Awards and recognitions

2020 ACM Distinguished Speaker

I have been selected as ACM Distinguished Speaker by the Association of Computing Machinery (https://speakers.acm.org/speakers/kumar_12579). Through the ACM Distinguished Speaker Program, ACM provides direct access to top technology leaders and innovators from nearly every sector of the computing industry for speaking engagements at colleges and universities, corporations, conferences, and ACM local Chapter events. https://speakers.acm.org/about. Currently, there are only 204 ACM Distinguished speakers who have been recognized for their contributions across the world. World-renowned innovators like Dr. Brian A. Barsky, a professor from UC Berkeley, and Dr. Salman A Baset, the CTO of IBM Blockchain Solutions are members. The full list of speakers can be found at https://speakers.acm.org/

Qualstar Hall of Fame [By Qualcomm]

Jan 2015: For the outstanding work in improving MPPS significantly on LLVM builds of the Jolokia modem. This work was conducted under immense time pressure and your efforts directly resulted in ensuring that LLVM was successful on low-tier modem products.

Sep 2014: For excellent efforts on analyzing and implementing various compiler optimizations to significantly improve Coremark benchmark.

Program Chair of LLVM CGO Workshop 2017-2021:

LLVM Performance Workshop brings engineers and academicians to present their innovations and findings on compilation and interpretation techniques. It is co-located with prestigious CGO, CC, HPCA, and PPoPP conferences. In the previous conferences, employees of companies like Samsung, Facebook, Qualcomm, Google, Intel have contributed. We also have had contributions from renowned universities like ETH Zurich, Saarland University, MIT, Argonne National Laboratory, Carnegie Mellon University, and Argonne National Laboratory.
Link of previous LLVM CGO workshops:

- http://llvm.org/devmtg/2017-02-04/
- http://llvm.org/devmtg/2018-02-24/
- http://llvm.org/devmtg/2019-02-16/
- http://llvm.org/devmtg/2020-02-23/
- http://llvm.org/devmtg/2021-02-28/

Mentions of my work by reputed entities

On GVNHoist optimization

- Lenovo enables GVNHoist while reporting SPEC 2017 numbers: https://www.spec.org/cpu2017/results/res2019q3/cpu2017-20190722-16310.html

- AMD enables GVNHoist while reporting SPEC 2017 numbers: https://www.spec.org/cpu2017/flags/aocc130-flags-revA2-HPE.html
- DELL enables GVNHoist while reporting SPEC 2017 numbers: http://www.crc.nd.edu/~rich/ROME/Dell/R6525/7742/cpu2017-20190930-18850.pdf
- HP Enterprise enables GVNHoist while reporting SPEC 2017 numbers: https://www.spec.org/cpu2017/results/res2019q1/cpu2017-20190204-10941.flags.html
- Gigabyte technology enables GVNHoist while reporting SPEC 2017 numbers: http://www.spec.org/cpu2017/results/res2019q3/cpu2017-20190722-16241.flags.html
- Super micro enables GVNHoist while reporting SPEC 2017 numbers: https://www.spec.org/cpu2017/results/res2019q3/cpu2017-20190806-16717.html
- GVNHoist enabled in LLVM (https://www.phoronix.com/scan.php?page=news_item&px=LLVM-Clang-4.0-Features)
- Embedded Linux presentation referring to GVNHoist (https://elinux.org/images/8/80/Status-of-embedded-Linux-2018-03-JJ64.pdf page-42)
- Intel's senior software engineer referring to GVNHoist (https://easyperf.net/blog/2017/10/27/Vectorization_warmup)
- GVNHoist contributes to peak performance in GPUs as mentioned in "Impact of Compiler Phase Ordering When Targeting GPUs" at the European Conference on Parallel Parallel Processing 2017 (https://arxiv.org/pdf/1810.10496.pdf)

On hot cold splitting optimization:

- A video recording to show why hot cold splitting optimization is used in all the iPhone apps: https://www.youtube.com/watch?v=YlKpO_q2HRw
- Huge performance improvements in some of the Apple's core libraries: https://github.com/apple/swift/pull/21016 For example: 48% In NSStringConversion
- The dlang community referring to hot cold splitting optimization in LLVM (https://forum.dlang.org/post/yhouqgqaxvqljsccpqxx@forum.dlang.org)
- Intel's senior software engineer referring to the hot cold splitting optimization https://easyperf.net/blog/2019/03/27/Machine-code-layout-optimizatoins

On string::find (string-search algorithm)

- The performance of libcxx's implementation of string::find has been improved dramatically. (http://llvmweekly.org/issue/157 r290761)
- Reference to string::find on libstdc++ (https://en.wikipedia.org/wiki/String-searching_algorithm)

On Demacrofier:

- Visual studio replacing macros: https://devblogs.microsoft.com/cppblog/convert-macros-to-constexpr/

- Repara project's Cevelop IDE: http://repara-project.eu/
  https://iris.unito.it/retrieve/handle/2318/1523738/52857/15_RePara_ISPA.pdf
  https://www.cevelop.com/

PlatformIO referred to my work on linkedin:

PlatformIO: https://www.linkedin.com/feed/update/urn:li:activity:6714130215875973120/

Research Papers with citations

[32 citations] A. Kumar, A. Sutton, and B. Stroustrup, "Rejuvenating C++ Programs through Demacrofication" in Software Maintenance, 2012. ICSM 2012. IEEE Conference on. IEEE, 2012

[6 citations] A. Kumar, Sebastian Pop, "SCoP Detection: A Fast Algorithm for Industrial Compilers", in IMPACT 2016 6th International Workshop on Polyhedral Compilation Techniques

[1 citation] A. Kumar, A. Sutton, and B. Stroustrup, "The Demacrofier", in Software Maintenance, 2012. ICSM 2012. IEEE Conference on. IEEE, 2012

G Kudrjavets, J Thomas, **A. Kumar**, N Nagappan, A Rastogi: "Quantifying Daily Evolution of Mobile Software Based on Memory Allocator Churn" in International Conference on Mobile Software Engineering and Systems 2022

G Kudrjavets, **A. Kumar**, N Nagappan, A Rastogi: "The Unexplored Terrain of Compiler Warnings" in International Conference on Software Engineering 2022

G Kudrjavets, **A. Kumar**, N Nagappan, A Rastogi: "Mining Code Review Data to Understand Waiting Times Between Acceptance and Merging: An Empirical Analysis" in International Conference on Mining Software Repositories 2022

Google Scholar: https://scholar.google.com/citations?user=Tm57yZwAAAAJ&hl=en

Co-authors of research papers:

Bjarne Stroustrup: The designer and original implementer of C++ programming language.
http://www.stroustrup.com/
https://scholar.google.com/citations?user=Rr9Y8acAAAAJ
Citation count: 20643

Nachiappan Nagappan: Software Engineer at Facebook
https://scholar.google.com/citations?user=Nzx_7P8AAAAJ&hl=en
Citation count: 16300

Sebastian Pop: Author of several major compiler optimizations, pioneer of polyhedral compiler frameworks in industrial compilers GCC and LLVM.
https://scholar.google.com/citations?user=OpmnkcAAAAAJ
Citation count: 651

Andrew Sutton: Professor at the University of Akron, Ohio. http://asutton.github.io/index.html
https://scholar.google.com/citations?user=7ZrkgVMAAAAJ
Citation count: 440

Ayushi Rastogi: Asst Professor at the University of Groningen
https://scholar.google.com/citations?user=5afoUz4AAAAJ
Citation count: 264

Gunnar Kudrjavets: Phd Student. Previously, Principal Engineer at Microsoft
https://scholar.google.com/citations?user=y7AYhKoAAAAJ
Citation count: 159

Invited course by RISC-V international in collaboration the Linux Foundation

"RISC-V Toolchain and Compiler Optimization Techniques"
edX is a leading American massive open online course provider created by Harvard and MIT. It hosts online university-level courses in a wide range of disciplines to a worldwide student body. It has more than 20 million learners.
Link to course:
https://www.edx.org/course/risc-v-toolchain-and-compiler-optimization-techniques

Patent

Patent title System and method for merging divide and multiply-subtract operations
Patent rejected: 15/853628
https://patents.google.com/patent/US20190102197A1/en?oq=15%2f853628

Co-authors of patent:

Bonnie Sexton: Author of 9 patents; Distinguished inventor at Samsung Electronics.
Patent profile:
https://patents.google.com/?inventor=Bonnie+Sexton&assignee=Samsung+Electronics+Co.%2c+Ltd.&language=ENGLISH&dups=language
LinkedIn profile: https://www.linkedin.com/in/bonnie-sexton-590b2611/

Technical Talks

Open Source Summit + Embedded Linux Conference North America (Approximate audience: 3500-4000)

- 2020 Code Size Compiler Optimizations and Techniques for Embedded Systems https://ossna2020.sched.com/event/c3Vh (https://static.sched.com/hosted_files/ossna2020/f9/OSSEmbeddedLinuxConference.pdf)

RISC-V Global Forum (Approximate audience: 700)

- 2020 Code Size Compiler Optimizations and Techniques for Embedded Systems https://riscvglobalforum2020.sched.com/event/dO2L (https://static.sched.com/hosted_files/riscvglobalforum2020/1d/OSSEmbeddedLinuxConference.pdf)

LLVM Developers' Meeting Presentations (Approximate audience: 300-500)

- 2020 Code Size Compiler Optimizations and Techniques https://whova.com/embedded/session/llvm_202010/1162331/ (https://llvm.org/devmtg/2020-09/slides/Kumar-LLVMDevCodeSizePdf.pdf)
- 2020 A fast algorithm for global code motion of congruent instructions https://whova.com/embedded/session/llvm_202010/1193951/ (https://llvm.org/devmtg/2020-09/slides/Kumar-LLVMGlobalSched.pdf)
- 2019 Hot Cold Splitting Optimization Pass In LLVM http://llvm.org/devmtg/2019-10/talk-abstracts.html#tech8 (https://llvm.org/devmtg/2019-10/slides/Kumar-HotColdSplitting.pdf)
- 2019 -Wall Found Programming Errors and Engineering Effort to Enable Across a Large Codebase http://llvm.org/devmtg/2019-10/talk-abstracts.html#lit4 (http://llvm.org/devmtg/2019-10/slides/Kumar-WallFoundCompilationErrors.pdf)
- 2018 Porting Function merging pass to thinlto http://llvm.org/devmtg/2018-10/talk-abstracts.html#talk2 (https://llvm.org/devmtg/2018-10/slides/Kumar-FunctionMergingPortThinLTO.pdf)
- 2017 Introsort based sorting function for libc++ http://llvm.org/devmtg/2017-10/#lightning3
- 2016 GVN-Hoist: Hoisting Computations from Branches http://llvm.org/devmtg/2016-11/#talk11 (http://llvm.org/devmtg/2016-11/Slides/Kumar-Pop-GVNHoist.pdf)
- 2016 Performance improvements in libcxx https://llvmdevelopersmeetingbay2016.sched.com/event/8Yzk/performance-improvements-in-libcxx
- 2016 Reducing the Computational Complexity of RegionInfo https://llvmdevelopersmeetingbay2016.sched.com/event/8Z2Z/lightning-talks https://llvm.org/devmtg/2016-11/Slides/Singhal-ReducingTheComputationalComplexity.pdf
- 2014 Implementation of global instruction scheduling in LLVM infrastructure http://llvm.org/devmtg/2014-10/#talk17 (http://llvm.org/devmtg/2014-10/Slides/Larin-GlobalInstructionScheduling.pdf)

LLVM Performance workshop at CGO (Approximate audience: 20-50)

- 2020 Cheap function entry instrumentation to collect runtime metrics http://llvm.org/devmtg/2020-02-23/#ak
- 2017 Performance analysis of libcxx at LLVM CGO http://llvm.org/devmtg/2017-02-04/#kumar (http://llvm.org/devmtg/2017-02-04/Performance-analysis-of-libcxx.pdf)
- 2017 Efficient clustering of case statements for indirect branch predictors: http://llvm.org/devmtg/2017-02-04/#menezes (goo.gl/qxBSxS)

GCC Cauldron (Approximate audience: 150-200)

- 2015 Proposal to improve loop optimizations by improving Vectorizer and Graphite (http://gcc.gnu.org/wiki/cauldron2015?action=AttachFile&do=view&target=Aditya+Kumar,+Sebastian+Pop_+Loop+optimizer+and+vectorization+BOF.pdf)

CPP Con (Approximate audience: 1400)

- 2021 Code Size Compiler Optimizations and Techniques for Embedded Systems https://cppcon2021.sched.com/event/nvCU (https://github.com/hiraditya/std-benchmark/blob/master/docs/slides/CppConCodesizeCompilerOptimizationAndTechniques.pdf)

CPP Now (Approximate audience: 100-150)

- 2017 Performance analysis and optimization of C++ standard libraries http://sched.co/A8J7 (https://github.com/hiraditya/std-benchmark/blob/master/docs/slides/slide-cppnow.pdf)

OOPSLA SPLASH-I Invited Talk (Approximate audience: 40-50)

- 2020 Programming Languages Mentoring Workshop https://2020.splashcon.org/profile/adityakumar (PLMW Mentoring)
- 2017 Performance Analysis and Optimization of C++ Standard Libraries https://2017.splashcon.org/track/splash-2017-SPLASH-I#program

Design Automation Conference (Approximate audience: 30-40)

- 2017 Performance Analysis and Optimization http://www2.dac.com/events/eventdetails.aspx?id=223-134 (https://github.com/hiraditya/std-benchmark/blob/master/docs/slides/slide-DAC-2017.pdf)

References to impactful work

Improvements to the C++ Standard Library:

- Improve iostream: https://reviews.llvm.org/D30268

- Improve string::find in libstdc++ and libc++ (https://gcc.gnu.org/ml/libstdc++/2016-12/msg00097.html, https://reviews.llvm.org/D27068)

Compiler optimizations:

- Global Instruction Scheduler in SSA IR level https://reviews.llvm.org/D32140
- Global Instruction Scheduler for VLIW architecture. (https://llvm.org/devmtg/2014-10/Slides/Larin-GlobalInstructionScheduling.pdf)
- GVN Hoist in SSA IR level https://llvm.org/devmtg/2016-11/Slides/Kumar-Pop-GVNHoist.pdf
- Hot-Cold Splitting in SSA IR level (https://reviews.llvm.org/D50658)
- A fast algorithm for Single Entry Single Exit region detection http://impact.gforge.inria.fr/impact2016/papers/impact2016-kumar.pdf
- A cheap function entry instrumentation technique to help detect dead code in large codebase https://reviews.llvm.org/D74362
- Merging similar functions across the whole program in ThinLTO https://reviews.llvm.org/D52896 https://llvm.org/devmtg/2018-10/slides/Kumar-FunctionMergingPortThinLTO.pdf
- Efficient clustering of case statements for indirect branch prediction: https://llvm.org/devmtg/2017-02-04/Efficient-clustering-of-case-statements-for-indirect-branch-prediction.pdf https://arxiv.org/pdf/1910.02351.pdf

Details of organizations and conferences that I have presented to:

Previous presenters at ACM Distinguished speakers at Washington DC chapter include:

- Burak Kantarci (https://www.linkedin.com/in/bkantarci/). He has co-authored over 150 journal and conference papers, and contributed to 11 book chapters. He serves as the chair of the IEEE ComSoc Communication Systems Integration and Modeling Technical Committee. He is a member of the ACM and senior member of the IEEE. He is also a Distinguished Speaker of the ACM.
- Thomas J. LeBlanc (https://en.wikipedia.org/wiki/Thomas_LeBlanc): 17th President of George Washington University.
- Prof. Robert Pless (https://www.cs.seas.gwu.edu/robert-pless): Department Chair & Patrick & Donna Martin Professor of Computer Science

Previous members of PLMW Workshop include:

- Benjamin Pierce. https://2020.splashcon.org/track/splash-2020-PLMW?
- Other attendees include well known professors from premier Universities like James Koppel from MIT, Jonathan Aldrich from Carnegie Mellon University to name a few.

People refer to my work on linkedin:

- PlatformIO: https://www.linkedin.com/feed/update/urn:li:activity:6714130215875973120/

LLVM Project and LLVM Developers' Meeting

The LLVM Project is a collection of modular and reusable compiler and toolchain technologies. LLVM project has been awarded the 2012 ACM Software System Award. This award is given by ACM to one software system worldwide every year. Link to the ACM award: https://awards.acm.org/award_winners/lattner_5074762. The LLVM Developers' Meeting is a bi-annual gathering of the entire LLVM Project community. The presenters come from some of the biggest technology companies like Apple, Google, Facebook, Nvidia, Qualcomm and from top research universities like University of California Los Angeles, Rice University, Stanford University, University of Illinois at Urbana-Champaign. A partial list of LLVM adopters is here: https://llvm.org/Users.html

RISC-V Global Forum

RISC-V Global Forum is an international conference organized by the RISC-V International organization. Speakers from technology companies like Nvidia, Western Digital, and well known organisations like the European Space Agency. https://riscv.org/proceedings/2020/09/risc-v-global-forum-proceedings/

The Embedded Linux Conference

The Embedded Linux Conference has been the premier vendor-neutral technical conference for more than 10 years for companies and developers using Linux in embedded products. It brings in thousands of attendees from all across the globe. Presenters include engineers from Google, Microsoft, Amazon, Facebook, Professor from Carnegie Mellon University, CEOs/CTOs from technology companies, and a Keynote from Linus Torvalds who is the principal developer of the Linux kernel. (https://www.embeddedlinuxconference.com/)

GNU Tools Cauldron

GNU Tools Cauldron is a conference held by the GNU community that maintains and develops GNU toolchain projects like gcc, gdb, glibc which form essential components of any Linux operating systems. (https://gcc.gnu.org/wiki/cauldron2015)

SPLASH conference

SPLASH is The ACM SIGPLAN conference on Systems, Programming, Languages and Applications: Software for Humanity (SPLASH) embraces all aspects of software construction and delivery to make it the premier conference at the intersection of programming, languages, and software engineering. (https://2020.splashcon.org/)

Design Automation Conference (DAC)

The Design Automation Conference (DAC) is the premier event devoted to the design and design automation of electronic chips and systems (https://www.dac.com/).

Cppcon

Cppcon (https://cppcon.org/) is the leading C++ conference for C++ experts. It is organized by the Standard C++ Foundation, a non-profit organization behind the language and the C++ community itself. The conference often has the keynot from the founder of C++ Bjarne Stroustrup.

Cppnow

Cppnow (https://cppnow.org/) is one of the two major C++ conferences where rigorous and highly impactful work is presented every year. Previous presenters include Prof. Bjarne Stroustrup (The designer and original implementer of C++ programming language), Marshall Clow(The chief maintainer of libc++ standard library), and many more.