

# DR. MASSIMILIANO ROSSI

## PERSONAL INFORMATION

*email* [maxrossi91@gmail.com](mailto:maxrossi91@gmail.com)

*website* <https://maxrossi91.com>

## EMPLOYMENT

- 2022-today** Illumina inc., San Diego, CA (*United States*)  
*Bioinformatics*  
*Scientist*  
Manager: Eric ROLLER
- 2020-2022** University of Florida, Gainesville, FL (*United States*)  
Department of Computer and Information Science and Engineering  
Mentor: Christina BOUCHER
- Postdoctoral**  
*associate*
- Oct.-Dec. 2019** University of Helsinki, Helsinki (*Finland*)  
Department of Computer Science  
Research Group "Genome-Scale Algorithmics"  
Mentor: Veli MÄKINEN
- Research fellow*

## EDUCATION

- 2016-2020** University of Verona, Verona (*Italy*)  
Department of Computer Science  
*Ph.D. degree in*  
*Computer Science*  
Thesis: *Algorithms and Data Structures for Coding, Indexing, and Mining of Sequential Data.*  
Advisors: Ferdinando CICALESE, Zsuzsanna LIPTÁK
- 2014-2016** University of Verona, Verona (*Italy*)  
Final mark: 110/110 e lode (top grade with honors) · *Embedded System Specialization*  
Thesis: *Methodology for behavioral inference on digital system for verification application and test sequence generation.*  
Advisor: Graziano PRAVADELLI
- 2010-2014** Marche Polytechnic University, Ancona (*Italy*)  
Final mark: 105/110 · *Computer and Automation Specialization*  
Thesis: *Methodology for design and reuse of peripherals drivers in embedded real-time operating systems for automation and control applications.*  
Advisors: Massimiliano PIRANI, Andrea BONCI
- Master's degree in*  
*Computer Science*  
*and Engineering*
- Bachelor's degree*  
*in Computer and*  
*Automation*  
*Engineering*

## RESEARCH VISITS

- Jun. 2019** University of Helsinki, Helsinki (*Finland*)  
Department of Computer Science  
Research Group "Genome-Scale Algorithmics"  
Host: Simon J. PUGLISI  
Duration: *1 week*  
Financed with a grant from the University of Helsinki.
- Visiting Ph.D*  
*Student*

May.-Sep. 2018

University of Helsinki, Helsinki (Finland)  
 Department of Computer Science  
 Research Group "Genome-Scale Algorithmics"

Visiting Ph.D  
 Student

Host: Simon J. PUGLISI  
 Duration: 5 months  
 Financed with a grant from the University of Verona and with a grant from the University of Helsinki.

## PUBLICATIONS

**In Journals**

1. K. MUKHERJEE, **M. ROSSI**, D. DOLE-MUINOS, A. AJAYI, M. PROSPERI, AND C. BOUCHER, "Finding Overlapping Rmaps via Clustering". *IEEE/ACM Transactions on Computational Biology and Bioinformatics*, (to appear)
2. **M. ROSSI**, M. OLIVA, B. LANGMEAD, T. GAGIE, AND C. BOUCHER, "MONI: A Pangenomics Index for Finding MEMs". *Journal of Computational Biology*, (to appear)
3. **M. ROSSI**, M. OLIVA, P. BONIZZONI, B. LANGMEAD, T. GAGIE, AND C. BOUCHER, "Finding MEMs using the  $r$ -index". *Journal of Computational Biology*, (to appear)
4. O. AHMED, **M. ROSSI**, S. KOVAKA, M. C. SCHATZ, T. GAGIE, C. BOUCHER, AND B. LANGMEAD, "Pan-genomic Matching Statistics for Targeted Nanopore Sequencing". *iScience*, **24** (6), 102696:1-14, 2021
5. K. MUKHERJEE, **M. ROSSI**, L. SALMELA, AND C. BOUCHER, "Fast and Efficient Rmap Assembly using the Bi-labelled de Bruijn Graph". *Algorithms for Molecular Biology*, **16** (1), 1-13, 2021.
- 6\* F. CICALESE, ZS. LIPTÁK, AND **M. ROSSI**, "On infinite prefix normal words". *Theoretical Computer Science*, vol. **859**, pp. 134-148, 2021.
- 7\* ZS. LIPTÁK, S. J. PUGLISI, AND **M. ROSSI**, "Pattern Discovery in Colored Strings". *ACM Journal of Experimental Algorithmics*, Vol. 26, pp. 1.1:1-1.1:26, 2020.
- 8\* F. CICALESE AND **M. ROSSI**, "On the multi-interval Ulam-Rényi game: for 3 lies 4 intervals suffice". *Theoretical Computer Science*, vol. **809**, pp. 339-356, 2020.
- 9\* F. CICALESE, ZS. LIPTÁK, AND **M. ROSSI**, "Bubble-Flip—A New Generation Algorithm for Prefix Normal Words". *Theoretical Computer Science*, vol. **743**, pp. 38-52, 2018.

**In Conference Proceedings**

- 10\* S. GIULIANI, G. ROMANA, AND **M. ROSSI**, "Computing Maximal Unique Matches with the  $r$ -index". *In Proceedings of the 20th Symposium on Experimental Algorithms (SEA 2020)*, LIPIcs, Vol. **233**, pp. 22:1-22:16, 2022
- 11\* N. K. BROWN, T. GAGIE, AND **M. ROSSI**, "RLBWT Tricks". *In Proceedings of the 20th Symposium on Experimental Algorithms (SEA 2020)*, LIPIcs, Vol. **233**, pp. 16:1-16:16, 2022
12. M. OLIVA, D. CENZATO, **M. ROSSI**, ZS. LIPTÁK, T. GAGIE, AND C. BOUCHER, "Efficient CSTs for Terabyte-Sized Data". *In Proceedings of Data Compression Conference (DCC 2021)*, IEEE, pp. 93-102, 2021
- 13\* C. BOUCHER, D. CENZATO, ZS. LIPTÁK, **M. ROSSI**, AND M. SCIORTINO, " $r$ -indexing the eBWT". *In proceedings of the 28th International Symposium on String Processing and Information Retrieval (SPIRE 2021)*, LNCS, vol. **12944**, pp. 3-12. Springer, Cham, 2021.

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\* Authors listed in alphabetic order.

- 14\* C. BOUCHER, D. CENZATO, ZS. LIPTÁK, **M. ROSSI**, AND M. SCIORTINO, "Computing the original eBWT faster, simpler, and with less memory". *In proceedings of the 28th International Symposium on String Processing and Information Retrieval (SPIRE 2021)*, LNCS, vol. **12944**, pp. 129-142. Springer, Cham, 2021.
15. O. AHMED, **M. ROSSI**, S. KOVAKA, M. C. SCHATZ, T. GAGIE, C. BOUCHER, AND B. LANGMEAD, "Pan-genomic Matching Statistics for Targeted Nanopore Sequencing". *In Proceedings of the 11th RECOMB Satellite Workshop on Massively Parallel Sequencing (RECOMB-Seq 2021)*, (to appear)
- 16\* C. BOUCHER, T. GAGIE, T. I. D. KÖPPL, B. LANGMEAD, G. MANZINI, G. NAVARRO, A. PACHECO AND **M. ROSSI**, "PHONI: Streamed Matching Statistics with Multi-Genome References". *In Proceedings of Data Compression Conference (DCC 2021)*, IEEE, pp. 193-202, 2021
17. M. OLIVA, **M. ROSSI**, J. SIRÉN, G. MANZINI, T. KAHVECI, T. GAGIE, AND C. BOUCHER, "Efficiently Merging r-indexes". *In Proceedings of Data Compression Conference (DCC 2021)*, IEEE, pp. 203-212. 2021
18. **M. ROSSI**, M. OLIVA, B. LANGMEAD, T. GAGIE, AND C. BOUCHER, "MONI: A Pangenomics Index for Finding MEMs". *In Proceedings of the 25th International Conference On Research In Computational Molecular Biology (RECOMB21)*, (to appear)
- 19\* C. BOUCHER, O. CVACHO, T. GAGIE, J. HOLUB, G. MANZINI, G. NAVARRO, AND **M. ROSSI**, "PFP Compressed Suffix Trees". *In proceedings of the SIAM Symposium on Algorithm Engineering and Experiments (ALENEX21)*, pp. 60-72. 2021.
- 20\* F. CICALESE AND **M. ROSSI**, "On the Redundancy of D-ary Fano codes". *In proceedings of the 47th International Conference on Current Trends in Theory and Practice of Computer Science (SOFSEM 2021)*, LNCS, vol. **12607**, pp. 263-277. Springer, Cham, 2021.
- 21\* D. COBAS, V. MÄKINEN, AND **M. ROSSI**, "Tailoring r-index for metagenomics". *In proceedings of the 27th International Symposium on String Processing and Information Retrieval (SPIRE 2020)*, LNCS, vol. **12303**, pp. 291-306. Springer, Cham, 2020.
22. K. MUKHERJEE, **M. ROSSI**, L. SALMELA, AND C. BOUCHER, "Fast and Efficient Rmap Assembly using the Bi-labelled de Bruijn Graph". *In proceedings of the 20th Workshop on Algorithms in Bioinformatics (WABI 2020)*, LIPIcs, Vol. **172**, 9:1–9:16, 2020.
- 23\* ZS. LIPTÁK, S. J. PUGLISI, AND **M. ROSSI**, "Pattern Discovery in Colored Strings". *In proceedings of the 18th Symposium on Experimental Algorithms (SEA 2020)*, LIPIcs, Vol. **160**, pp. 12:1-12:14, 2020
24. **M. ROSSI**, "Greedy additive approximation algorithms for minimum-entropy coupling problem". *In Proceedings of 2019 IEEE International Symposium on Information Theory (ISIT 2019)*, IEEE, pp. 1127-1131, 2019.
- 25\* S. J. PUGLISI AND **M. ROSSI**, "On Lempel-Ziv Decompression in Small Space". *In Proceedings of Data Compression Conference (DCC 2019)*, IEEE, pp. 221-230, 2019.
- 26\* F. CICALESE, ZS. LIPTÁK, AND **M. ROSSI**, "On infinite prefix normal words". *In Proceedings of the 45th International Conference on Current Trends in Theory and Practice of Computer Science (SOFSEM 2019)*, LNCS, vol. **11376**, pp. 122-135, Springer, Cham, 2019.
- 27\* F. CICALESE, ZS. LIPTÁK, AND **M. ROSSI**, "Bubble-Flip—A New Generation Algorithm for Prefix Normal Words". *In Proceedings of the International Conference on Language and Automata Theory and Applications (LATA 2018)*, LNCS, vol. **10792**, pp. 207-219, Springer, Cham, 2018.
- 28\* F. CICALESE AND **M. ROSSI**, "On the multi-interval Ulam-Rényi game: for 3 lies 4 intervals suffice". *In Proceedings of the Italian Conference on Theoretical Computer Science (ICTCS 2017)*, vol. **1949**, pp. 39-50, CEUR-WS, 2017.

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\* Authors listed in alphabetic order.

29. A. BONCI, M. PIRANI, **M. ROSSI**, AND E. M. GABBANINI, "Embedded system for a Ballbot robot." *In Proceedings of the 12th International Workshop on Intelligent Solutions in Embedded Systems (WISES 2015)*, IEEE, pp. 157-161, 2015.

### Blog post

30. S. HAN, V. ONUCHIC, **M. ROSSI**, E. ROLLER, AND D. CAMERON, "enotyping of High Homology HBA1 and HBA2 from Illumina Whole-Genome Sequencing". *In Genomics Research Hub.*, Illumina. 2022.

## TEACHING EXPERIENCE

**2021**

Dalhousie University

Guest lecturer for the Bachelor course "*Design and Analysis of Algorithms*" held by Travis GAGIE · 1 lecture on Fast Fourier Transform · 180 enrolled students

**2019**

University of Helsinki

Guest lecturer for the Master course "*Data Compression Techniques*" held by Simon J. PUGLISI · 4 lectures (8 hours) on Dictionary compression · 20-40 enrolled students

**2018/19**

University of Verona

Teaching Assistant for the Master course "*Algorithms*" held by Romeo RIZZI · 1-semester course · 40-60 enrolled students

**2018/19,  
2017/18,  
2016/17**

University of Verona

Teaching Assistant for the Master course "*Programming Challenges*" held by Romeo RIZZI · 1-semester course · 20-40 enrolled students

**2018/19,  
2017/18,  
2016/17,  
2015/16**

University of Verona

Teaching Assistant for the Bachelor course "*Algorithms in Bioinformatics*" held by Ferdinando CICALESE · 1-semester course · 60-80 enrolled students

## MENTORING EXPERIENCE

**2020/21**

University of Florida

Help supervising students

Yu HONG · PhD student · "*From PFP to Lempel-Ziv77 for large scale data*"

Marco OLIVA · PhD student · "*Efficiently Merging r-indexes*"

Kingshuk MUKHERJEE · PhD student · "*Fast and Efficient Rmap Assembly using the Bi-labelled de Bruijn Graph*"

Herman PERERA · Undergraduate student · "*Speeding up compressed suffix arrays*"

## GRANTS/FELLOWSHIPS

Grants

UNIVERSITY OF VERONA · *Programma di internazionalizzazione Scuola di Dottorato di Scienze Naturali ed Ingegneristiche anno 2018* · Research visit at the University of Helsinki (total: 3500 €). February 2018

UNIVERSITY OF VERONA · *Programma di internazionalizzazione Scuola di Dottorato di Scienze Naturali ed Ingegneristiche anno 2019* · Participation at ISIT 2019 (total: 1000 €).  
May 2019

WORKSHOP ON WORDS AND COMPLEXITY · *Student grant* · Participation at the *Workshop on Words and Complexity* (total: 600 €).  
February 2018

ENTROPY · *Student travel grant* · Participation at ISIT 2019 (total: 400 CHF).  
June 2019

BIRDS PROJECT · *Student travel grant* · Participation at SPIRE/WCTA 2019 (total: 1000 €).  
June 2019

*Fellowships* · GOOGLE · *Google Hash Code 2019 Final Round* · Invitation and participation fellowship (total: 600 €).  
April 2019

#### SCIENTIFIC RESPONSIBILITIES

*Reviewer* · for the international conferences: RP 2019, LATIN 2020, MFCS 2020, ESA 2020 (Track B), DCC 2021, RECOMB 2021, ISMB 2021, CPM 2021, IWOCA 2021

for the international journals: IEEE/ACM Trans. Comput. Biol. Bioinform., Theoret. Comp. Sci., Algorithmica, Bioinformatics

*Publicity chair* · for the international conference: SPIRE 2020

*Program co-chair* · for the international workshop: WCTA 2022

#### PROGRAMMING SKILLS

*Programming / Scripting Languages* · (ADVANCED) C/C++; (INTERMEDIATE) Python, Bash, MATLAB, SQL, Cuda C/C++; (BASIC) R, Verilog, VHDL.

*Frameworks and tools* · git, sdsl, CMake, networkx, SQLite, Simulink, SystemC, Adobe Illustrator, Slurm, L<sup>A</sup>T<sub>E</sub>X.

*Bioinformatics tools* · BWA, Bowtie2, VG-toolkit, Salmon, DEseq2, tophat, cufflinks, Cummerbound, samtools, Picard, GATK, ksw2, klib.

*Bioinformatics analysis* · read alignment, RNA-seq, rt-qPCR differential expression.

*Operating Systems* · (ADVANCED) Linux; (INTERMEDIATE) Windows; MacOS.

*Data structures implemented* · Fenwick trees, Segment/Range trees, Union-Find, Biased 2-3 trees, AVL trees, B-trees, Mergeable dictionaries, Indexed priority queues, Tries, FM-indexes, *r*-indexes, wavelet matrices, RLBWT.

*Data structures used* · Rank, Select, Range minimum/maximum queries, Suffix trees, Enhanced suffix arrays.

*Projects* · Pangenomics index for finding MEMs; Compressed suffix tree for large scale data; Pattern mining of colored strings; Lempel-Ziv 77 decompression in small space; Generation algorithm for prefix normal words; Assertion miner and test pattern generator for embedded systems using simulation traces; Model predictive control using a dual gradient-projection algorithm; Firmware for a ballbot robot;

#### PROGRAMMING CONTESTS

*Google Hash Code 2019* · Participant · Rank 21st global (1st Italian team)  
April 2019 · Dublin (*Ireland*)

*Italian Collegiate Programming Contest 2019* · Organizer  
May 2019 · Verona (*Italy*)

## OTHER ACADEMIC ACTIVITIES/EXPERIENCES

*Invited Talks*

*MONI: Design Challenges for a Pangenomic Tool* · Pangenomics Bio Hacking 2021  
December 2021 · Milan (*Italy*) - held online.

*Conference Presentations*

*MONI: A Pangenomics read aligner* · Poster at Genome Informatics  
November 2021 · Cold Spring Harbor, NY (*United States*) - held online.

*MONI: A Pangenomics Index for Finding MEMs* · Contributed talk at the 25th International Conference on Research in Computational Molecular Biology (RECOMB 2021)  
August 2021 · Padova (*Italy*) - held online.

*Finding Overlapping Rmaps via Gaussian Mixture Model Clustering* · Contributed talk at the International Workshop on Data Mining in Bioinformatics (BIOKDD 2021)  
August 2021 · Singapore (*Singapore*) - held online.

*PPF Compressed Suffix Trees* · Contributed talk at Workshop on Data Structures for Bioinformatics (DSB 2021)  
February 2021 · Milan (*Italy*) - held online.

*On the redundancy of D-ary Fano codes* · Contributed talk at the 47th International Conference on Current Trends in Theory and Practice of Computer Science (SOFSEM 2021)  
January 2021 · Bolzen (*Italy*) - held online.

*PPF Compressed Suffix Trees* · Contributed talk at the SIAM Symposium on Algorithm Engineering and Experiments (ALENEX21)  
January 2021 · Alexandria, VA (*United States*) - held online.

*Finding MEMs with the RLBWT* · Contributed talk at the 15th Workshop on Compression, Text and Algorithms (WCTA 2020)  
October 2020 · Orlando, FL (*United States*) - held online.

*Pattern discovery in colored strings* · Contributed talk at the 18th Symposium on Experimental Algorithms (SEA 2020)  
June 2020 · Catania (*Italy*) - held online.

*Practical mergeable dictionaries* · Contributed talk at the 14th Workshop on Compression, Text and Algorithms (WCTA 2019)  
October 2019 · Segovia (*Spain*)

*Greedy additive approximation algorithms for minimum-entropy coupling problem* · Contributed talk at the 2019 IEEE International Symposium on Information Theory (ISIT 2019)  
July 2019 · Paris (*France*)

*On Lempel-Ziv Decompression in Small Space* · Contributed talk at the Data Compression Conference (DCC 2019)  
March 2019 · Snowbird, UT (*United States*)

*On Infinite Prefix Normal Words* · Contributed talk at the 45<sup>th</sup> International Conference on Current Trends in Theory and Practice of Computer Science (SOFSEM 2019)  
January 2019 · Nový Smokovec (*Slovakia*)

*Bubble-Flip—A New Generation Algorithm for Prefix Normal Words* · Contributed talk at the 12<sup>th</sup> International Conference on Language and Automata Theory and Applications (LATA 2018)  
April 2018 · Ramat Gan (Israel)

*Bubble-Flip—A New Generation Algorithm for Prefix Normal Words* · Contributed talk at the Workshop on Words and Complexity  
February 2018 · Villeurbanne (France)

*On the multi-interval Ulam-Rényi game: for 3 lies 4 intervals suffice* · Contributed talk at the Italian Conference on Theoretical Computer Science (ICTCS 2017)  
September 2017 · Naples (Italy)

*Embedded system for a Ballbot robot* · Poster at the Workshop on Intelligent Solutions in Embedded Systems (WISES 2015)  
November 2015 · Ancona (Italy)

*Further  
conferences*

International Symposium on String Processing and Information Retrieval (SPIRE 2021)  
October 2021 · Lille (France) - held online.

International Symposium on String Processing and Information Retrieval (SPIRE 2020)  
October 2020 · Orlando, FL (United States) - held online.

International Symposium on String Processing and Information Retrieval (SPIRE 2019)  
October 2019 · Segovia (Spain)

European Symposium on Algorithms 2018 (ESA 2018)  
August 2018 · Helsinki (Finland)

Workshop on Data Structures for Bioinformatics (DSB 2018)  
May 2018 · Helsinki (Finland)

*Summer Schools  
attended*

*Graph theory, algorithms and applications* · Organized by Raffaele CERULLI, Andrew GOLDBERG, Giuseppe F. ITALIANO, Robert E. TARJAN  
May 2017 · Erice (Italy)

*PhD Modelling Week · Optimization in city-logistics* · Organized by Luca DI PERSIO, Romeo RIZZI, Renata MANSINI, Marco CALIARI, Michele BONOLLO, Antonio MARIGONDA, Giandomenico ORLANDI  
September 2016 · Verona (Italy)

*Languages*

ITALIAN · Mother tongue

ENGLISH · Very good (written and spoken)

REFERENCES

**Dr. Christina BOUCHER**  
(*Postdoc mentor*)  
Email: [cboucher@cise.ufl.edu](mailto:cboucher@cise.ufl.edu)  
URL: <https://www.christinaboucher.com>

University of Florida  
Department of Computer and Information  
Science and Engineering  
Gainesville, FL, United States

**Dr. Ben LANGMEAD**  
(*Co-author*)  
Email: [langmea@cs.jhu.edu](mailto:langmea@cs.jhu.edu)  
URL: <https://langmead-lab.org>

Johns Hopkins University  
Department of Computer Science  
Baltimore, MD, United States

**Dr. Travis GAGIE**

*(Co-author)*

Email: [travis.gagie@dal.ca](mailto:travis.gagie@dal.ca)

URL: <https://www.dal.ca/faculty/computerscience/faculty-staff/travis-gagie.html>

Dalhousie University  
Faculty of Computer Science  
Halifax, Canada

**Dr. Ferdinando CICALÉSE**

*(Ph.D. Advisor)*

Email: [ferdinando.cicalese@univr.it](mailto:ferdinando.cicalese@univr.it)

URL: <http://profs.scienze.univr.it/cicalese>

University of Verona  
Department of Computer Science  
Verona, Italy

**Dr. Zsuzsanna LIPTÁK**

*(Ph.D. Advisor)*

Email: [zsuzsanna.liptak@univr.it](mailto:zsuzsanna.liptak@univr.it)

URL: <http://profs.scienze.univr.it/liptak>

University of Verona  
Department of Computer Science  
Verona, Italy

Dr. Massimiliano Rossi

Atlanta, GA, January 20, 2023