilson, A., Chou, S., Kamil, S., Amarasinghe, S., Kjolstad, F.
  2020; 4 (OOPSLA): 30
- **Tensor Algebra Compilation with Workspaces** *Proceedings of the 2019 IEEE/ACM International Symposium on Code Generation and Optimization*
  Kjolstad, F., Ahrens, P., Kamil, S., Amarasinghe, S.
  2019: 13
- **Format Abstraction for Sparse Tensor Algebra Compilers** *Proceedings of the ACM on Programming Languages*
  Chou, S., Kjolstad, F., Amarasinghe, S.
  2018; 2 (OOPSLA): 30
- **The Tensor Algebra Compiler** *Proceedings of the ACM on Programming Languages*
  Kjolstad, F., Kamil, S., Chou, S., Lugato, D., Amarasinghe, S.
  2017; 1 (OOPSLA): 29
- **Simit: A Language for Physical Simulation** *ACM TRANSACTIONS ON GRAPHICS*
  Kjolstad, F., Kamil, S., Ragan-Kelley, J., Levin, D. I., Sueda, S., Chen, D., Vouga, E., Kaufman, D. M., Kanwar, G., Matusik, W., Amarasinghe, S.
  2016; 35 (2)
- **Why New Programming Languages for Simulation?** *ACM TRANSACTIONS ON GRAPHICS*
  Bernstein, G. L., Kjolstad, F.
  2016; 35 (2)
- **MPI Datatype Processing using Runtime Compilation** *Proceedings of the 20th European MPI Users' Group Meeting*
  Schneider, T., Kjolstad, F., Hoefler, T.
  2013: 6
- **Automatic Datatype Generation and Optimization**
  Kjolstad, F., Hoefler, T., Snir, M.
  ASSOC COMPUTING MACHINERY.2012: 327–28
- **Transformation for Class Immutability** *33rd International Conference on Software Engineering*
  Kjolstad, F., Dig, D., Acevedo, G., Snir, M.
  2011

- **Transformation for Class Immutability**
  Kjolstad, F., Dig, D., Acevedo, G., Snir, M., IEEE
  IEEE.2011: 61–70
- **Ghost Cell Pattern** *Proceedings of the 2010 Workshop on Parallel Programming Patterns*
  Kjolstad, F., Snir, M.
  2010: 9