

Giovanni Barbarino

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EXECUTIVE SUMMARY Postdoc researcher in Mathematics at UMONS, Faculté Polytechnique, Mathematics and Operational Research Unit. Twenty published articles and eleven preprints. Advanced knowledge of linear algebra, optimization methods for matrix factorization, clustering methods for community detection, perturbation theory on matrices, asymptotic symbols for matrix sequences, analysis of structured linear systems, spectral theory of random matrices and signal processing, acquired during work for master degree, Ph.D. and research activity.

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**WEB OF SCIENCE
RESEARCHERID** P-2201-2019

EDUCATION AND RESEARCH

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- 2023 – present **Postdoc Researcher in Mathematics at UMONS**,
Faculté Polytechnique de Mons,
Mathematics and Operational Research Unit.
- 2020 – 2023 **Postdoc Researcher in Mathematics at Aalto University, Helsinki**.
Department of Mathematics and Systems Analysis.
- 2016 – 2020 **Ph.D. in Mathematics at Scuola Normale Superiore, Pisa**.
Thesis: *Spectral symbols for matrix sequences*,
Advisor Prof. Stefano Serra-Capizzano, co-Advisor prof. Michele Benzi.
- 2011 – 2016 **Master Degree at Scuola Normale Superiore, Pisa**.
4th year colloquium: Quasi-Birth and Death Stochastic Processes with an infinite number of phases: asymptotic decay properties,
Advisor Prof. Beatrice Meini.
- 2014 – 2016 **Master Degree in Mathematics at University of Pisa**.
Thesis: *Nonnegative Matrix Factorization: Theory with an application to translations invariant image processing*,
Advisor Prof. Luca Gemignani, Co-advisor Prof. Luca Romani
Final grade: 110/110 with honours.
- 2011 – 2014 **Bachelor Degree in Mathematics at University of Pisa**.
Expander Graphs: Spectral Properties and Applications,
Advisors Prof. Dario Andrea Bini
Final grade: 110/110 with honours.

GRANTS AND FUNDS

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- Sep 2023 – present Supported by the ERC consolidator grant no. 101085607, European Union
Project: *Beyond Low-Rank Factorizations (eLinoR)*

- Jun 2023 Conference Support for Foundations of Computational Mathematics FoCM in Paris.
- Jun 2023 ILAS LAA Early Career Award, Early Career Speakers for the 25th ILAS Conference.
- Feb 2022 – Jan 2023 Grant awarded by Alfred Kordelinin säätiö, Finland, no. 210122, as the PI of the Project *Decorrelation Methods for Multi-Input Nonstationary Signals*.
- Oct 2016 – Feb 2020 Scholarship at Scuola Normale Superiore - PhD
- Sep 2011 – Oct 2016 Scholarship at Scuola Normale Superiore - Bachelor and Master Degree

PUBLICATIONS

- Jun 2024 *Extension and convergence analysis of Iterative Filtering to spherical data*, j/w Roberto Cavassi, Antonio Cicone, Linear Algebra and its Applications.
- Apr 2024 *On Properties and Structure of the Analytic Singular Value Decomposition* j/w John G. McWhirter, Jennifer Pestana, Ian Proudler, Stephan Weiss, IEEE Transactions on Signal Processing.
- Mar 2024 *On the periodicity of singular vectors and the holomorphic block-circulant SVD on the unit circumference*, Linear Algebra and its Applications.
- Jan 2024 *Stabilization and Variations to the ALIF Algorithm: the Fast Resampled Iterative Filtering Method* j/w Antonio Cicone, Numerische Mathematik.
- Sep 2023 *On the Rellich eigendecomposition of para-Hermitian matrices and the sign characteristics of $*$ -palindromic matrix polynomials* j/w Vanni Noferini, Linear Algebra and its Applications.
- Aug 2023 *An extension of the theory of GLT sequences: sampling on asymptotically uniform grids*, j/w Carlo Garoni, Linear and Multilinear Algebra.
- Nov 2022 *Role extraction for digraphs via neighborhood pattern similarity* j/w Paul Van Dooren and Vanni Noferini, Physical Review E.
- Aug 2022 *Conjectures on spectral properties of ALIF algorithm*, j/w Antonio Cicone, Linear Algebra and Its Applications.
- Jun 2022 *Rectangular GLT sequences* j/w Carlo Garoni, Mariarosa Mazza, Stefano Serra-Capizzano, Electronic Transactions on Numerical Analysis.
- Feb 2022 *The limit empirical spectral distribution of Gaussian monic complex matrix polynomials*, j/w Vanni Noferini, Journal of Theoretical Probability.
- Dec 2021 *Constructive approach to the monotone rearrangement of functions*. j/w Davide Bianchi and Carlo Garoni, Expositiones Mathematicae.
- Sep 2021 *The limit empirical spectral distribution of complex matrix polynomials*, j/w Vanni Noferini, Random Matrices: Theory and Applications.
- Sep 2021 *A systematic approach to reduced GLT*, BIT Numerical Mathematics
- Mar 2020 *Non-Hermitian perturbations of Hermitian matrix-sequences and applications to the spectral analysis of the numerical approximation of partial differential equations*, j/w Stefano Serra-Capizzano, Numerical Linear Algebra with Applications.
- Jan 2020 *Block Generalized Locally Toeplitz Sequences: Theory and Applications in the Multidimensional Case* j/w Stefano Serra-Capizzano and Carlo Garoni, Electronic transactions on numerical analysis.
- Jan 2020 *Block Generalized Locally Toeplitz Sequences: Theory and Applications in the Unidimensional Case* j/w Stefano Serra-Capizzano and Carlo Garoni, Electronic transactions on numerical analysis.
- Feb 2019 *Spectral Measures*, Proceedings of Cortona Meeting, Springer INdAM Series.
- Dec 2017 *From convergence in measure to convergence of matrix-sequences through concave functions and singular values*, j/w Carlo Garoni, Electronic Journal of Linear Algebra.
- Sep 2017 *Equivalence between GLT sequences and measurable functions*, Linear Algebra and its Applications.

Dic 2016 *Grafi Expanders: Proprietà Spettrali e Applicazioni*, Edizioni Accademiche Italiane.

PREPRINTS

- Mar 2024 *Dual Simplex Volume Maximization for Simplex-Structured Matrix Factorization*, j/w Maryam Abdolali, Nicolas Gillis.
- Jan 2024 *Normal form for GLT sequences, functions of normal GLT sequences, and spectral distribution of perturbed normal matrices*, j/w Carlo Garoni.
- Dec 2023 *Spectral properties of flipped Toeplitz matrices*, j/w Sven-Erik Ekström, Carlo Garoni, David Meadon, Stefano Serra-Capizzano, Paris Vassalos.
- Sep 2023 *From asymptotic distribution and vague convergence to uniform convergence, with numerical applications*, j/w Sven-Erik Ekström, Carlo Garoni, David Meadon, Stefano Serra-Capizzano, Paris Vassalos.
- Aug 2023 *Ergodic Estimations for Toeplitz Sequences Generated by a Symbol*.
- Jul 2022 *Theoretical results for eigenvalues, singular values, and eigenvectors of (flipped) Toeplitz matrices and related computational proposals*, j/w Sven-Erik Ekström, Stefano Serra-Capizzano, Paris Vassalos.
- Aug 2021 *Matrix-less eigensolver for large structured matrices* j/w Melker Claesson, Sven-Erik Ekström, Carlo Garoni, David Meadon, Technical Report, Uppsala University.
- Jul 2018 *Notes on asymptotic eigenvalues distribution on complex circles*.
- Aug 2018 *Conjectures on Perturbations of Hermitian Sequences*.
- Oct 2017 *Diagonal Matrix Sequences and their Spectral Symbols*.
- Aug 2016 *Permutation NMF*.

COLLABORATIONS AND RESEARCH GROUPS

- Feb 2024 – Present Collaboration with Professor David Sossa of Universidad de O'Higgins, Rancagua, Chile, on the topic "Critical Angles between Convex Cones".
- Jul 2023 – Present Member of the Research Group of Professor Nicolas Gillis, Mons University, Mons, on the ERC funded Project "Beyond Low-Rank Factorizations (eLinoR)".
- Gen 2023 – Mar 2024 Collaboration with Strathclyde University on the Project "Decorrelation Methods for Multi-Input Nonstationary Signals" of which I am the PI.
- Sep 2020 – Present Collaboration with L'Aquila University on the Project "Decorrelation Methods for Multi-Input Nonstationary Signals" of which I am the PI.
- Sep 2019 – Jun 2023 Member of the Research Group of Professor Vanni Noferini, Aalto University, Helsinki, on the topic "Non-backtracking Centrality Measures and Beyond".
- Feb 2017 – Present Member of the Research Group of Professor Stefano Serra-Capizzano, Insubria University, Como, on the topic "GLT Symbols for Matrix Sequences".
- Oct 2016 Collaboration with Perugia University on the topic "Geometric Means for Matrix Sequences".

TALKS AND PRESENTATIONS

- Sep 2024 *Computational Complexity for Maximal Angle Chasing between Convex Cones* - Invited Speaker at Workshop on Conic Optimization and Euclidean Jordan Algebras (Rancagua).
- Jun 2024 *Dual Simplex Volume Maximization for Simplex-Structured Matrix Factorization* - 8th Alama Meeting: Linear Algebra, Matrix Analysis and Applications (Gijón).
- May 2024 *Ergodic Estimations for Toeplitz Sequences* - SIAM Conference on Applied Linear Algebra LA24 (Paris).

- Sep 2023 *The Fast Resampled Iterative Filtering Method* - XXII Congresso dell'Unione Matematica Italiana (Pisa).
- Jun 2023 *Role Extraction for Digraphs via Neighbourhood Pattern Similarity* - Invited Speaker at Foundations of Computational Mathematics FoCM (Paris).
- Jun 2023 *On the eigendecomposition of para-Hermitian matrices* - 25th Conference of the International Linear Algebra Society ILAS (Madrid).
- May 2023 *New stability results for IF Methods* - Invited Speaker at Mathematics for Signal processing and Applications in Geophysics and other fields MaSAG23 (Rome).
- May 2023 *Reduced GLT and Applications* - Numerical Linear Algebra Days (L'Aquila).
- Feb 2023 *On the Rellich eigendecomposition of para-Hermitian matrices on the unit circle* - Online SEminar on Linear algebra and Operator Theory OSELOT, online
- Jun 2022 *Approximation of the Laplace-Beltrami operator by its symbol* - Linear Algebra, Matrix Analysis, and Applications j/w Due giorni di Algebra Lineare Numerica (Alcalá de Henares).
- Apr 2022 *The limit empirical spectral distribution of complex matrix polynomials* - Nordic numerical linear algebra meeting 2022 (Helsinki).
- Jul 2021 *Iterative Filtering Algorithms* - Invited Speaker at Mathematics for Nonstationary Signals and applications in Geophysics and other fields (L'Aquila).
- Nov 2020 *The limit empirical spectral distribution of complex matrix polynomials* - Communications in NLA, online.
- Oct 2019 *Symbols for matrix-sequences: Application-Driven Structure* - University of Aalto.
- Nov 2018 *Higher order spectral symbols and eigenvalues approximation for Toeplitz matrices* - University of Pisa.
- Feb 2018 *Perturbations of Hermitian Matrices and Applications to Spectral Symbols* - Two days of Linear Algebra and Applications (Padua).
- Oct 2017 *Generalized Locally Toeplitz Sequences: a Link between Measurable Functions and Spectral Symbols and Ordering the Eigenvalues: GLT Symbols and Spectral Measures* - Invited Speaker at University of Insubria, Como.
- Sep 2017 *Equivalence between GLT sequences and measurable functions* - INdAM Meeting Structured Matrices in Numerical Linear Algebra: Analysis, Algorithms and Applications (Cortona).
- Jul 2017 *Equivalence between GLT sequences and measurable functions* - CIME-EMS Summer School on Splines and PDEs (Cetraro).
- Aug 2016 *Permutation NMF* - Rome-Moscow Summer School.

OTHER CONFERENCES AND SCHOOLS

- Feb 2019 Two days of Linear Algebra and Applications (Rome).
- Jan 2019 Intelligent Machines and Mathematics (Bologna).
- Feb 2018 GNCS Indam Assembly (Montecatini).
- Sep 2017 INdAM Meeting Structured Matrices in Numerical Linear Algebra: Analysis, Algorithms and Applications (Cortona).
- Jul 2017 FoMICS Summer school, (Lugano).
- Feb 2017 Two days of Linear Algebra (Como).
- Jul 2011 *International Mathematical Summer School* for talented students in their last two years of high school. The program featured plenary talks and mini-courses by leading international mathematicians at Jacobs University.

TEACHING AND VISITING

- 2024 Teacher for the Doctoral Course "Topics in Low Rank Factorization and Data Analysis" at the University of Insubria. Length: 20h
- 2023 TA for the Master/Doctoral Course "Models and Methods in Data Science" at the University of Mons. Length: 12h
- 2022 – 2024 Co-advisor for Bachelor Thesis. Reviewer and Commission Member for Master Thesis.
- 2020 TA for the Master/Doctoral Course "Combinatorial Network Analysis" at Aalto University. Length: 12h
- 2019 – 2020 Visiting PhD at Department of Mathematics and Systems Analysis, Aalto University, Helsinki, Finland, 09/09/2019-09/02/2020 Host: Prof. Vanni Noferini.
- 2017 – 2019 Teacher at Stages of preparation for Mathematics Olympiad for UMI. I have taught kids from 13 to 19 years old and I have held lessons for high school teachers.
- 2017/2018 Visiting to University of Insubria, Department of Science and High Technology, Como, Italy, 22/10/2017-25/10/2017, 10/11/2017-15/11/2017, 11/12/2017-20/12/2017, 25/09/2018-06/10/2018. Host: Prof. Stefano Serra-Capizzano.
- 2016 Visiting to University of Perugia, Department of Mathematics and Computer Science, Perugia, Italy, 20/10/2016-22/10/2016. Host: Prof. Bruno Iannazzo.
- 2016 – 2017 Tutor, Scuola Normale Superiore, Pisa. I have tutored students in their first year of university.

REFEREE WORK AND MEMBERSHIPS

Reviewer at ZbMATH (Zentralblatt MATH), MathSciNet and for scientific journals:

Applied and Computational Harmonic Analysis
Linear and Multilinear Algebra
Electronic Journal of Linear Algebra
Applied Mathematics and Computation
Journal of Mathematics
Mathematical Methods in the Applied Sciences
BIT Numerical Mathematics
SIAM Journal on Matrix Analysis and Applications (SIMAX)

- 2023 – present Member of International Linear Algebra Society (ILAS).
- 2023 – present Member of Unione Matematica Italiana (UMI).
- 2019 – present Member of SIAG on Linear Algebra (SIAM).
- 2018 – present Member of GNCS Indam (Italian Scientific Computing National Group).
- 2011 – present Organizer of National Mathematics Olympiad for UMI.
Preparation and evaluation of tests at several levels (local and national).

PERSONAL SKILLS

- Languages Italian: mother tongue.
English: advanced (C1).
French: medium (B1).
- Computer skills - software development (Phyton, C/C++, OCaml, Qtcreator, Javascript);
- website development (HTML, CSS, Wordpress);
- mathematical software (Mathematica, MATLAB, Octave, Singular, CoCoA, Fortran);
- document preparation, especially for scientific works (LaTeX, Word, Excel, Jupyter).

PERSONAL INTERESTS

2015 – present I'm interested in developing software for artificial intelligence.

Sports I am a swimmer and an amateur chess player.

Awards – Italian Mathematical Olympiad, Gold medal (2009 and 2011), Silver medal (2008 and 2010).

– Kangaroo (mathematical italian competition), First place (2009).

– Mathematical Games of Bocconi (mathematical italian competition), First place(2010), Third place(2009).

– "Albo Nazionale delle Eccellenze - Albo dei Diplomati con 100 e lode": National registry for perfect mark 100/100 with honours in high school.

– "Albo Nazionale delle Eccellenze - Albo dei Premiati in competizioni": National registry for prizes in 12 mathematics, physics and computer science competitions .