

**Dichiarazione Sostitutiva di Certificazione (art. 46 DPR n. 445/2000)**  
**Dichiarazione Sostitutiva dell'Atto di Notorietà (art. 47 DPR n. 445/2000)**

Il sottoscritto Giulio Ermanno Pibiri

- o nato a Bagno a Ripoli (FI) il 13/07/1990
- o attualmente residente a Prato (PO) in via Guizzelmi, n. 16, CAP 59100
- o reperibile al numero di telefono +39 340 9100050

visto il D.P.R. 28 dicembre 2000, n. 445 concernente "T.U. delle disposizioni legislative e regolamentari in materia di documentazione amministrativa" e successive modifiche ed integrazioni;

vista la Legge 12 novembre 2011, n. 183 ed in particolare l'art. 15 concernente le nuove disposizioni in materia di certificati e dichiarazioni sostitutive;

consapevole che, ai sensi dell'art. 76 del DPR 445/2000, le dichiarazioni mendaci, la falsità negli atti e l'uso di atti falsi sono punite ai sensi del Codice penale e delle leggi speciali vigenti in materia, dichiara sotto la propria responsabilità: che quanto dichiarato nel seguente *Curriculum Vitae et Studiorum*, comprensivo delle informazioni sulla produzione scientifica, corrisponde a verità.

## Giulio Ermanno Pibiri

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### *Curriculum Vitae et Studiorum*

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#### Contact Information

"Ca' Foscari" University of Venice  
Department of Environmental Sciences, Informatics and Statistics (DAIS)  
Via Torino 155, 30170 Mestre (Venice), Italy

Email [giulioermanno.pibiri@unive.it](mailto:giulioermanno.pibiri@unive.it)  
Personal Web page <https://jerp.github.io>

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#### Personal Information

Place of birth Bagno a Ripoli (Florence), Italy  
Date of birth 13 July 1990

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## Education

- 01/11/2015 – 31/10/2018 **PhD in Computer Science (INF/01).**
- o University of Pisa, Pisa, Italy
  - o Thesis: *Space- and Time-Efficient Data Structures for Massive Datasets* (Defended on 08/03/2019)
  - o Grade: Excellent
  - o Supervisor: Rossano Venturini (<https://rossanoventurini.github.io>)
- 2012 – 2014 **Master Degree in Computer Science & Networking (class LM18).**
- o University of Pisa and Scuola Superiore Sant'Anna, Pisa, Italy
  - o Thesis: *Dynamic Elias-Fano Encoding* (Defended on 06/03/2015)
  - o Grade: 110/110 *summa cum laude*
  - o Supervisor: Rossano Venturini (<https://rossanoventurini.github.io>)
- 2009 – 2012 **Bachelor Degree in Computer Engineering (class L08).**
- o University of Florence, Florence, Italy
  - o Thesis: *Quantum Computation & Grover's Algorithm* (Defended on 09/10/2012)
  - o Grade: 110/110 *summa cum laude*
  - o Supervisor: Gabriele Vezzosi (<http://www.dma.unifi.it/~vezzosi>)
- 2004 – 2009 **High School Diploma.**
- o Liceo Scientifico Statale Guido Castelnuovo, Florence, Italy
  - o Grade: 100/100.

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## Research Interests

- Keywords Data Structures, Data Compression, Indexing, Efficiency
- Short Description The research activity focuses on devising compressed data structures and algorithms to index and search large quantities of data. The proposed solutions are available as research papers and optimized software libraries (written in C++).
- Research Problems *Robustness Verification of Tree Ensembles* (CSS 2023); *Colored k-mer Indexing* (WABI 2023); *Reference Indexing* (RECOMB 2023); *Locality-Preserving Minimal Perfect Hashing for k-mers* (BIOINF 2023); *Compressed and Weighted Dictionaries for k-mers* (BIOINF 2022, WABI 2022, ALGOMB 2023, GBO 2023); *Time Series Compression* (SPIRE 2021); *Minimal Perfect Hashing* (SIGIR 2021, TKDE 2023); *Prefix-Sums* (SPE 2020); *Rank/Select Queries* (INFOSYS 2021); *Query Auto-Completion* (SIGIR 2020); *Bitmap Compression* (DCC 2021); *Indexing of Semantic Relations* (TKDE 2020, ICDE 2021); *Indexing and Estimation of Language Models* (SIGIR 2017, TOIS 2019); *Inverted Index Compression* (TOIS 2017, EBDT 2018, WSDM 2019, TKDE 2019, CSUR 2020); *Succinct and Dynamic Ordered Sets of Integers* (CPM 2017).

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## Research Positions

- 06/06/2022 – present **Assistant Professor of Computer Science.**
- o Department of Environmental Sciences, Informatics and Statistics, "Ca' Foscari" University of Venice, Venice, Italy
  - o Protocollo n. 52696, 01/06/2022
- 15/03/2021 – 31/05/2022 **Postdoctoral Research Fellow in Computer Science.**
- o Institute of Science and Information Technologies "A. Faedo" (ISTI), National Research Council of Italy (CNR), Pisa, Italy
  - o Research grant issued on the European project ACCORDION with theme "Tecniche algoritmiche per compressione, indicizzazione e ricerca di grandi quantità di dati e progettazione di relative librerie software open source" (Protocollo n. 0000901/2021, 09/03/2021, ISTI 004/2021 - PI)
  - o Reference publications: SIGIR 2021, SPIRE 2021, BIOINF 2022, WABI 2022

- 01/11/2018 – **Postdoctoral Research Fellow in Computer Science.**  
 28/02/2021
- o Institute of Science and Information Technologies “A. Faedo” (ISTI), National Research Council of Italy (CNR), Pisa, Italy
  - o Research grant issued on the European project BIGDATAGRAPES with theme “Compressione, indicizzazione e ricerca su grandi collezioni di dati semantici” (Protocollo n. 0003847, 24/10/2018, ISTI 014/2018 - PI)
  - o Reference publications: TKDE 2019, TKDE 2020, SIGIR 2020, SPE 2020, INFOSYS 2021, DCC 2021, ICDE 2021
- 01/11/2015 – **PhD Student in Computer Science.**  
 31/10/2018
- o University of Pisa, Pisa, Italy
  - o Thesis: *Space- and Time-Efficient Data Structures for Massive Datasets*
  - o Supervisor: Rossano Venturini (<https://rossanoventurini.github.io>)
  - o Reference publications: TKDE 2019, TOIS 2019, WSDM 2019, SIGIR 2017, CPM 2017, TOIS 2017
- Part of the research was conducted **abroad** (6 months):
- o 01/05/2018 – 01/10/2018
    - The University of Melbourne, School of Computing and Information Systems, Melbourne, Australia
    - Supervisor: Alistair Moffat (<https://people.eng.unimelb.edu.au/ammoffat>)
    - Worked on fast dictionary-based decoding of compressed inverted index data.
    - Reference publication: WSDM 2019
  - o 01/04/2018 – 30/04/2018
    - RIKEN Advanced Intelligence Project (AIP), Tokyo, Japan
    - Supervisor: Yasuo Tabei (<https://sites.google.com/site/yasuotabei>)
    - Worked on various problems, such as, string similarity search, trie indexing, rank/select indexes, and sparse matrix multiplication.
    - Reference publication: INFOSYS 2021

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## Research Visits

- 19/10/2022 – Inria, Rennes, France. Visiting dr. Pierre Peterlongo and dr. Karel Brinda.  
 21/10/2022
- 10/05/2022 – The University of Lille, CNRS, CRISAL Laboratory, Lille, France. Visiting dr. Antoine Limasset  
 12/05/2022 and dr. Camille Marchet.
- 01/05/2018 – The University of Melbourne, School of Computing and Information Systems, Melbourne,  
 01/10/2018 Australia. Visiting prof. Alistair Moffat and dr. Matthias Petri.
- 01/04/2018 – RIKEN Advanced Intelligence Project (AIP), Tokyo, Japan. Visiting dr. Yasuo Tabei and dr.  
 30/04/2018 Shunsuke Kanda.

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## Projects

- 01/09/2021 – **Italian PON project OK-INSAD.**  
 31/05/2021
- o Institute of Science and Information Technologies “A. Faedo” (ISTI), National Research Council of Italy (CNR), Pisa, Italy
  - o Role: Investigator
- 15/03/2021 – **European project ACCORDION.**  
 31/05/2021
- o Institute of Science and Information Technologies “A. Faedo” (ISTI), National Research Council of Italy (CNR), Pisa, Italy
  - o Role: Investigator
- 01/11/2018 – **European project BIGDATAGRAPES.**  
 28/02/2021
- o Institute of Science and Information Technologies “A. Faedo” (ISTI), National Research Council of Italy (CNR), Pisa, Italy
  - o Role: *Task Leader* for the task 3.3 “Big Data Indexing”
- 01/06/2017 – **European project LIGA.**  
 31/10/2018
- o Institute of Science and Information Technologies “A. Faedo” (ISTI), National Research Council of Italy (CNR), Pisa, Italy
  - o Role: Principal Developer

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## Teaching Activity

- A.Y. 2023/2024 Teacher for AUTONOMOUS, DISTRIBUTED AND PERVASIVE SYSTEMS-2 (code PHD156-2, 2 CFU), PhD Program in Computer Science, Ca' Foscari University, Italy
- A.Y. 2023/2024 Teacher for COMPUTER SCIENCE I - MOD. 1 (code CT0569, 6 CFU), Bachelor Degree in Ingegneria Fisica, Ca' Foscari University, Italy
- A.Y. 2023/2024 Teacher for INTRODUCTION TO PROGRAMMING-1 (code CT0441, 6 CFU), Bachelor Degree in INFORMATICA, Ca' Foscari University, Italy
- A.Y. 2023/2024 Teacher for PROGRAMMING AND LABORATORY-2 (code CT0442, 6 CFU), Bachelor Degree in INFORMATICA, Ca' Foscari University, Italy
- A.Y. 2022/2023 Teacher for Introduction to Algorithms (3h), Invited lecture, IIS A. Pacinotti, Mestre (Venice), Italy
- A.Y. 2022/2023 Teacher for KNOWLEDGE, INTERACTION AND INTELLIGENT SYSTEMS-2 (code PHD157-2, 2 CFU), PhD Program in Computer Science, Ca' Foscari University, Italy
- A.Y. 2022/2023 Teacher for COMPUTER SCIENCE I - MOD. 1 (code CT0569, 6 CFU), Bachelor Degree in Ingegneria Fisica, Ca' Foscari University, Italy
- A.Y. 2022/2023 Teacher for COMPUTER SCIENCE FOR CULTURAL HERITAGE (code CT0612, 6 CFU), Bachelor Degree in SCIENZE E TECNOLOGIE PER I BENI CULTURALI, Ca' Foscari University, Italy
- A.Y. 2022/2023 Teacher for PROGRAMMING AND LABORATORY-2 (code CT0442, 6 CFU), Bachelor Degree in INFORMATICA, Ca' Foscari University, Italy
- A.Y. 2021/2022 Teacher for *Theory and Practice of Data Compression* (5 CFU), PhD Program in Ingegneria dell'Informazione, University of Pisa, Italy
- A.Y. 2019/2020 Teacher for *Algorithmics and Laboratory - Corso B* (code 008AA, 3 CFU), Bachelor Degree in Computer Science, University of Pisa, Italy
- A.Y. 2018/2019 Assistant for *Algorithmics and Laboratory - Corso A* (code 008AA, 3 CFU), Bachelor Degree in Computer Science, University of Pisa, Italy
- A.Y. 2017/2018 Assistant for *Competitive Programming and Contests* (code 645AA, 6 hours), Master Degree in Computer Science, University of Pisa, Italy
- A.Y. 2016/2017 Assistant for *Competitive Programming and Contests* (code 645AA, 6 hours), Master Degree in Computer Science, University of Pisa, Italy
- A.Y. 2015/2016 Teacher for *Algorithmics and Laboratory - Corso di recupero* (code 008AA, 3 CFU), Bachelor Degree in Computer Science, University of Pisa, Italy
- A.Y. 2015/2016 Assistant for *Algorithmics and Laboratory - Corso A* (code 008AA, 3 CFU), Bachelor Degree in Computer Science, University of Pisa, Italy

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## Awards and Grants

- 2022 *Young Researcher Award* for the year 2021, issued by ISTI-CNR.
- 2021 *Young Researcher Award* for the year 2020, issued by ISTI-CNR.
- 2020 *Young Researcher Award* for the year 2019, issued by ISTI-CNR.
- 2017 *SIGIR Student Travel Grant*, issued by ACM SIGIR.
- 2015 *PhD Scholarship*, issued by the University of Pisa, Department of Computer Science.
- 2015 *Master Degree Award* for the A.Y. 2013/2014, issued by Scuola Superiore Sant'Anna.
- 2015 *Best Master Thesis Award in Theoretical Computer Science*, issued by the Italian chapter of the European Association for Theoretical Computer Science (EATCS).

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## Organizing Committees

- 2023 Co-Chair of the 18-th edition of the Workshop on Compression, Text, and Algorithms (WCTA), co-located with SPIRE 2023.

- 2020 The 28-th edition of the Annual European Symposium on Algorithms (ESA 2020).
- 2019 The 30-th edition of the International Symposium on Combinatorial Pattern Matching (CPM 2019).
- 2017 The 24-th International Symposium on String Processing and Information Retrieval (SPIRE 2017).
- 2016 The 39-th ACM International SIGIR Conference on Research and Development in Information Retrieval (SIGIR 2016). (As student volunteer.)

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## Program Committees

- 2024 The 47-th ACM International SIGIR Conference on Research and Development in Information Retrieval (SIGIR 2024).
- 2024 The 14-th RECOMB Satellite Conference on Biological Sequence Analysis (RECOMB-SEQ 2024).
- 2023 The 31-st European Symposium on Algorithms (ESA 2023 – Track B).
- 2023 The 13-rd RECOMB Satellite Conference on Biological Sequence Analysis (RECOMB-SEQ 2023).
- 2023 The 46-th ACM International SIGIR Conference on Research and Development in Information Retrieval (SIGIR 2023).
- 2023 The 13-rd International Symposium on Algorithms and Complexity (CIAC 2023).
- 2023 The 45-th European Conference on Information Retrieval (ECIR 2023).
- 2023 The 16-th International ACM Conference on Web Search and Data Mining (WSDM 2023).
- 2022 The 45-th ACM International SIGIR Conference on Research and Development in Information Retrieval (SIGIR 2022).
- 2022 The 44-th European Conference on Information Retrieval (ECIR 2022).
- 2022 The 15-th International ACM Conference on Web Search and Data Mining (WSDM 2022).
- 2021 The 30-th ACM International Conference on Information and Knowledge Management (CIKM 2021).
- 2021 The 44-th ACM International SIGIR Conference on Research and Development in Information Retrieval (SIGIR 2021).
- 2021 The 43-rd European Conference on Information Retrieval (ECIR 2021).
- 2021 The 14-th International ACM Conference on Web Search and Data Mining (WSDM 2021).
- 2020 The 29-th ACM International Conference on Information and Knowledge Management (CIKM 2020).
- 2020 The 43-rd ACM International SIGIR Conference on Research and Development in Information Retrieval (SIGIR 2020).
- 2019 The 42-nd ACM International SIGIR Conference on Research and Development in Information Retrieval (SIGIR 2019).

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## Reviewing Activity

2016 – present I am or have been an anonymous reviewer for the following conferences/journals.

## Conferences

- o SIGIR – ACM Conference on Research and Development in Information Retrieval
- o WSDM – ACM Conference on Web Search and Data Mining
- o WWW – The Web Conference
- o CIKM – ACM Conference on Information and Knowledge Management
- o CPM – Annual Symposium on Combinatorial Pattern Matching
- o DCC – IEEE Data Compression Conference
- o ECIR – European Conference on Information Retrieval
- o ESA – European Symposium on Algorithms
- o SPIRE – String Processing and Information Retrieval
- o ISAAC – International Symposium on Algorithms and Computation
- o RECOMB – International Conference on Research in Computational Molecular Biology
- o RECOMB-SEQ – Satellite Conference on Biological Sequence Analysis.
- o CIAC – International Symposium on Algorithms and Complexity

## Journals

- o TALG – ACM Transactions on Algorithms
- o Bioinformatics
- o INFOSYS – Information Systems
- o SPE – Software: Practice and Experience
- o JEA – Journal of Experimental Algorithmics
- o Algorithmica
- o MDPI Algorithms
- o IEEE TIFS – Transactions on Information Forensics and Security
- o IPM – Information Processing and Management

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## Talks

### Invited Keynote

- 22/11/2023 *Compressing and indexing pangenomes with meta-colored compacted de Bruijn graphs.* ALPACA-PANGAIA Annual Workshop. Amsterdam, Netherlands.
- 20/10/2022 *Modular reference indexing with the de Bruijn graph: overview and challenges.* Workshop on Indexing Omic Sequences. Rennes, France.
- 10/05/2022 *On Weighted K-Mer Dictionaries.* TUDASTIC 2022 (Tutorials on Data Structures for Text Indexation and Compression). Lille, France.

### Conferences

- 25/07/2023 *Locality-Preserving Minimal Perfect Hashing of K-Mers.* ISMB 2023, Lyon, France.
- 21/03/2023 *Spectrum Preserving Tilings Enable Sparse and Modular Reference Indexing.* DSB 2023, Delft, Netherlands.
- 05/09/2022 *On Weighted K-Mer Dictionaries.* WABI 2022, Potsdam, Germany.
- 13/07/2022 *Sparse and Skew Hashing of K-Mers.* ISMB 2022. Madison, Wisconsin, USA.
- 14/06/2022 *PTHash: Revisiting FCH Minimal Perfect Hashing.* DSB 2022, Düsseldorf, Germany.
- 20/05/2022 *Sparse and Skew Hashing of K-Mers.* RECOMB-seq 2022. La Jolla, California, USA.
- 04/10/2021 *TSXor: A Simple Time-Series Compression Algorithm.* SPIRE 2021. Lille, France (Virtual event).
- 14/09/2021 *PTHash: Revisiting FCH Minimal Perfect Hashing.* IIR 2021. Polytechnic University of Bari, Bari (Virtual event).

- 07/2021 *PTHash: Revisiting FCH Minimal Perfect Hashing*. SIGIR 2021. Montreal, Canada (Virtual event).
- 04/2021 *Compressed Indexes for Fast Search of Semantic Data*. ICDE 2021. Chania, Greece (Virtual event).
- 03/2021 *Fast and Compact Set Intersection through Recursive Universe Partitioning*. DCC 2021. Snow Bird, USA (Virtual event).
- 27/07/2020 *Efficient and Effective Query Auto-Completion*. SIGIR 2020. Xi'An, China (Virtual event).
- 17/09/2019 *Compressed Indexes for Fast Search of Semantic Data*. IIR 2019. Department of Information Engineering, Padova, Italy.
- 12/02/2019 *Fast Dictionary-based Compression for Inverted Indexes*. WSDM 2019. Melbourne Exhibition Center, Melbourne, Australia.
- 10/08/2017 *Efficient Data Structures for Massive N-Gram Datasets*. SIGIR 2017. Keio Plaza Hotel, Tokyo, Japan.
- 06/07/2017 *Dynamic Elias-Fano Representation*. CPM 2017. University Library of Warsaw, Warsaw, Poland.
- 06/06/2017 *Efficient Data Structures for Massive N-Gram Datasets*. IIR 2017. Università della Svizzera Italiana, Lugano, Switzerland.

### Seminars

- 02/11/2023 *Compressing and indexing pangenomes with meta-colored compacted de Bruijn graphs*. ISTI-CNR, Pisa, Italy (Virtual event).
- 19/05/2022 *Sparse and Skew Hashing of K-Mers*. ISTI-CNR, Pisa, Italy (Virtual event).
- 22/12/2021 *Minimal Perfect Hashing and K-Mer String Dictionaries*. "Ca' Foscari" University of Venice, Venice, Italy (Virtual event).
- 16/11/2021 *PTHash: Revisiting FCH Minimal Perfect Hashing*. ISTI-CNR, Pisa, Italy (Virtual event).
- 04/03/2021 *Efficiency for Real-World Applications*. ISTI-CNR, Pisa, Italy (Virtual event).
- 07/06/2019 *Ordered Set Problems*. ISTI-CNR, Pisa, Italy.
- 01/02/2019 *Indexing Compressed Data for Fast Retrieval*. University of Pisa, Pisa, Italy.
- 29/10/2018 *Effective Web Graph Representations*. University of Pisa, Pisa, Italy.
- 17/05/2018 *On Optimally Partitioning Variable-Byte Index Data*. RMIT University, Melbourne, Australia.
- 10/04/2018 *Elias-Fano Encoding: a powerful tool for data structure design*. RIKEN AIP, Tokyo, Japan.
- 21/06/2016 *Elias-Fano Encoding: succinct representation of monotone integer sequences with search operations*. University of Pisa, Pisa, Italy.

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## Publications

### Journal Papers

- TKDE 2023 Giulio Ermanno Pibiri and Roberto Trani, *Parallel and External-Memory Construction of Minimal Perfect Hash Functions with PTHash*. 2023. IEEE Transactions on Knowledge and Data Engineering (TKDE), pages 12.  
DOI: 10.1109/TKDE.2023.3303341  
ISSN: 1041-4347
- GBIO 2023 Sebastian Schmidt, Shahbaz Khan, Jarno Alanko, Giulio Ermanno Pibiri, Alexandru I. Tomescu, *Matchtigs: minimum plain text representation of k-mer sets*. 2023. Genome Biology (GBIO), pages 33.  
DOI: 10.1186/s13059-023-02968-z  
ISSN: 1474-7596

- BIOINF 2023 Giulio Ermanno Pibiri, Yoshihiro Shibuya, and Antoine Limasset, *Locality-Preserving Minimal Perfect Hashing of  $k$ -mers*. 2023. Bioinformatics (BIOINF), pages 9.  
DOI: 10.1093/bioinformatics/btad219  
ISSN: 1367-4803
- ALGOMB 2023 Giulio Ermanno Pibiri, *On Weighted  $k$ -mer Dictionaries*. 2023. Algorithms for Molecular Biology (ALGOMB), pages 25.  
DOI: 10.1186/s13015-023-00226-2  
ISSN: 1748-7188
- BIOINF 2022 Giulio Ermanno Pibiri, *Sparse and Skew Hashing of  $k$ -mers*. 2022. Bioinformatics (BIOINF), pages 9.  
DOI: 10.1093/bioinformatics/btac245  
ISSN: 1367-4803
- INFOSYS 2021 Giulio Ermanno Pibiri and Shunsuke Kanda, *Rank/Select Queries over Mutable Bitmaps*. 2021. Information Systems (INFOSYS), pages 15.  
DOI: 10.1016/j.is.2021.101756  
ISSN: 0306-4379
- CSUR 2020 Giulio Ermanno Pibiri and Rossano Venturini, *Techniques for Inverted Index Compression*. 2020. ACM Computing Surveys (CSUR), pages 36.  
DOI: 10.1145/3415148  
ISSN: 0360-0300
- SPE 2020 Giulio Ermanno Pibiri and Rossano Venturini, *Practical Trade-Offs for the Prefix-Sum Problem*. 2020. Software: Practice and Experience (SPE), pages 29.  
DOI: 10.1002/spe.2918  
ISSN: 0038-0644
- TKDE 2020 Raffaele Perego, Giulio Ermanno Pibiri and Rossano Venturini, *Compressed Indexes for Fast Search of Semantic Data*. 2020. IEEE Transactions on Knowledge and Data Engineering (TKDE), pages 12.  
DOI: 10.1109/TKDE.2020.2966609  
ISSN: 1041-4347
- TKDE 2019 Giulio Ermanno Pibiri and Rossano Venturini, *On Optimally Partitioning Variable-Byte Codes*. 2019. IEEE Transactions on Knowledge and Data Engineering (TKDE), pages 12.  
DOI: 10.1109/TKDE.2019.2911288  
ISSN: 1041-4347
- TOIS 2019 Giulio Ermanno Pibiri and Rossano Venturini, *Handling Massive  $N$ -Gram Datasets Efficiently*. 2019. ACM Transactions on Information Systems (TOIS), pages 41.  
DOI: 10.1145/3302913  
ISSN: 1046-8188
- TOIS 2017 Giulio Ermanno Pibiri and Rossano Venturini, *Clustered Elias-Fano Indexes*. 2017. ACM Transactions on Information Systems (TOIS), volume 2, pages 33.  
DOI: 10.1145/3052773  
ISSN: 1046-8188

## Conference Papers

- CCS 2023 Stefano Calzavara, Lorenzo Cazzaro, Giulio Ermanno Pibiri, Nicola Prezza, *Verifiable Learning for Robust Tree Ensembles*. 2023. ACM SIGSAC Conference on Computer and Communications Security (CCS), 16 pages.  
DOI: 10.1145/3576915.3623100  
ISBN: 9781450394505
- WABI 2023 Jason Fan, Noor Pratap Singh, Jamshed Khan, Giulio Ermanno Pibiri, Rob Patro, *Fulgor: A fast and compact  $k$ -mer index for large-scale matching and color queries*. 2023. International Workshop on Algorithms in Bioinformatics (WABI), 21 pages.  
DOI: 10.4230/LIPIcs.WABI.2023.18  
ISBN: 9783959772433



- RECOMB 2023 Jason Fan, Jamshed Khan, Giulio Ermanno Pibiri, and Rob Patro, *Spectrum preserving tilings enable sparse and modular reference indexing*. 2023. International Conference on Research in Computational Molecular Biology (RECOMB), 20 pages.  
DOI: 10.1007/978-3-031-29119-7\_2  
ISBN: 9783031291197
- WABI 2022 Giulio Ermanno Pibiri, *On Weighted  $k$ -mer Dictionaries*. 2022. International Workshop on Algorithms in Bioinformatics (WABI), 20 pages.  
DOI: 10.4230/LIPIcs.WABI.2022.9  
ISBN: 9783959772433
- SPIRE 2021 Andrea Bruno, Franco Maria Nardini, Giulio Ermanno Pibiri, Roberto Trani, and Rossano Venturini, *TSXor: A Simple Time Series Compression Algorithm*. 2021. International Symposium on String Processing and Information Retrieval (SPIRE), 8 pages.  
DOI: 10.1007/978-3-030-86692-1\_18  
ISBN: 9783030866921
- SIGIR 2021 Giulio Ermanno Pibiri and Roberto Trani, *PTHash: Revisiting FCH Minimal Perfect Hashing*. 2021. ACM Conference on Research and Development in Information Retrieval (SIGIR), pages 10.  
DOI: 10.1145/3404835.3462849  
ISBN: 9781450380379
- DCC 2021 Giulio Ermanno Pibiri, *Fast and Compact Set Intersection through Recursive Universe Partitioning*. 2021. IEEE Data Compression Conference (DCC), pages 10.  
DOI: 10.1109/DCC50243.2021.00037  
ISBN: 9781665403337
- SIGIR 2020 Simon Gog, Giulio Ermanno Pibiri and Rossano Venturini, *Efficient and Effective Query Auto-Completion*. 2020. ACM Conference on Research and Development in Information Retrieval (SIGIR), pages 10.  
DOI: 10.1145/3397271.3401432  
ISBN: 9781450380164
- WSDM 2019 Giulio Ermanno Pibiri, Matthias Petri, Alistair Moffat, *Fast Dictionary-based Compression for Inverted Indexes*. 2019. ACM Conference on Web Search and Data Mining (WSDM), pages 9.  
DOI: 10.1145/3289600.3290962  
ISBN: 9781450359405
- SIGIR 2017 Giulio Ermanno Pibiri and Rossano Venturini, *Efficient Data Structures for Massive  $N$ -Gram Datasets*. 2017. ACM Conference on Research and Development in Information Retrieval (SIGIR), pages 10.  
DOI: 10.1145/3077136.3080798  
ISBN: 9781450350228
- CPM 2017 Giulio Ermanno Pibiri and Rossano Venturini, *Dynamic Elias-Fano Representation*. 2017. Annual Symposium on Combinatorial Pattern Matching (CPM), pages 14.  
DOI: 10.4230/LIPIcs.CPM.2017.30  
ISBN: 9783959770392

## Posters

- ICDE 2021 Raffaele Perego, Giulio Ermanno Pibiri and Rossano Venturini, *Compressed Indexes for Fast Search of Semantic Data*. 2021. IEEE International Conference on Data Engineering (ICDE), pages 2.  
DOI: 10.1109/ICDE51399.2021.00248  
ISBN: 9781728191850

## PhD Thesis

- 2019 Giulio Ermanno Pibiri. *Space- and Time-Efficient Data Structures for Massive Datasets*. 2019. Ph.D. Thesis, University of Pisa, 210 pages.

## Chapters

EBDT 2018 Giulio Ermanno Pibiri and Rossano Venturini, *Inverted Index Compression*. 2018. Encyclopedia of Big Data Technologies (EBDT), pages 8.  
DOI: 10.1007/978-3-319-63962-8\_52-1  
ISBN: 9783319639628

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## Software

GitHub profile All software is open-source and available from <https://github.com/jermp>.

## Data Structures

Efficient C++ implementations of the following data structures (see also related publications):

- Inverted Indexes (TOIS 2017, TKDE 2019, WSDM 2019, SIGIR 2020, CSUR 2020)
- Tries (SIGIR 2017, TOIS 2019, TKDE 2020)
- Compressed Bitmaps (DCC 2021)
- Mutable Bitmaps with Rank/Select (INFOSYS 2021)
- Segment-Trees and Fenwick-Trees (SPE 2020)
- Minimal Perfect Hash Functions (SIGIR 2021, TKDE 2023), Locality-Preserving Minimal Perfect Hash Functions (BIOINF 2023)
- $k$ -mer Dictionaries (BIOINF 2022, WABI 2022, ALGOMB 2023, GBIO 2023)
- Colored  $k$ -mer indexes (WABI 2023)

A more detailed list follows below.

- fulgor** Fulgor: A fast and compact  $k$ -mer index for large-scale matching and color queries.  
Reference publication: WABI 2023.
- sshash** SSHAsh: A compressed, weighted, associative, exact dictionary for  $k$ -mers. (See also the membership-only version **sshash-lite**.)  
Reference publication: BIOINF 2022, WABI 2022, ALGOMB 2023, GBIO 2023.
- lphash** LPHash: Fast and compact locality-preserving minimal perfect hashing for  $k$ -mer sets.  
Reference publication: BIOINF 2023.
- pthash** PTHash: Fast and compact minimal perfect hash functions.  
Reference publications: SIGIR 2021, TKDE 2023
- rank\_select** Mutable bitmaps with support for Rank and Select queries.  
Reference publication: INFOSYS 2021.
- psds** A range of tree-shaped data structures for maintaining prefix-sums, including:
  - binary Segment-Tree (top-down and bottom-up),
  - b-ary Segment-Tree,
  - Fenwick-Tree,
  - b-ary Fenwick-Tree,
  - blocked Fenwick-Tree,
  - truncated Fenwick-Tree.Reference publication: SPE 2020.
- autocomplete** Efficient and effective autocompletion framework, based on forward/inverted indexes, succinct RMQ, and string dictionaries (Front-Coding and tries).  
Reference publication: SIGIR 2020.

<b>2i_bench</b>	<p>A benchmarking suite for inverted index data structures, featuring the following compressors:</p> <ul style="list-style-type: none"> <li>o Elias-Fano and partitioned Elias-Fano,</li> <li>o Opt-PFor-Delta,</li> <li>o Binary Interpolative,</li> <li>o QMX,</li> <li>o Simple family,</li> <li>o Variable-Byte family, including Opt-VByte,</li> <li>o Gamma, Delta, Rice, Zeta,</li> <li>o DINT.</li> </ul> <p>Reference publication: CSUR 2020.</p>
<b>interp</b>	An efficient implementation of the Binary Interpolative Coding algorithm.
<b>s_indexes</b>	<p>Compressed bitmap indexes that support fast intersection and union.</p> <p>Reference publication: DCC 2021.</p>
<b>rdf_indexes</b>	<p>Trie-based indexes for semantic data like RDF triples.</p> <p>Reference publication: TKDE 2020.</p>
<b>dint</b>	<p>DINT: fast and compact dictionary-based decoder for inverted lists.</p> <p>Reference publication: WSDM 2019.</p>
<b>opt_vbyte</b>	<p>Optimal partitioning of inverted lists compressed using binary vectors and point-wise encoders, like Variable-Byte.</p> <p>Reference publication: TKDE 2019.</p>
<b>tongrams</b>	<p>Fast language model queries and estimation in compressed space.</p> <p>Reference publications: SIGIR 2017, TOIS 2019.</p>
<b>clustered_indexes</b>	<p>Clustered Elias-Fano inverted indexes.</p> <p>Reference publication: TOIS 2017.</p>

## Miscellanea

<b>essentials</b>	<p>A C++ library providing essential core utilities for data structure design and benchmarking. More precisely:</p> <ul style="list-style-type: none"> <li>o benchmarking facilities, including: messages displaying local time, configurable timer class, function to prevent code elision by compiler, simple creation and printing of json documents;</li> <li>o functions to serialize-to and load-from disk data structures,</li> <li>o functions to compute the number of bytes consumed by data structures,</li> <li>o support for creating, removing, and iterate inside directories,</li> <li>o transparent support for contiguous memory allocation.</li> </ul>
<b>cmd_line</b>	Command line parser for C++17. It offers all handy features in just 150 lines of code.
<b>mm_file</b>	A self-contained, header-only, implementation of memory-mapped files in C++ for both reading and writing.

## Languages

Italian	<b>Native</b>	<i>CEFR level: C2</i>
English	<b>Fluent</b>	<i>CEFR level: C1</i>
2018	<b>TOEFL iBT in English.</b> 100 (HIGH level)	
2008	<b>First Certificate in English (Level B2).</b> University of Cambridge, Cambridge, United Kingdom	