

# Francesco Silvestri

## Curriculum vitae

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## PERSONAL DATA

|             |                 |                |                   |
|-------------|-----------------|----------------|-------------------|
| First name  | Francesco       | Birth place    | Asolo (TV), Italy |
| Last name   | Silvestri       | Gender         | Male              |
| Nationality | Italiana        | Marital status | Married, two kids |
| Birth date  | August 15, 1981 |                |                   |

## RESEARCH TOPICS

My research targets algorithms and data structures, with an emphasis on big data and high performance. In particular, I have been extensively working on: similarity search, graph and trajectory mining, MapReduce and multicore algorithms, memory-efficient algorithms, algorithmic fault tolerance.

## EDUCATION

- 04/2009 **Ph.D. in Computer Engineering**, *University of Padova*.  
Supervisor: Andrea Pietracaprina; dissertation title: “Oblivious Computations on Memory and Network Hierarchies”.
- 09/2005 **M.S. in Computer Engineering** (“Laurea Quinquennale”), *University of Padova*, *summa cum laude*.  
Supervisors: Andrea Pietracaprina and Geppino Pucci; thesis title “Simulation of D-BSP Parallel Programs on the Ideal Cache Hierarchy”.

## PROFESSIONAL APPOINTMENTS

- Since 12/2019 **Associate Professor in Computer Engineering**, *Department of Information Engineering, University of Padova*.
- 12/2016 - 11/2019 **Assistant Professor in Computer Engineering**, *Department of Information Engineering, University of Padova*.
- 01/2015 - 11/2016 **Postdoctoral Researcher**, *IT University of Copenhagen*, ERC Project SSS (Scalable Similarity Search), Host: Rasmus Pagh.
- 10/2013 - 03/2014 **Part-time Lecturer and Visiting Scholar**, *IT University of Copenhagen*, host: Rasmus Pagh.
- 02/2009 - 12/2014 **Postdoctoral Researcher**, *Department of Information Engineering, University of Padova*, Host: Andrea Pietracaprina.
- 10/2007 - 04/2008 **Visiting Scholar**, *Department of Computer Science, University of Texas at Austin*, host: Vijaya Ramachandran.

## TEACHING

Courses

- 2020 **Big Data Computing**, *University of Padova*.
  - 2017-2019 **Computer Architecture**, *University of Padova*.
  - 2016 **Algorithm Engineering**, *IT University of Copenhagen*.
  - 2016, 2015 **Advanced Algorithms Seminars**, *IT University of Copenhagen*.
  - 2015 **Algorithm Design Project**, *IT University of Copenhagen*.
  - 2013 **Algorithm Design II**, *IT University of Copenhagen*.
  - Since 2011 **Co-supervised 9 master students and 5 bachelor students**.  
University of Padova (5 master students, 5 bachelor students), IT University of Copenhagen University (4 master students).
  - Before 2014 **Teaching assistant**, *Data Mining (2014,2013), Large Data Sets (2010, 2008), Introduction to Probability (2007), Algorithms and Data Structures I (2006)*, University of Padova.
- [Pedagogical training](#)
- 2018 **Program “Teaching for Learning” for assistant professors**, *University of Padova*.  
A series of workshops (31 hours) on methods and tools for improving teaching quality.
  - 2014-2016 **Workshops on university teaching**, *IT University of Copenhagen*, Workshops topics: Teaching computational competencies; Use your voice; Project and Thesis Supervision; Flipped Learning; Introduction to teaching at ITU; Develop you professional skills as an examiner.
  - 2014 **Course “University Teaching 101”**, *Johns Hopkins University*.

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## PUBLICATIONS

### [Bibliometric indicators:](#)

- Scholar h-index: 12; total citations: 512
- Scopus h-index: 10; total citations: 305

### [Journal papers](#)

13. H. M. Park, F. Silvestri, U Kang, R. Pagh, C.W. Chung, and S.H. Myaeng. “Enumerating Trillion Subgraphs On Distributed Systems”. *ACM Trans. on Knowledge Discovery from Data*, 12(71), 2018.
12. G. Bilardi, M. Scquizzato and F. Silvestri. “A Lower Bound Technique for Communication in BSP”. *ACM Transactions on Parallel Computing*, 4(3), 14:1–14:27, 2018.
11. R. Pagh, N. Pham, F. Silvestri, and M. Stöckel. “I/O-Efficient Similarity Join”. *Algorithmica*, 78(4), 1263–1283, 2017.
10. R. Pagh, F. Silvestri, J. Sivertsen, and M. Skala. “Approximate furthest neighbor with application to annulus query”. *Information Systems*, special issue for SISAP’15, 64, 152–162, 2017.
9. S. Caminiti, I. Finocchi, E. G. Fusco, and F. Silvestri. “Resilient dynamic programming”. *Algorithmica*, 77, 389–425, 2017.
8. G. Bilardi, A. Pietracaprina, G. Pucci, M. Scquizzato and F. Silvestri. “Network-Oblivious Algorithms”. *Journal of the ACM*, volume 63(1), 3:1–3:36, 2016.
7. L. De Stefani and F. Silvestri. “Exploiting non-constant safe memory in resilient algorithms and data structures”. *Theoretical Computer Science*, 583, 86–97, 2015.

6. A. Pietracaprina, G. Pucci, F. Silvestri, and F. Vandin. “Space-Efficient Parallel Algorithms for Combinatorial Search Problems”. *Journal of Parallel and Distributed Computing*, special issue on irregular computations, 76, 58–65, 2015.
5. L. L. Pilla, P. Rech, F. Silvestri, C. Frost, P. O. A. Navaux, M. Sonza Reorda, and L. Carro. “Software-Based Hardening Strategies for Neutron Sensitive FFT Algorithms on GPUs”. *IEEE Transactions on Nuclear Science*, 61(4), 1874–1880, 2014.
4. R. A. Chowdhury, V. Ramachandran, F. Silvestri, and B. Blakeley. “Oblivious Algorithms for Multicores and Networks of Processors”. Special Issue of *Journal of Parallel and Distributed Computing* dedicated to selected IPDPS’10 papers, 73(7), 911–925, 2013.
3. F. Silvestri. “Review of Graph Theory and Interconnection Networks by Lih-Hsing Hsu and Cheng-Kuan Lin”. In *SIGACT News* 43(4), 30–34, ACM, 2012.
2. S. Nasso, F. Silvestri, F. Tisiot, B. Di Camillo, A. Pietracaprina, and G. M. Toffolo. “An Optimized Data Structure for High Throughput 3D Proteomics Data: mzRTree”. *Journal of Proteomics*, 73(6), 1176.-1182, 2010.
1. F. Silvestri. “On the limits of cache-oblivious rational permutations”. *Theoretical Computer Science* special issue containing the extended versions of the best papers presented at the 2nd Symposium on Trustworthy Global Computing, 402(2-3), 221-233, 2008.

#### Conference papers

27. F. Silvestri and F. Vella. A Computational Model for Tensor Core Units, 2019.
26. M. Aumüller, R. Pagh and F. Silvestri. Fair Near Neighbor Search: Independent Range Sampling in High Dimensions. Submitted, 2019.
25. M. Ceccarelo, A. Driemel and F. Silvestri. “FRESH: Fréchet Similarity with Hashing”, *Proc. of Algorithms and Data Structures Symposium (WADS)*, 2019.
24. S. McCauley and F. Silvestri. “Adaptive MapReduce Similarity Join”. *Proc. Workshop on Algorithms and Systems for MapReduce and Beyond (BeyondMR)*, Houston (USA), 2018.
23. M. Aumüller, T. Christiani, R. Pagh and F. Silvestri. “Distance-sensitive hashing”. *Proc. 37th ACM Symposium on Principles of Database Systems (PODS)*, pages 89-104, Houston (USA), 2018.
22. A. Driemel and F. Silvestri. “Locality-Sensitive Hashing of Curves”. *Proc. 33rd International Symposium on Computational Geometry (SoCG)*, LIPIcs 77, 37:1–37:16, Brisbane (Australia) 2017.
21. H.K. Ahn, N. Baraldo, E. Oh and F. Silvestri. “A Time-Space Trade-Off for Triangulations of Points in the Plane”. *Proc. 23rd International Computing and Combinatorics Conference (COCOON)*, 10392 (LNCS), 3–12, Hong Kong (China) 2017.
20. M. Goswami, R. Pagh, F. Silvestri and J. Sivertsen. “Distance Sensitive Bloom Filters Without False Negatives”. *Proc. 28th ACM-SIAM Symposium on Discrete Algorithms (SODA)*, 257-269, Barcelona (Spain), 2017.
19. T. D. Ahle, R. Pagh, I. Razenshteyn, and F. Silvestri. “On the Complexity of Maximum Inner Product Search”. *Proc. of 35th ACM Symposium on Principles of Database Systems (PODS)*, pages 151-164, San Francisco (USA).

18. R. Pagh, F. Silvestri, J. Sivertsen, and M. Skala. “Approximate Furthest Neighbor in High Dimensions”. *Proc. 8th Int. Conference on Similarity Search and Applications (SISAP)*, LNCS 9371, 3-14, Glasgow (UK), 2015.
17. R. Pagh, N. Pham, M. Stöckel, and F. Silvestri. “I/O-efficient Similarity Join in High Dimensions”. *Proc. of 23rd Annual European Symposium on Algorithms (ESA)*, LNCS 9294, pages 941-952, Patras (Greece), 2015.
16. M. Ceccarello and F. Silvestri. “Experimental Evaluation of Multi-Round Matrix Multiplication on MapReduce”. *Proc. of 17th SIAM Meeting on Algorithm Engineering & Experiments (ALENEX)*, pages 119-132, San Diego (USA), 2015.
15. H.M. Park, F. Silvestri, U Kang, and R. Pagh. “MapReduce Triangle Enumeration With Guarantees”. *Proc. of 23rd ACM International Conference on Information and Knowledge Management (CIKM)*, 1739-1748, Shangai (China), 2014.
14. F. Silvestri. “Subgraph Enumeration in Massive Graphs”. *Proc. of Sixth Workshop on Massive Data Algorithmics*, Wroclaw, Poland, 2014.
13. R. Pagh and F. Silvestri. “The Input/Output Complexity of Triangle Enumeration”. *Proc. of 33rd ACM Symposium on Principles of Database Systems (PODS)*, 224-233, Snowbird (USA), 2014.
12. M. Scquizzato and F. Silvestri. “Communication Lower Bounds for Distributed-Memory Computations”. *Proc. of 31st Symposium on Theoretical Aspects of Computer Science (STACS)*, LIPcs 25, 627-638, Lyon (France) 2014.
11. A. Pietracaprina, G. Pucci, F. Silvestri, and F. Vandin. “Space-Efficient Parallel Algorithms for Combinatorial Search Problems”. *Proc. of 38th International Symposium on Mathematical Foundations of Computer Science (MFCS)*, LNCS 8087, 717-728, Klosterneuburg (Austria), 2013.
10. P. Rech, L. Pilla, F. Silvestri, P. Navaux and L. Carro. “Neutron Sensitivity and Software Hardening Strategies for Matrix Multiplication and FFT on Graphics Processing Units”. *Proc. of 3rd Workshop on Fault-Tolerance for HPC at Extreme Scale (FTXS)*, 13-20, New York (USA), 2013.
9. P. Rech, L. Pilla, F. Silvestri, C. Frost, P. O. A. Navaux, M. Sonza Reorda, and L. Carro. “Neutron Sensitivity and Hardening Strategies for Fast Fourier Transform on GPUs”. *Proc. of 14th European Conference on Radiation and its Effects on Components and Systems (RADECS)*, Oxford (UK), 2013.
8. G. Bilardi, M. Scquizzato, and F. Silvestri. “A lower bound technique for communication on BSP with application to the FFT”. *Proc. of 18th International European Conference on Parallel and Distributed Computing (EURO-PAR)*, LNCS 7484, 676-687, Rhodes Island (Greece) 2012.
7. A. Pietracaprina, G. Pucci, M. Riondato, F. Silvestri, and E. Upfal. “Space-Round Tradeoffs for MapReduce Computations”. *Proc. of 26th ACM International Conference on Supercomputing (ICS)*, 235-244, Venice (Italy), 2012.
6. S. Caminiti, I. Finocchi, E. G. Fusco, and F. Silvestri. “Dynamic programming in faulty memory hierarchies (cache-obliviously)”. *Proc. of 31st Conference on Foundations of Software Technology and Theoretical Computer Science (FSTTCS)*, LIPcs 13, 433-444, Mumbai (India), 2011.

5. R. A. Chowdhury, F. Silvestri, B. Blakeley, and V. Ramachandran. “Oblivious Algorithms for Multicores and Network of Processors”. *Proc. of IEEE 24th International Parallel & Distributed Processing Symposium (IPDPS)*, Atlanta (USA), 2010.
4. P. Bertasi, A. Pettarin, M. Squizzato, and F. Silvestri. “A Novel Resource Driven Job Allocation Scheme for Desktop Grid Environments”. *Proc. of the 5th Symposium on Trustworthy Global Computing (TGC)*, LNCS 6084, 268–283, Munich (Germany), 2010.
3. G. Bilardi, A. Pietracaprina, G. Pucci, and F. Silvestri. “Network-Oblivious Algorithms”. *Proc. of 21st IEEE International Parallel & Distributed Processing Symposium (IPDPS)*, Long Beach (USA), 2007.
2. F. Silvestri. “On the Limits of Cache-Oblivious Matrix Transposition”. *Proc. of the 2nd Symposium of Trustworthy Global Computing (TGC)*, LNCS 4661, 233–243, Lucca (Italy), 2006.
1. A. Pietracaprina, G. Pucci, and F. Silvestri. “Cache-Oblivious Simulation of Parallel Programs”. *Proc. of 20th IEEE International Parallel & Distributed Processing Symposium (Workshop on Advances in Parallel and Distributed Computing Models, APDCM)*, Rhodes Island (Greece), 2006.

#### Software packages

5. FRESH, a library for Fréchet Similarity, 2018. Available at <https://github.com/Cecca/FRESH>
4. FN, a data structure for furthest neighbor queries, 2015. Available at <https://github.com/johanvts/FN-Implementations>.
3. M<sub>3</sub>, an optimal MapReduce matrix multiplication library implemented in Hadoop, 2015. Available at <http://www.dei.unipd.it/m3>
2. CTPP, an optimal randomized MapReduce algorithm for the enumeration of triangles in a graph; implemented in Hadoop, 2014. Available at <http://datalab.snu.ac.kr/cttpj/>.
1. mzRTree, a Java library for 2D range queries of proteomics data, 2010. Available at <http://www.dei.unipd.it/mzrtree>.

#### Theses

2. F. Silvestri. “Oblivious Computations on Memory and Network Hierarchies”. Ph.D. Thesis, University of Padova, 2009. Supervisor: Prof. Andrea Pietracaprina.
1. F. Silvestri. “Simulazione di algoritmi paralleli per il modello D-BSP su una gerarchia di cache ideali” (in Italian), “Laurea quinquennale” thesis in Computer Science Engineering, 2005. Supervisors Prof. A. Pietracaprina and G. Pucci. University of Padova.

#### Patents

1. South Korea Patent (pending), “MapReduce Triangle Enumeration With Guarantees”. number 10-2015-0020455, 2015.

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## RESEARCH GRANTS

2018-2019 **University of Padova**, *Trajectory analytics for gait analysis*, Role: P.I..

2018 **University of Padova**, *Travel grant for international collaborations*.

2014-2017 **MIUR-PRIN project**, *AMANDA: Algorithmics for MAssive and Networked DAta*, Role: task leader.

2013, 2011 **University of Padova**, *Senior Research Fellowship*.

2013, 2011 **Amazon Web Services (AWS)**, *AWS in Education research grant*.

Since 2006 **Participation in the following projects:** Progetto SID 2017 (2019-2017), ERC SSS (2014-2019), MIUR Projects AMANDA (2014-2017), ALGODEEP (2010–2012), MAINSTREAM (2007–2009), ALGONEXT (2004–2006); University of Padova Strategic Project STPD08JA32 (2010–2012); AURORA Project of Trento Province and INFN (2009–2011); European Project FET-IST FP6 AEOLUS (2005–2009).

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## AWARDS

- 04/2010 **Best Paper Award in the Algorithmic Track**, *24th IEEE International Parallel & Distributed Processing Symposium*, USA.  
Award for the paper: R. A. Chowdhury, F. Silvestri, B. Blakeley, V. Ramachandran, "Oblivious Algorithms for Multicores and Networks of Processors"
- 04/2008 **IEEE TCPP Travel Award**, *Ph.D. Forum of the 22nd IEEE International Parallel & Distributed Processing Symposium*, USA.
- 03/2007 **IEEE TCPP Travel Award**, *21st IEEE International Parallel & Distributed Processing Symposium*, USA.

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## SERVICE TO THE SCIENTIFIC COMMUNITY

### Program and organizing committees

- Program Committees The Web Conference (WWW, 2020-2018), IEEE Cluster (Cluster, 2019-2017), European Symposium on Algorithms (ESA, Track B, 2019, 2015), International Colloquium on Automata, Languages, and Programming (ICALP, 2019), International Conference on Parallel Processing (ICPP, 2019), Workshop on Algorithms and Systems for MapReduce and Beyond (BeyondMR, 2018-2017), International Symposium on Computer Architecture and High Performance Computing (SBAC-PAD, 2017-2016), ACM Principles of Database Systems Symposium (PODS, 2017), International Joint Conference on Artificial Intelligence (IJCAI, 2016) IEEE International Parallel & Distributed Processing Symposium (IPDPS, 2016-2015, 2013), ACM/IEEE Supercomputing Conference (SC, workshop selection 2015, poster selection 2014-2013), Workshop on Massive Data Algorithmics (MASSIVE, 2014), IEEE International Conference on Big Data (BigData, 2013).
- Organizing Committees IEEE International Parallel & Distributed Processing Symposium (IPDPS, publicity chair, 2018-2017; publicity co-chair, 2016-2012), IEEE Cluster (Cluster, publicity co-chair, 2015), ACM International Conference on Supercomputing (ICS, submission co-chair, 2012), European Summer School in Information Retrieval (ESSIR, 2009).
- Editorial boards Guest Editor of the special issue "Big Data Algorithmics" of the journal "Algorithms" (2019).

### Reviewing

Grants National Science Center of Poland (2018)

Journals TOIS (2018), TODS (2018), VLDB J. (2018), JPDC (2017,2009), J. ACM (2016), IEEE TKDE (2019-2016), ACM JEA (2015,2014), ACM TOPC (2014), ACM TALG (2013), IEEE TPDS (2013,2009), TOCS (2011).

Conferences (Reviews for Program Committees are excluded) SoCG (2019, 2018), ACM-SIAM SODA (2018-2015,2012), ACM SPAA (2018,2012,2011), PODS (2018-2016) ALENEX (2017,2015,2011), ESA (2016,2015,2013,2012), EURO-PAR (2016), SWAT (2016), ICDT (2016), ICDCN (2016), IJCAI (2016), SISAP (2016), ACM/IEEE SC (2014,2013), MASSIVE (2014), IEEE BigData (2013), ALGOSENSOR (2012), IEEE ICPADS (2011), SPIRE (2011), ACM ICS (2010), IEEE HiPC (2009), ACM SPAA (2008), FUN (2007), PACT (2007), SIROCCO (2007,2006).

### Departmental/university service

- 2018-now **Organizer and founder of "The Coding DEI"**, *Department of Information Engineering, University of Padova.*
- 2018-now **Popularizing algorithms**, *Introducing algorithms and computational thinking to kids (5-10 years).*
- 2017-now **Member of the Formative Tutoring Program**, *Department of Information Engineering, University of Padova.*
- 2018-now **Member of the PhD School Board**, *Department of Information Engineering, University of Padova.*
- 2015 **Organizer of Working Meetings**, *IT University of Copenhagen.*
- 2011-2012 **Representative of Postdoctoral Researchers**, *Department of Information Engineering, University of Padova.*
- 2008-2010 **Organizer and Co-Founder of the Ph.D. Student Group**, *Department of Information Engineering, University of Padova.*

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## PROFESSIONAL EXPERIENCES

### Professional Qualifications

- 2018 National Scientific Qualification as associate professor in Computer Science (INF/01).
- 2017 National Scientific Qualification as associate professor in Computer Engineering (ING-INF/05).
- 2006 Admitted to the Italian Engineering Association.

### Main scientific collaborations

- Ongoing University of Bonn (A. Driemel), City University of New York (M. Goswami), IT University of Copenhagen (M. Aumüller, R. Pagh), University of Rome "Tor Vergata" (G. Italiano), Free University of Bozen (F. Vella).
- Past MIT (I. Razenshteyn), Korea Advanced Institute of Science and Technology (U Kang), Lasso Excite (Danish software company), IConsulting (Italian consulting company), University of Delaware (M. Taufer), Brown University (E. Upfal), Universidade Federal do Rio Grande do Sul (P. Rech), Sapienza University of Rome (I. Finocchi), University of Texas at Austin (V. Ramachandran), Stony Brook University (R. A. Chowdhury).

### Participation to invitation-only workshops

- 2019 Facebook AI Systems Faculty Summit
- 2019 Dagstuhl Seminar "Theoretical Foundations of Storage Systems"
- 2019 Dagstuhl Seminar "Data Structures for the Cloud and External Memory Data"
- 2018 Workshop on Scalable Approaches to High Performance and High Productivity Computing
- 2017 Dagstuhl Seminar "Theory and Applications of Hashing"
- 2017 Hawaii Workshop on Parallel Algorithms and Data Structures
- 2016 Dagstuhl Seminar "Data Structures and Advanced Models of Computation on Big Data"
- 2014 Workshop on Scalable Approaches to High Performance and High Productivity Computing



- 2012 Workshop on Scalable Approaches to High Performance and High Productivity Computing
- 2010 Workshop on Scalable Approaches to High Performance and High Productivity Computing.

#### Invited seminars

- 2020 Indo-German Spring School on Algorithms for Big Data. Title: TBA
- 2019 Accademia Galileiana di Scienze, Lettere ed Arti. XIX Seminario di Tecnologie dell'Informazione. Title: "Chi si somiglia si piglia" algoritmi per trovare somiglianze nei Big Data.
- 2018 Free University of Bozen. Title: Distance-sensitive Hashing.
- 2018 University of Rome "Tor Vergata", Title: Distance-sensitive Hashing.
- 2017 IT University of Copenhagen. Title: Locality-sensitive hashing for curves.
- 2014 ENS de Lyon. Title: The Input/Output Complexity of Triangle Enumeration.
- 2014 University of Southern Denmark. Title: The Input/Output Complexity of Triangle Enumeration.
- 2013 IT University of Copenhagen. Title: Space-Round Tradeoffs for MapReduce Computations.
- 2011 Workshop on Recent Advances in Data Structures (Chennai, India). Title: Resilient Data Structures.
- 2010 Sapienza University of Rome. Title: Obliviousness in the Parallel Settings.
- 2007 University of Texas at Austin. Title: On The Limits Of Cache And Network-Oblivious Matrix Transposition.

#### Languages

- Italian: mother tongue;
- English: full professional proficiency;