University of Illinois at Chicago
Engineering Research Facility
842 West Taylor Street, Room 3028
Chicago, IL, 60607-7053
☎ 312- 996-8635
✉ mmaggi3@uic.edu
http://www.cs.uic.edu/~mmaggion/

Marco Maggioni

Curriculum Vitae

"Knowledge and wisdom are like the trunk of the baobab tree. No one person's arm span is great enough to encompass them." (African proverb)

Education

2009-Present **PhD Candidate in Computer Science**, *University of Illinois*, Chicago, IL.
Dissertation Topic "Sparse Convex Optimization on GPUs" – Advisors: Prof. T. Y. Berger-Wolf – Expected graduation: December 2014 (Current PhD GPA: 4.00)

May 2012 **MS in Bioinformatics**, *University of Illinois*, Chicago, IL.
Thesis: "GPU-based Linear Algebra for Calculating Steady-State Probability and Dynamics of Molecular Networks" – Advisor: Prof. J. Liang – Graduated with Summa cum laude

July 2010 **MS in Computer Engineering**, *Politecnico di Milano*, Milan, Italy.
Thesis: "Trojan-Free FPGA Circuits using ECC-based Functional Trust-Checking" – Advisor: Prof. M. D. Santambrogio – Graduated with grade 110/110

May 2009 **MS in Computer Science**, *University of Illinois*, Chicago, IL.
Thesis: "Techniques for Fully Integrated Embedding of Design and Verification Logic for Trusted FPGA Circuits" – Advisor: Prof. S. Dutt – Graduated with distinction

July 2006 **BS in Computer Engineering**, *Politecnico di Milano*, Milan, Italy.
Thesis: "Salomone: Allocazione e Scheduling per la Progettazione di Sistemi Embedded Riconfigurabili" – Advisor: Prof. F. Ferrandi – Graduated with grade 110/110

Experience

2010-Present **University of Illinois**, *Chicago*, IL.
PhD Research Assistant in the Computer Science department.

2014-Present **Image-Based Ecological Information System**, *Nanyuki*, Kenya.
Computer Systems Engineer for the design and deployment of a scalable computing infrastracture to support the IBEIS research project.

May-August 2014 **Argonne National Laboratory**, *Lemond*, IL.
Summer Research Aide in the Mathematical and Computer Science division working on parallel linear algebra algorithms for recursively low-rank compressed matrices.

2011-2013 **Maxeler Technologies Ltd**, *Hammersmith*, London, UK.
Part-time Consultant for optimization and acceleration of life science algorithms.

May-August 2011 **Maxeler Technologies Ltd**, *Hammersmith* , London, UK.
Summer Internship on FPGA-based linear correlation analysis of brain networks.

Awards

2014 **Dean's Scholar Award**, *University of Illinois*, Chicago, IL.
A one-year non-renewable award presented by the Dean of the Graduate College in recognition of the most distinguished advanced-level graduate students.

2014 **FMC Technologies Fellowship**, *FMC Technologies Inc. Educational Fund*, IL.
Fellowships awarded to outstanding students with preference given to candidates in Business Administration, Engineering, or related fields.

2014 **NFS Travel Grant**, *IEEE Technical Committee on Parallel Processing*.
Travel assistance grant available for IPDPS 2014 student authors

2014 **GSC Travel Award**, *UIC Graduate Student Council*, Chicago, IL.
Travel award available to students actively participating in academic or professional meetings

2013 **Fifty for the Future**, *Illinois Technology Foundation*, Chicago, IL.
Award that recognizes exceptional students and talents with an interest in and potential to use technology in innovative ways

2012 **UIC Provost's Award for Graduate Research**, *University of Illinois*, Chicago, IL.
Project : "Enhanced Field Data Collection and GPS Mapping on Android-based Tablets"

2012 **UIC Student Research Forum Award**, *University of Illinois*, Chicago, IL.
Project : "Computational Kinship Reconstruction in Wild Populations using ILP Optimization on GPU Architectures" - 1^{st} place in Engineering/Physical Sciences graduate category

2011 **Chancellor's Research Fellowship Award**, *University of Illinois*, Chicago, IL.
Project : "Computational Kinship Reconstruction in Wild Populations using ILP Optimization on Hybrid Architectures"

2011 **Outstanding Teaching Assistant Award**, *Department of Computer Science, University of Illinois*, Chicago, IL.
Course: CS366 Computer Architecture II

Research

Interests My general research interests are parallel algorithms and computer architectures, with special focus on sparse algebra and convex optimization on GPUs. My research aims to design novel GPU-based algorithmic techniques to efficiently solve ILP (along with its LP relaxation), QP and SDP. My focus is on large sparse problems arising from a computational biology, an applicative area that uses solutions of algorithmic problems to answer questions about biological systems. In addition, my work has application in a wide range of disciplines, such as combinatorial optimization, operations research, control theory, structural optimization, economics and several other engineering fields. Up to now, I have worked on improving the state-of-the-art in Sparse Matrix-Vector multiplication (SpMV) on GPUs, providing a solid foundation for my future research. Despite the fact that adapting sparse computation to GPUs is a challenging task, we can envision a speedup that will allow us to solve convex optimization problems faster than any state-of-the-art solver.

I am also contributing to IBEIS (Image-Based Ecological Information System). This research project aims to build a large autonomous computational system that starts from image data and progresses all the way to answering ecological and conservation queries. Based on image analysis algorithms, IBEIS can identify individuals from species with distinctive striped, spotted, wrinkled or notched markings, such as elephants, giraffes and zebras. I am focusing on scaling IBEIS and its algorithms to the magnitude of image data available nowadays, with particular interest in using GPUs.

2011-Present **Computational Population Biology Laboratory**, *under Tanya Y. Berger-Wolf*, University of Illinois, Chicago.
Working on GPU-based combinatorial optimization algorithms for reconstructing sibling relationship in wild animal populations.

2010-2013 **Molecular and Systems Computational Bioengineering Laboratory**, *under Jie Liang*, University of Illinois, Chicago.
Working on GPU-based sparse linear algebra for calculating the landscape probability distribution and dynamics of molecular networks.

2010-2011 **Chicago Tri-Institutional Center for Chemical Methods and Library Development**, *under Jie Liang*, University of Illinois, Chicago.
Developing GPU algorithms for assessing chemical similarity in large-scale compound databases.

2008-2009 **Design Automation and Reconfiguration Technology Laboratory**, *under Shantanu Dutt*, University of Illinois, Chicago.
Designing techniques for trusted FPGA circuits.

2006-2009 **Dynamic Reconfigurability in Embedded Systems Design - Research Group**, *under Marco D. Santambrogio*, Politecnico di Milano, Milan.
Working on task scheduling for FPGA-based reconfigurable systems.

Publications & Conferences

IPDPS2015 **Distributed Data Structure and Parallel Algorithms for Recursively Low-Rank Compressed Matrices**, *M. Maggioni and J. Chen*, International Parallel & Distributed Processing Symposium, 2015, Hyderabad, India, May 25-29, in preparation.

AsHES2014 **CoAdELL: Adaptivity and Compression for Improving Sparse Matrix-Vector Multiplication on GPUs**, *M. Maggioni and T. Y. Berger-Wolf*, International Workshop on Accelerators and Hybrid Exascale Systems, 2014, Phoenix, May 20, to appear.

GTC2014 **Adaptivity and Compression: a Recipe for Sparse Matrix-Vector Multiplication on GPUs**, *M. Maggioni and T. Y. Berger-Wolf*, NVIDIA GPU Technology Conference, 2014, San Jose, March 24-27.

ICPP2013 **AdELL: An Adaptive Warp-Balancing ELL Format for Efficient Sparse Matrix-Vector Multiplication on GPUs**, *M. Maggioni and T. Y. Berger-Wolf*, International Conference on Parallel Processing, 2013, Lyon, France, October 1-4, pp. 11-20.

ICCS2013 **An Architecture-Aware Technique for Optimizing Sparse Matrix-Vector Multiplication on GPUs**, *M. Maggioni and T. Y. Berger-Wolf*, International Conference on Computational Science, 2013, Barcelona, Spain, June 5-7, pp. 329-338.

HiCOMB2013 **GPU-based Steady-State Solution of the Chemical Master Equation**, *M. Maggioni, T. Y. Berger-Wolf and J. Liang*, International Workshop on High Performance Computational Biology, 2013, Boston, May 20, pp. 579-588.

GTC2013 **Unveiling Cellular Mechanisms using GPU-based Sparse Linear Algebra**, *M. Maggioni, T. Y. Berger-Wolf and J. Liang*, NVIDIA GPU Technology Conference, 2013, San Jose, March 18-21.

Biotropica2013 **Infestation by a Common Parasite is correlated with Ant Symbiont Identity in a Plant-Ant Mutualism**, *M. Schumer, R. Birger, C. Tantipathananandh, J. Aurisano, M. Maggioni, and P. Mwangi*, Biotropica Journal, 2013, Vol. 45, Issue 3, pp. 276-279.

ACMBCB2012 **An Integrated Optimization Framework for Inferring two-generation Kinships and Parental Genotypes from Microsatellite Samples**, *D. Won, C. Chou, W. A. Chaovalitwongse, T. Y. Berger-Wolf, B. Dasgupta, A. A. Khokhar, M. V. Ashley, J. Palagi, M. Maggioni and S. I. Sheikh* , ACM International Conference on Bioinformatics, Computational Biology and Biomedicine, 2012, Orlando, Florida, October 7-10, pp 392-399.

ICCS2011 **GPU-accelerated Chemical Similarity Assessment for Large Scale Databases**, *M. Maggioni, M. D. Santambrogio and J. Liang*, International Conference on Computational Science, 2011, Singapore, June 1-3, pp 2007-2016.

GLSVLSI2009 **Task Graph Scheduling for Reconfigurable Architectures driven by Reconfigurations Hiding and Resources Reuse**, *M. D. Santambrogio, M. Redaelli and M. Maggioni*, ACM Great Lakes Symposium on VLSI, 2009, Boston, May 10-12, pp. 21-26.

Patents

61/885,619 **Adaptive Matrix Format for Sparse Matrix-Vector Multiplication on Graphic Processing Units**, *M. Maggioni and T. Y. Berger-Wolf*, U.S. patent application, 2013, October, pending.

Hardware/Software Donations

Spring 2014 **Tesla K40 GPU**, *Academic Hardware Donation Program*.
GPU accelerator for investigating on branch-and-bound ILP algorithms and completing the PhD dissertation on "Sparse Convex Optimization on GPUs"

Fall 2013 **Xilinx ISE**, *Xilinx University Program*.
FPGA development tool for accelerating the linear-correlation analysis of brain networks

Fall 2012 **MaxCard Virtex-5 Board**, *Maxeler University Program*.
FPGA card for accelerating the linear-correlation analysis of brain networks

Academia

2009–2011 **Teaching Assistant**, *University of Illinois*, Chicago, IL.
- CS466 Advanced Computer Architecture, Spring 2011
- CS366 Computer Architecture II, Spring 2011
- CS366 Computer Architecture II, Fall 2010
- CS401 Computer Algorithms I, Spring 2010
- CS202 Data Structures and Discrete Mathematics II, Fall 2009
- CS102 Introduction to Programming, Spring 2009

2007-2012 **Relevant coursework**, *University of Illinois*, Chicago, IL.
- BIOE594 Introduction to Applied Optimization, Fall 2012
- CS594 Field Computational Ecology, Spring 2012
- CS566 Parallel Processing, Fall 2011
- CS502 Computational Biology, Spring 2011
- CS583 Data Mining and Text Mining, Fall 2010
- MCS471 Numerical Analysis, Fall 2010
- BIOE480 Introduction to Bioinformatics, Fall 2009

- ECE467 Introduction to VLSI Design, Fall 2009
- CS469 Computer Systems Design, Spring 2009
- CS465 Digital Systems Design, Spring 2009
- CS569 High Performance Processors and Systems, Spring 2008
- ECE565 VLSI Design Automation, Fall 2007
- CS501 Computer Algorithms II, Fall 2007
- CS401 Computer Algorithms I, Fall 2007

Languages

Italian	**Native speaker**	*My native language.*
English	**Fluent**	*Speaking, reading, and writing.*

Knowledge and Skills

- Broad preparation in the field of computer science. Natural proclivity for algorithm design with emphasis on complexity analysis, data structure and parallelization.
- Strong computer engineering background, from modern computer architecture to VLSI circuit design. Experience with parallel and GPU programming.
- Ability to rapidly adapt himself to new problems and challenges. Genuine interest in any kind of scientific application.
- Good organizational skills.
- Innately friendly and at ease in any social and working context.

Languages	C, C++, CUDA, PThreads, OpenMP, MPI, Java, MATLAB, Perl, Python, HTML, mySQL
Hardware Design	VHDL, Cadence tools, Xilinx tools, Altera tools
Op. Systems	MacOSX, Linux, Unix, Windows
Scient. Writing	Latex, PowerPoint

Other Activities

2006-Present **Agape ONLUS**, *Besana in Brianza*, Milano, Italy.
Cofounder and volunteer of Agape ONLUS, a non-profit organization involved in drinkable-water and schooling projects in underdeveloped countries as Camerun and Congo.

2003-2008 **Youth Sunshine Festival**, *Besana in Brianza*, Milano, Italy.
Creator and organizer of the Youth Sunshine Festival, a benefit event for promoting ethnic music and intercultural exchanges.

References

These persons are familiar with my professional qualifications and my character:

Tanya Y. Berger-Wolf
Department of Computer Science and Bioengineering
Associate Professor at University of Illinois at Chicago
Contact: +1-(312)-413-8719 – tanyabw@cs.uic.edu

Marco D. Santambrogio
Department of Computer Engineering
Assistant Professor at Politecnico di Milano and Research Affiliate at MIT
Contact: +1-(617)-253-2323 – santambr@mit.edu – (Boston office)
Contact: +39-02-2399-3492 – marco.santambrogio@polimi.it – (Milan office)

Jie Liang
Department of Bioengineering and Computer Science
Professor at University of Illinois at Chicago
Contact: +1-(312)-355-1789 – jliang@uic.edu
Jie Chen
Mathematics and Computer Science Division
Argonne National Laboratory
Contact: +1-(630)-252-3313 – jchen@msc.anl.gov
Oliver Pell
VP of Engineering
Maxeler Technologies Ltd
Contact: +44-(208)-762-6196 – oliver@maxeler.com

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