

Research Areas

- Intersection of compilers and the following areas:
 - Deep learning: building compilers for deep learning and using deep learning to improve compilers.
 - Hardware accelerators: building compilers for hardware accelerators.
 - High performance computing: programming models and compilers for HPC systems.

Education

- 2019 Postdoctoral associate, **MIT**. Supervised by Prof. Saman Amarasinghe.
- 2015 PhD degree in computer science, **Paris Sorbonne UPMC** university (ranked 1st in France). Supervised by Prof. Albert Cohen (Google AI).
- 2011 Master's degree in computer science, Paris Sorbonne UPMC university (ranked 1st in France).
- 2010 Engineering degree in computer science, Ecole Superieure d'Informatique, Algiers (ranked 1st in Algeria).

Work Experience & Projects

- 2015 **MIT (USA): Postdoctoral Associate (4 years).**
- Led the team that developed the Tiramisu compiler (<http://tiramisu-compiler.org/>). Tiramisu is a polyhedral compiler for deep learning, tensor algebra and image processing. Tiramisu applies advanced code optimizations and generates efficient code for multicore and GPU (CUDA) architectures.
 - Led a team that developed a fully automatic optimization technique for the Tiramisu compiler. This technique uses deep learning to create a cost model to search a large space of optimizations.
 - Collaborated with researchers from MIT, UC Berkeley, Stanford, Facebook, Google and Adobe to develop an automatic code optimization technique for the Halide compiler. This technique relies on deep learning to create a cost model.
 - Member of multiple teams/projects: GraphIt (a DSL compiler for graph analytics), Seq (a python compiler for genomic applications) and FROST (a DSL backend for FPGA)
- 2013 **NVIDIA (USA): Internship (4 months).**
- Participated in the development of the Nvidia NOVA DSL compiler. A fully automatic DSL for image processing targeting CUDA.
- 2010 **INRIA (France): Research Assistant/Graduate Student (4 years).**
- Led the team that designed the PENCIL language, a subset of C crafted to allow compilers to generate efficient code for hardware accelerators. This project was a part of the CARP European project and led to many collaborations with industrials and academic institutions (ARM, Imperial College London, ...).
 - Developed a technique that relaxes the tiling legality check to allow compilers to apply loop tiling even if the code has false dependences.
 - Member of the team that developed the PENCIL/PPCG polyhedral compiler. Worked mainly on GPU code generation (OpenCL). PENCIL/PPCG is an automatic polyhedral compiler that was recently used to build Tensor Comprehensions, the Facebook deep learning compiler.
- 2010 **Google Summer of Code 2010 (3 months).**
- Designed and implemented a pass to import/export the polyhedral representation of programs from GCC.

Teaching Experience

- 2018 **MIT (USA): MIT Kaufman Teaching Certificate Program.**
- Certified for teaching by the MIT Kaufman Teaching Certificate Program (KTCP).
- 2018 **MIT (USA): Teaching Assistant.**
- A class about programming high performance systems.
- 2017 **ESI (Algiers): Main Teacher.**
- Designed a full class about programming high performance systems for Master and PhD students. The class included an introduction to parallel programming, code optimization, programming shared memory systems (OpenMP), programming distributed memory systems (MPI) and programming GPUs (CUDA). I designed all the lectures, lab assignments and class projects.
- 2012 **Paris Sorbonne UPMC (France): Teaching Assistant.**
- Taught three different classes about CUDA, C and Fortran (graduate and undergraduate levels).
 - GPGPU programming (CUDA, master's degree).
 - Introduction to programming (C language, bachelor's degree).
 - Imperative programming (Fortran, bachelor's degree).

Papers

1. "An Expressive Polyhedral Compiler for Deep Learning". [Under Review]
2. "Building Cost Models for Full Programs Using Deep Learning". [Under Review]
3. "Learning to Optimize Halide with Tree Search and Random Programs". SIGGRAPH 2019. Andrew A., Karima M., Luke A., Tzu-Mao L., Michael G., R. Baghdadi, Steven J., Benoit S., Jonathan R., Fredo D. [PDF][WebSite]
4. "Seq: A high-performance language for computational biology". OOPSLA 2019. A. Shajii, I. Numanagic, R. Baghdadi, B. Berger, S. Amarasingh.
5. "Tiramisu: A Polyhedral Compiler for Expressing Fast and Portable Code". CGO'19. R. Baghdadi, J. Ray, M. B. Romdhane, E. D. Sozzo, A. Akkas, Y. Zhang, P. Suriana, S. Kamil, S. Amarasinghe. [PDF] [WebSite]
6. "GraphIt - A High-Performance DSL for Graph Analytics". OOPSLA'18. Y. Zhang, M. Yang, R. Baghdadi, S. Kamil, J. Shun, S. Amarasinghe. [PDF][WebSite]
7. "A Unified Backend for Targeting FPGAs from DSLs". ASAP'18. E. Sozzo, R. Baghdadi, S. Amarasinghe, and M. Santambrogio. [PDF]
8. "A Common Backend for Hardware Acceleration on FPGA". ICCD'17. E. D. Sozzo, R. Baghdadi, S. Amarasinghe, M. D. Santambrogio. [PDF]
9. "PENCIL: a Platform-Neutral Compute Intermediate Language for Accelerator Programming". PACT'15. R. Baghdadi, U. Beaugnon, A. Cohen, T. Grosser, M. Kruse, C. Reddy, S. Verdoolaege, J. Absar, S. v. Haastregt, A. Kravets, A. Lokhmotov, A. Betts, J. Ketema, A. F.~Donaldson, R. David, E. Hajiyev. [PDF]
10. "PENCIL Language Specification". Research Report RT-8706, INRIA. R. Baghdadi, A. Cohen, S. Verdoolaege, T. Grosser, J. Absar, S. v. Haastregt, A. Kravets, A. Lokhmotov, A. F.~Donaldson. [PDF]
11. "Scalable Polyhedral Compilation, Syntax vs. Semantics: 1-0 in the First Round", ArXiv preprint, 2015. R. Baghdadi, A. Cohen.
12. "VOBLA: A Vehicle for Optimized Basic Linear Algebra". LCTES'14. U. Beaugnon, A. Kravets, S. V. Haastregt, R. Baghdadi, D. Tweed, J. Absar, A. Lokhmotov. [PDF]
13. "Improved Loop Tiling Based on the Removal of Spurious False Dependences". ACM TACO. R. Baghdadi, A. Cohen, S. Verdoolaege, K. Trifunovic. [PDF]
14. "Pencil: Towards a Platform-Neutral Compute Intermediate Language for DSLs". WOLFHPC'12. R. Baghdadi, A. Cohen, S. Guelton, S. Verdoolaege, J. Inoue, T. Grosser, G. Kouveli, A. Kravets, A. Lokhmotov, C. Nugteren, F. Waters, A. F.~Donaldson. [PDF]

Presentations & Posters

1. "An Expressive Polyhedral Compiler for Deep Learning", Riyadh Baghdadi, Saman Amarasinghe, SRC TECHCON 2019, September 2019, Austin, TX, United States.
2. "Accelerating LQCD Calculations Using the Tiramisu Compiler", Riyadh Baghdadi, Michael Wagman, Andrew Pochinsky, Saman Amarasinghe, William Detmold, 2019 Scientific Discovery through Advanced Computing Principal Investigator (PI) Meeting, July 2019, Rockville, MD.
3. "A Polyhedral Deep Learning Framework", Riyadh Baghdadi, 2019 MIT Alliances annual meeting, June 2019, Cambridge, MA, USA.
4. "The Tiramisu Polyhedral Compiler for Deep Learning and Dense Computations", Riyadh Baghdadi, MIT PL Offsite meeting, May 2019, Cambridge, MA, USA.
5. "Tiramisu: A High-Performance Compiler for Domain-Specific Architectures", Riyadh Baghdadi, 2019 ADA Annual Symposium (Center for Application Driven Architectures), April 2019. Ann Arbor, MI, USA.
6. "A Platform for Exploring Machine Learning Based AutoScheduling". Workshop on Optimization, Modeling, Analysis and Space Exploration, Feb. 2019. R. Baghdadi.
7. "The Tiramisu Compiler for Deep Learning", Riyadh Baghdadi, 2018 MIT Alliances annual meeting, June 2018, Cambridge, MA, USA.
8. "A relaxed permutability criterion", Riyadh Baghdadi, Dixiemes rencontres de la communaute francaise de compilation, Sep 2015, Banyuls-sur-Mer, France.
9. "PENCIL: a subset of C99 for Accelerator Programming", Riyadh Baghdadi, Seminaire LAMIH, Universite de Valenciennes, Sep 2015, Valenciennes, France.
10. "PENCIL: a Platform-Neutral Compute Intermediate Language for DSL Compilers and for Accelerator Programming", Riyadh Baghdadi, MIT Seminar - Massachusetts Institute of Technology, May 2015, Cambridge, Massachusetts.
11. "Language Support For Better Polyhedral Compilation Targeting Accelerators". GRGPL'15. R. Baghdadi.
12. "Extending the Scope of Polyhedral Compilation: Progresses in Handling Irregular Codes and in Scalability". R. Baghdadi, ACM SRC, CGO 2015.
13. "Generating Highly Optimized CUDA and OpenCL from Domain Specific Languages", R. Baghdadi, Google PhD Student Summit, 2014.
14. "PENCIL: A platform-neutral intermediate language for the parallelizing compilation of DSLs". U. Beaugnon, R. Baghdadi, J. Absar, A. Betts, A. Cohen, A. Donaldson, T. Grosser, S. V. Haastregt, Y. Hu, J. Ketema, A. Kravets, A. Lokhmotov, S. Verdoolaege. DSLDI'14.
15. "Language support for polyhedral compilation: evaluation on image processing benchmark". R. Baghdadi, S. Verdoolaege, U. Beaugnon, A. Cohen, R. David and E. Hajiyev. 8'th meeting of the french compiler community, 2014.
16. "The Potential of Synergistic Static, Dynamic and Speculative Loop Nest Optimizations for Automatic Parallelization". R. Baghdadi, A. Cohen, C. Bastoul, L-N. Pouchet and L. Rauchwerger. PESPMA'10.
17. "Putting Polyhedral Optimization Techniques to Work in Production Compilers: Progresses in Scalability and Memory Management". R. Baghdadi, ACM SRC, CGO 2012.

Student Mentoring

- PhD students
 - Lorenzo Di Tucci (student visiting from Politecnico di Milano, 2018-2019).
 - Emanuele Del Sozzo (student visiting from Politecnico di Milano, 2017-2018).
- Master students (MIT, USA)
 - Abdurahmane Akkas (2018-2019).
 - Malek Ben Romdhane (2017-2018).

- Jessica Ray (2016-2018).
- Patricia Suriana (2015-2016).
- Master students (ESI, Algeria)
 - Thinhinane Ihadadene (2018-2019).
 - Mohammed Henni (2018-2019).
 - Mekki Ilhem Isra (2018-2019).
 - Gueroudji Amal (2018-2019).
 - Zina Taklit (2018-2019).
 - Asma Balamane (2018-2019).
 - Hachilif Radja (2018-2019).
 - Ikram Manseri (2017-2018).
- Undergraduate students (MIT, ESI)
 - Kamel Abdous (ESI, Summer 2019).
 - David Vargas (MIT, 2017-2018).

Funding and Grant Proposals

Participated in writing multiple grant proposals (without PI status), the following grant proposals were accepted.

- DARPA D3M (Data-Driven Discovery of Models): Human Data Interaction Project (DARPA-16-43-D3M-FP-041).
- DOE SCIDAC: Computing the Properties of Matter with Leadership Computing Resources (DE-SC0018121).
- MIT Alliances FinTech funding: A Domain Specific Language for Real-time, Low-latency Financial Computations.

Awards

1. **Two bronze medals** in the ACM Student Research Competition (CGO 2015, CGO 2012).
2. **Ranked second nationwide** at the **Microsoft Imagine Cup** competition (2008).

Reviews & Program Committee Membership

1. Journals: ACM TACO (Transactions on Architecture and Code Optimization), ACM TOPC (Transactions on Parallel Computing), Elsevier PARCO (Parallel Computing), Elsevier JPDC (Journal of Parallel and Distributed Computing), Springer IJPP (International Journal of Parallel Programming), IEEE Access Journal.
2. Conferences: PACT'19.
3. Workshops: RWDSL'18 (Workshop on Real World Domain Specific Languages), GPGPU'10 (Workshop on General-Purpose GPU).