Manuel Ariel **Cáceres Reyes**

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About me

I am a Doctoral Student at University of Helsinki. I work under the supervision of Alexandru I. Tomescu in the Graph Algorithms team, part of the Algorithmic Bioinformatics group at the Department of Computer Science. My research focuses on graph algorithms, algorithmic bioinformatics and compressed data structures. I consider myself a person responsible and devoted to his job. I enjoy learning new skills and I am always in search of new knowledge that I can apply to my job and life.

Education

University of Helsinki — *Helsinki, Finland*

PhD. in Computer Science — *2020 - Now*

- Thesis Working Title: Parameterized and "Safe & Complete" Graph Algorithms for Bioinformatics.

University of Chile — *Santiago, Chile*

MSc. in Computer Science, dual degree program with Computer Science Engineering. — *2012 - 2019*

- Thesis Topic: Compressed Suffix Trees using Block Trees.
  Design and implementation of suffix trees, a data structure widely use in string processing. The structure was adapted to work in compressed space, specially for repetitive inputs. To do so I used and modified Block Trees, a modern data structure capable of capturing the repetitions.

Distinctions & Scholarships

Researcher of the year award for junior researchers, Department of Computer Science, University of Helsinki, Finland — *2021*

Third place in the *Contest of Master Thesis in Computer Science of Latin America* (CLEI 2020), Ecuador — *2020*

Outstanding International Research, Department of Computer Science, University of Chile, Chile — *2019*

Scholarship to cover the 2nd semester of MSc. in Computer Science, University of Chile, Chile — *2018*

Part of the Honor List (top 6% of students), University of Chile, Chile — *2012-2015*

Maximum Score in the National University Selection Test, Mathematics, Chile — *2011*

Publications

- *Chaining of Maximal Exact Matches in Graphs*, Nicola Rizzo, **Manuel Cáceres**, Veli Mäkinen. Submitted to **CPM23**. A preliminary version can be found at `https://arxiv.org/abs/2302.01748`.
- *Parameterized Algorithms for String Matching to DAGs: Funnels and Beyond*, **Manuel Cáceres**. Submitted to **CPM23**. A preliminary version can be found at `https://arxiv.org/abs/2212.07870`.
- *Safety Meets Integer Linear Programming for Flow Decompositions*, Fernando H. C. Dias. **Manuel Cáceres**, Lucia Williams, Brendan Mumey and Alexandru I. Tomescu. Submitted to **Bioinformatics**.
- *Minimum Path Cover in Parameterized Linear Time*, **Manuel Cáceres**, Massimo Cairo, Brendan Mumey, Romeo Rizzi and Alexandru I. Tomescu. Submitted to **SICOMP**. A preliminary version can be found at `https://arxiv.org/abs/2211.09659`.
- *Width Helps and Hinders Splitting Flows*, **Manuel Cáceres**, Massimo Cairo, Andreas Grigorjew, Shahbaz Khan, Brendan Mumey, Romeo Rizzi, Alexandru I. Tomescu and Lucia Williams. Accepted to the *European Symposium on Algorithms (**ESA**) 2022*. A preliminary version can be found at `https://arxiv.org/abs/2207.02136`.
- *Chaining for Accurate Alignment of Erroneous Long Reads to Acyclic Variation Graphs*, Jun Ma, **Manuel Cáceres**, Leena Salmela, Veli Mäkinen and Alexandru I. Tomescu. Submitted to **Bioinformatics**. A preliminary version can be found at `https://doi.org/10.1101/2022.01.07.475257`.
- *Safety and Completeness in Flow Decompositions for RNA Assembly*, Shahbaz Khan, Milla Kortelainen, **Manuel Cáceres**, Lucia Williams and Alexandru I. Tomescu. Accepted to the *International Conference on Research in Computational Molecular Biology (**RECOMB22**)*.
- *Sparsifying, Shrinking and Splicing for Minimum Path Cover in Parameterized Linear Time*, **Manuel Cáceres**, Massimo Cairo, Brendan Mumey, Romeo Rizzi and Alexandru I. Tomescu. Accepted to the *ACM-SIAM Symposium on Discrete Algorithms (**SODA**) 2022*. A preliminary version can be found at `https://arxiv.org/abs/2007.07575`.
- *Safety in multi-assembly via paths appearing in all path covers of a DAG*, **Manuel Cáceres**, Brendan Mumey, Edin Husić, Romeo Rizzi, Massimo Cairo, Kristoffer Sahlin and Alexandru I. Tomescu. Accepted to the *IEEE/ACM Transactions on Computational Biology and Bioinformatics* (**TCBB**).
- *Faster Repetition-Aware Compressed Suffix Trees based on Block Trees*, **Manuel Cáceres** & Gonzalo Navarro. Accepted to the *Information and Computation* (**I&C**). Open Access publication: `https://doi.org/10.1016/j.ic.2021.104749`.
- *A linear-time parameterized algorithm for computing the width of a DAG*, **Manuel Cáceres**, Massimo Cairo, Brendan Mumey, Romeo Rizzi and Alexandru I. Tomescu. Accepted to the *International Workshop on Graph-Theoretic Concepts in Computer Science* (**WG**) 2021. A preliminary version can be found at `https://arxiv.org/abs/2007.07575`.
- *Block Trees*, Djamal Belazzougui, **Manuel Cáceres**, Travis Gagie, Pawel Gawrychowski, Juha Kärkkäinen, Gonzalo Navarro, Alberto Ordóñez, Simon J. Puglisi, and Yasuo Tabei. Accepted to the *Journal of Computer and System Sciences* (**JCSS**) 2021. A preliminary version can be found at `https://me.ariel.computer/files/jcss20.pdf`.
- *Fast Indexes for Gapped Pattern Matching*, **Manuel Cáceres**, Simon J. Puglisi and Bella Zhukova. Accepted to the *International Conference on Current Trends in Theory and Practice of Informatics* (**SOFSEM**) 2020 conference. A preliminary version can be found at `https://arxiv.org/abs/2002.12662`.
- *Faster Repetition-Aware Compressed Suffix Trees based on Block Trees*, **Manuel Cáceres** and Gonzalo Navarro. Accepted to the *String Processing and Information Retrieval* (**SPIRE**) 2019 conference. A preliminary version can be found at `https://arxiv.org/abs/1902.03274`.

Research visits & Presentations

- Talk "Minimum Path Cover in Parameterized Linear Time" at the Helsinki CS Theory Seminar, 2023, Finland.
- Talk "Parameterized Linear Time String Matching to DAGs: Funnels and Beyond" at University of Venice, 2022, Italy.
- Research visit (2 weeks, 2022) at University of Venice, Italy. During the visit I worked with Professor Nicola Prezza and his research group on the development of new algorithms for computing the smallest-width co-lexicographic order of finite state automata.
- Talk "Parameterized Linear Time String Matching to DAGs: Funnels and Beyond" in the *Workshop on Compression, Text, and Algorithms* (WCTA) 2022, Concepción, Chile.
- Talk "Chaining for Accurate Alignment of Erroneous Long Reads to Acyclic Variation Graphs" in the *Workshop Data Structures in Bioinformatics* (DSB) 2022, Düsseldorf, Germany.
- Talk 'A linear-time parameterized algorithm for computing the width of a DAG" in the *International Workshop on Graph-Theoretic Concepts in Computer Science* (WG) 2021, Warsaw, Poland.
- Talk "Safety in multi-assembly via paths appearing in all path covers of a DAG" in the *Workshop Data Structures in Bioinformatics* (DSB) 2021, Milano, Italy.
- Talk "Faster Minimum Path Covers of dense DAGs of small width" in the *Bioinformatics Research and Education Workshop* (BREW) 2020, Tartu, Estonia.
- Talk of my master thesis results in the *X Workshop CeBiB – Biotechnology, Metabolic Engineering, Bioinformatics, and Important Applications* 2019, Santiago, Chile.
- Talk of my master thesis work to the research group: *Database Laboratory* (2018) of the University of A Coruña, Coruña, Spain.
- Research stay (2018, one month) at University of A Coruña, Coruña, Spain, granted by the BIRDS project. During the stay I worked with PhD. student Adrián Gómez on mt master thesis chapter: *Compression of Repetitive Differential Arrays*.
- Talk of my master thesis work to the research group: *Genome Scale Algorithmics* (2018) of the University of Helsinki, Helsinki, Finland.
- Research stay (2018, two months) at University of Helsinki, Helsinki, Finland granted by the BIRDS project. During the stay I worked with Associate Professor Simon Puglisi and PhD. student Bella Zhukova on the problem *Variable-Length Pattern Matching*.
- Poster presentation of my master thesis proposal on the *VIII Workshop CeBiB – Biotechnology, Metabolic Engineering, Bioinformatics, and Important Applications* 2018, Santiago, Chile.

Teaching

University of Helsinki *Helsinki, Finland*

Lecturer *2023-Now*

- Undergraduate course *Models of Computation*. I prepared and taught the final two lectures on Computational Complexity, and helped preparing and grading the exam.

University of Helsinki *Helsinki, Finland*

Teaching Assistant *2020-Now*

- Depending on the course I prepared and presented model solutions to typical problems, graded exams, exercises and assignments, guided students with their projects or assignments, and took exams of the following graduate level courses:
  - *Elements of Bioinformatics.*
  - *Design and Analysis of Algorithms.*

University of Chile *Santiago, Chile*

Lecturer *2019*

- Undergraduate course *Computer Tools for Engineering & Science*, including text processors, spreadsheets, Matlab, R, Maple and basic Python. I prepared and taught classes and helped students with in-class exercises.

University of Chile *Santiago, Chile*

Teaching Assistant *2014 - 2018*

- Depending on the course I prepared and presented model solutions to typical problems, graded exams, exercises and assignments, guided students with their projects or assignments, and took exams of the following graduate and undergraduate level courses:
  - *Design and Analysis of Algorithms.*
  - *Algorithms and Data Structures.*
  - *Theory of computation.*
  - *Advanced Analysis of Algorithms.*
  - *Computer Tools for Engineering & Science.*
  - *Introduction to Programming.*
  - *Development of Software for Lego Robots.*

Service

- Subreferee of the *ACM Journal of Experimental Algorithmics* (**JEA**), in 2023.
- Subreferee of the *SIAM Symposium on Algorithm Engineering and Experiments* (**ALENEX**) 2023.
- Subreferee of the *ACM-SIAM Symposium on Discrete Algorithms* (**SODA**) 2023.
- Co-supervision of summer intern "Santeri Toivonen" in project *Practical Minimum Path Cover*, 2022.
- Subreferee of the *International Symposium on Mathematical Foundations of Computer Science* (**MFCS**) 2022.
- Subreferee of the *Symposium on Experimental Algorithms* (**SEA**) 2022.
- Subreferee of the *Data Compression Conference* (**DCC**) 2022.
- Co-supervision of master thesis "Co-Linear Chaining on Graphs with Cycles", Jun Ma, University of Helsinki, graduated 2021 (co-supervision with Alexandru I. Tomescu).
- Co-supervision of summer intern "Juho Kesälä" in project *Random path in a DAG*, 2021.
- Co-supervision of summer intern "Milla Kortalainen" in project *Safe and Complete paths for flow decompositions*, 2021.
- Subreferee of the *Workshop on Algorithms in Bioinformatics* (**WABI**) 2021.
- Subreferee of the *International Conference on Research in Computational Molecular Biology* (**RECOMB**) 2021.
- Subreferee of the *Data Compression Conference* (**DCC**) 2021.
- Subreferee of the *Workshop on Algorithms in Bioinformatics* (**WABI**) 2020.
- Reviewer of the *Bioinformatics Research and Education Workshop* (**BREW**) 2020.
- Subreferee of the *SIAM Symposium on Algorithm Engineering and Experiments* (**ALENEX**) 2020.
- Subreferee of the *Theoretical Computer Science* (**TCS**) journal, in 2019.
- Subreferee of the *European Symposia on Algorithms* (**ESA**) 2018 track B.

Other Professional Experience

SimpliRoute *Santiago, Chile*

Full-Stack Developer *2019*

- Develop new features, optimize features, detect and fix bugs of the mobile and web apps "SimpliRoute" `www.simpliroute.com`, *the number one software of logistic intelligence in Latin America*.

Adereso *Santiago, Chile*

Full-Stack Developer *2019*

- Develop new features, optimize features, detect and fix bugs of the web app "PostCenter" `www.postcenter.io`, which centralizes and optimizes customer support of companies.

NIC Labs Chile *Santiago, Chile*

Research Internships *2014, 2015*

- Development of a stream processor of DNS packets in the context of the paper "Real Time Analytics on DNS (RaTA-DNS)", `https://doi.org/10.1109/TLA.2016.7555282`.
- Conformity tests for the crypographic standard PKCS#11 in the context of the paper "Poor Man's Hardware Security Module (pmHSM): A Threshold Cryptographic Backend for DNSSEC", `https://doi.org/10.1145/2998373.2998452`.