

CURRICULUM VITAE

Bruno Serra Loff Barreto

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Summary statement

In 2007, Bruno Loff completed his MSc. in Information Systems and Computer Engineering at IST (Instituto Superior Técnico), in Lisbon, under the supervision of Professor José Félix Costa.

In the 2007/2008 academic year he worked as a researcher at Centro de Matemática e Aplicações Fundamentais (Center for Mathematics and Fundamental Applications), also in Lisbon, and as a teaching assistant in the Department of Mathematics at IST.

From 2008 to 2013, he worked in Centrum voor Wiskunde en Informatica (Center for Mathematics and Computer Science), in Amsterdam, under the supervision of Professor Harry Buhrman. There he labored towards the attainment of his PhD in Theoretical Computer Science, which he successfully defended in January 2014. He was also a teaching assistant, and supervised two MSc students, at the co-located Institute for Logic, Language and Computation of the University of Amsterdam.

The year of 2014 was spent partly in research, and partly pursuing his interest in Buddhist meditation, by way of several solitary meditation retreats. He was then challenged by Professor Michal Koucký to join him at the Department of Applied Mathematics of Charles University, in Prague, where he worked as a postdoctoral student, from January 2015 to this day.

He has published numerous papers, several of which were in the top publication venues of his area of expertise (namely STOC and CCC). He is also a proficient communicator and a skilled lecturer, as any of his former students or colleagues will avow.

Bruno's interests are wide and he has an eclectic approach to research. He would feel equally at home at a Computer Science or Mathematics department. In his MSc years, he worked on systems of second-order logic, on philosophy of computing, and on descriptive complexity. During his PhD he published in diverse fields in the area of Computational Complexity. In the last few years, he worked on applying Shannon's information theory to communication complexity, and on the computational complexity of algebraic machines. But he also worked on various software implementations — including graph matching algorithms, parsing algorithms, and cryptographic primitives.

He is broadly interested in providing better algorithms for solving computational problems, or in proving that such algorithms are mathematically impossible. His last four publications (listed below), are examples of such results.

Academic positions and degrees

- 2015– **Charles University**, Prague. Postdoctoral student at the Department of Applied Mathematics.
- 2008 – 2013 **Centrum voor Wiskunde en Informatica**, University of Amsterdam, PhD in Theoretical Computer Science.
Title of Dissertation: *A Medley for Computational Complexity*
Supervisor: Harry Buhrman
- 2007–2008 **Instituto Superior Técnico**, Technical University of Lisbon, Teaching assistant at the Department of Mathematics.
- 2005–2007 **Instituto Superior Técnico**, Technical University of Lisbon, Master of Science in Information Systems and Computer Engineering.
Title of Dissertation: *Physics, Computation, and Definability*
Supervisor: José Félix Costa
- 2001–2005 **Instituto Superior Técnico**, Technical University of Lisbon, Bachelor of Science in Information Systems and Computer Engineering.

Publications

- 2014 Harry Buhrman, Michal Koucký, Bruno Loff, and Florian Speelman. Catalytic Space: non-determinism and hierarchy. Proceedings of the 33rd International Symposium on Theoretical Aspects of Computer Science (STACS 2016). Accepted paper.
- 2013 Harry Buhrman, Richard Cleve, Michal Koucký, Bruno Loff, and Florian Speelman. Computing on a full memory: Catalytic Space. Proceedings of the 46th Annual Symposium on the Theory of Computing (STOC 2014): 857–866.
- 2012 Joshua Brody, Harry Buhrman, Michal Koucký, Bruno Loff, Florian Speelman, and Nikolay Vereshchagin. Towards a reverse Newman’s theorem in interactive information complexity. Proceedings of the 28th IEEE Conference on Computational Complexity (CCC 2013): 243–253.
✉ We were invited to submit the paper to a special issue of the journal *Algorithmica*’s, edited by Mark Braverman, on the topic of Information Complexity. We worked on an extended version of the paper, which was accepted and is now in print.
- 2012 Harry Buhrman, Bruno Loff, and Leen Torenvliet. Hardness of approximation for knapsack problems. *Theory of Computing Systems*, 56(2):372–393, Springer, 2015.
- 2011 Eric Allender, Harry Buhrman, Luke Friedman, and Bruno Loff. Reductions to the set of random strings: The resource-bounded case. Proceedings of the 37th International Symposium on Mathematical Foundations of Computer Science (MFCS 2012): 88–99.
✉ After the paper was presented on an informal talk at the CiE 2012 conference, we were invited to submit the paper to the conference’s special issue of selected papers. It appears in Arnold Beckmann and Anuj Dawar (eds.), *Logical Methods in Computer Science* 10(3):1–18.
- 2010 Harry Buhrman, Lance Fortnow, John M. Hitchcock, and Bruno Loff. Learning reductions to sparse Sets. Proceedings of the 38th International Symposium on Mathematical Foundations of Computer Science (MFCS 2013): 243–253.
- 2009 Harry Buhrman, Lance Fortnow, Michal Koucký, and Bruno Loff. Derandomizing from random strings. Proceedings of the 25th IEEE Conference on Computational Complexity (CCC 2010): 58–63.

- 2008 Amir M. Ben-Amram, Bruno Loff, and Isabel Oitavem. Monotonicity constraints in characterizations of PSPACE. *Journal of Logic and Computation* 22(2):179–195, Cambridge University Press, 2012.
- 2008 Edwin Beggs, José Félix Costa, Bruno Loff, and John Tucker. The complexity of measurements in classical physics. *Theory and Applications of Models of Computation, TAMC 2008, Lecture Notes in Computer Science* 4978, Springer, 2008.
- 2007 Bruno Loff, José Félix Costa, and Jerzy Mycka. A foundation for real recursive function theory. *Annals of Pure and Applied Logic*, 160(3):255–288, Elsevier, 2009.
- 2007 Bruno Loff, and José Félix Costa. Five views of hypercomputation. *International Journal of Unconventional Computing*, 5 (3):193–207, Old City Publishing, 2009.
- 2007 José Félix Costa, Bruno Loff, and Jerzy Mycka. The new promise of analog computation. Appears in S. B. Cooper, B. Löwe, and A. Sorbi (eds.), *Lecture Notes in Computer Science* 4497: 189–195, Springer, 2007.
- 2006 Bruno Loff, José Félix Costa, and Jerzy Mycka. Computability on reals, infinite limits and differential equations. *Journal of Applied Mathematics and Computation*, 191(2):353–371, Elsevier, 2007.

Work in progress

- 2015 Pavel Hubáček, Michal Koucký, and Bruno Loff. Proofs of space: simplified and optimized.

Teaching Experience

- 2015–2016 Supervising an MSc thesis on parsing of programming languages.
- Spring '15 *Selected Topics in Computational Complexity*, a graduate course on three of my favorite results in computational complexity. The syllabus and lecture notes are available online at <http://wp.me/P5Jf0h-8>.
- 2013–2015 *Implementing the Micali–Vazirani matching algorithm*, a project with the goal of understanding and implementing the Micali–Vazirani matching algorithm. The first student who tried to work on it gave up, but

the faculty took over and finished the implementation. A second student later joined, and improved it in numerous ways. It is publicly available at <https://github.com/jorants/MV-matching-C>.

2013 *Seminar on Hilbert's 10th Problem*, a one-semester MSc project where the goal was to learn the full proof of Hilbert's 10th problem, and prepare a seminar about it. The project was very successful, much to the merit of the student, Yuning Feng (fengyuning1984@gmail.com).

2009–2012 *Complexity Theory*, three times teaching assistant.

2008 *Advanced Theory of Computing*, an unofficial course I have taught on an extra-curricular basis to a few highly-motivated *Theory of Computing* students of the previous semester.

2008 *Discrete Mathematics*, teaching assistant.

2007 *Theory of Computing*, teaching assistant.