

Laura Selicato

Curriculum Vitae et Studiorum

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Ph.D. in Mathematics, University of Bari Aldo Moro.

Personal Info

Name Laura
Surname Selicato
Place and date of birth Conversano (BA), Italy 13/07/1991
Nationality Italian
Sex Female

Education

26 Oct 2023 **Doctor of Philosophy in Mathematics certified by Doctor Europaeus**, University of Bari Aldo Moro, Bari.

I obtained the title of Ph.D. in Computer Science and Mathematics (Mathematics Curriculum) at the University of Bari Aldo Moro. My research project, placed within the Numerical Analysis context, focused on the study of hyperparameter optimization in learning low-rank approximation techniques (SSD MAT/08). I took the final exam in English, during which I discussed my thesis entitled: "Bi-level optimization for hyperparameters tuning in sparse low-rank learning algorithms". During my doctorate, I carried out a research period abroad in Poland (for details please refer to the Visiting Positions section). Most of the results of my thesis have been published in journals and conference proceedings (for details please refer to the Publications section).

11 July 2019 **Master's Degree**, University of Bari Aldo Moro, Bari.

The experimental thesis work, entitled **Low Rank Approximation Methods for Indoor Positioning**, was carried out following an internship at the Indoor Positioning Nextome company. The skills acquired are in the field of data analysis and optimization, filtering and analysis techniques electromagnetic signal noise.

14 July 2016 **Bachelor's Degree**, University of Bari Aldo Moro, Bari.

The thesis work, entitled **Computational Logic and ProLog: an application in the real world**, has been developed in computational logic and natural language, with study of Clarissa software (NASA Ames).

Work Experience

Sep 2023 - ongoing **Research fellow at the Consiglio Nazionale delle Ricerche (CNR)**.

I'm a research fellow at the CNR - Istituto di Ricerca Sulle Acque (IRSA) and I deal with solving optimization problems related to water distribution systems and related to multi-objective optimization as decision support.

Oct 2019-May 2023 **Ph.D. student.**

in Computer Science and Mathematics at the University of Bari Aldo Moro, of the XXXV cycle students.

September 1-18, 2020 **Alumni Science Camp.**

Teaching activity in the Summer camp organized by Alumni Mathematica for children from 8-11 years old, to intruce them into a the knowledge of STEM disciplines.

Jan-May 2020 **Mathematics tutor at Department of Pharmacology.**

Supplementary teaching activity in maths for the course of "Pharmacy, drug sciences" at the University of Bari Aldo Moro

Mar-Nov 2018 **Internship Activities.**

at the Nextome Company. (For details see section 'Research Activity')

From Oct 2016 **Didactic support for the preparation of university maths exams.**

Support in the preparation of Linear Algebra exams, Mathematics Discrete, Mathematical Statistics, and Mathematical Analysis.

Membership to Scientific Groups

From June 2020 to today **Member of PRIMO Research Group.**

Post Graduate Researchers in Inverse problems, Machine Learning and Optimization, <https://primomath.wordpress.com>

From February 2020 to today **Member of GNCS Indam Group.**

Gruppo Nazionale per il Calcolo Scientifico, subgroup of Istituto di Alta Matematica

From July 2019 to today **Member of ALUMNI MATHEMATICA.**

With the intention of being an increasingly important figure within the association, after joined the association in 2019 I became member of the board of directors (I have been entitled vice-president since the 2021). In particular we organize workshops, summer school, courses on various programming languages (Python, Java, Android ...) and events to bring Mathematics, Logic and the scientific method into society, to link people to science.

Corses and School

From January 31 to February 25, 2022 **MIVA PhD winter school "Advanced mathematical models for image analysis", Online.**

I have been selected to attended this school organized by the UMI MIVA direction committee.

September 6-10, 2021 **Recent stability issues for linear dynamical systems. Matrix nearness problems and eigenvalue optimization (CIME) - Summer School, Cetraro Marina.**

I got a full grant to attended the school organized by Centro Internazionale Matematico Estivo CIME, taught by Nicolas Gillis, Michael Overton, Bart Vandereycken, Nicola Guglielmi and Christian Lubich

June 21-25, 2021 **Regularization Methods for Machine Learning, Online.**

I have been selected to attended this school organized by Lorenzo Rosasco, within the PhD Program in Computer Science of the University of Genova and the MaLGa (Machine Learning Genova Center) group

From June 10 to July 7, 2021 **Stochastic Models for Complex Systems, Università di Salerno - Online.**

I have been selected to attended this school taught by Enrico Scalas, Yuliia Mishura and Jorge Navarro

- From May 4 to June 3, 2021 **Data Science: an algorithmic approach**, *Università degli Studi della Campania "Luigi Vanvitelli" Dipartimento di Matematica e Fisica*.
I have been selected to attend this school held by Erkki Somersalo, within the PhD Program in Mathematics, Physics and Applications to Engineering, supported by Indam.
- From October 2 to November 6, 2020 **Moxoff Academy**, *Politecnico di Milano - Italy*.
I got a full grant to attend the Moxoff Academy. This school is a technical-scientific specialization course in the field of applied mathematics and data science in which mathematical modeling and numerical computation are mixed with data intelligence and software engineering.
- January 27 - 31, 2020 **Mathematics for Engineering Applications - Winter School**, *Politecnico di Bari, Dipartimento di Meccanica, Matematica e Management - Italy*.
I participated to this school on Application of Mathematics to Engineering, in particular to Cryptography, Electronics, Mechanics, Robotics.
- July 15 - 19, 2019 **Summer School: Mathematical Methods in Data Science - MMDS 2019**.
Active participation and in-depth analysis of the following topics: Exploratory data analysis, Clustering, PCA and SVD, Bayesian Statistics and Networks Neural.
- From May to July, 2019 **24 CFU course for teaching**.
- From March to June, 2019 **Machine Learning Meetup**.
Participation in various machine learning meetups, organized by Alumni Mathematica in collaboration with the Italian Association for Machine Learning and Sprint Lab.
- July 16 - 20, 2018 **Summer School: Mathematical Methods in Data Science - MMDS 2018**.
Active participation and in-depth analysis of the following topics: Exploratory data analysis, Clustering, PCA and SVD, Bayesian Statistics and Networks Neural.

Languages

- Italian **Mother tongue**.
- English **Intermediate**.
Communication skills of the English language corresponding to level B2.
- Spanish **Basic**.
Communication skills of the Spanish language corresponding to level A2.

Computer skills

- Advanced **operating system Microsoft Windows and application Microsoft office**.
- Advanced **Matlab, R, and LaTeX**.
- Intermediate **Python**.

Visiting Position

- September 2021-December 2021 **Visiting PhD student at Wroclaw University of Science and Technology, Poland**.
I have been a visiting student at Wroclaw University of Science and Technology from September 15, 2021 to December 18, 2021, working under the supervision of Professor Rafał Zdunek at the Department of Field Theory, Electronic Circuits, and Optoelectronic. I worked on the improvement of a framework, then published (see Publications section), for the optimization of penalty hyperparameters in nonnegative matrix factorizations.

Honors and Awards

- Scholarship winner **Moxoff Academy, Milano.**
Winner of one of the 10 scholarships
- Ranked 2th **Data Analysis competition on the occasion of the 200th anniversary of the birth of Florence Nightingale, Spain.**
Competition organized by the Rladies Spain group, in collaboration with the Spanish Biometric Society and the Catalan Statistical Society
- Ranked 1th **Soroptimist Club degree Award, Bari.**
best Master's thesis in Mathematics, containing results to promote Mathematical Sciences and their applications
- Ranked 3th **Doctorate with scholarship, Bari.**

Teaching Activities

- From November 2020 to December 2020 **Intensive remedial course.**
I taught basic mathematics to prepare students who want to access the Computer Science degree at the University of Bari Aldo Moro, teaching Real Analysis and Logic.
- September 1-18 2020 **Alumni Science Camp.**
Summer camp organized by Alumni Mathematica for children from 8-11 years old to introduce them into a knowledge of STEM disciplines
- From December 2019 to May 2020 **Mathematics tutor at Department of Pharmacology.**
I was the tutor of students for the bachelor's degree in Pharmacology and Drugs Science teaching Real Analysis (function study, limits, ode).
- From October 2019 to November 2019 **Intensive remedial course.**
I taught basic mathematics to prepare students who want to access the Computer Science degree at the University of Bari Aldo Moro, teaching Real Analysis and Logic.
- [Reviewer activity](#)
- From 2021 **Reviewer for journals:**
- Nature Lecture Notes in Computer Science (LNCS).
 - Heliyon Journal

Conference and Workshop

Works Presented

- 20-22 Sep 2023 **PRIMO (Post-graduate Researchers in Inverse Problems, Machine Learning, and Optimization) Poster, Bari.**
I presented a poster titled: "Penalty Hyperparameters Optimization in Nonnegative Matrix Factorization problems".
- 26 May 2023 **PRIMO (Post-graduate Researchers in Inverse Problems, Machine Learning, and Optimization) Talks, Online.**
I presented a talk titled: "Optimization of Penalty Hyperparameters".
- 6 - 8 Sep 2022 **PRIMO (Post-graduate Researchers in Inverse Problems, Machine Learning, and Optimization) Workshop, Trieste.**
I presented a talk titled: "Optimization of Penalty Hyperparameters in Factorization problems", during the workshop.
- 7-10 June 2022 **SDS2022 meeting - Structural Dynamical Systems: Computational Aspects, Rosa Marina, Ostuni.**
I presented a light talk titled: "Penalty Hyperparameters Optimization in Non-negative Matrix Factorization problems", during the conference.

- 11–13 May 2022 **Numerical Methods for Compression and Learning**, GSSI, L'Aquila.
I presented a poster titled: "Optimization of Penalty Hyperparameters in Non-negative Matrix Factorization problems", during the Numerical Methods for Compression and Learning conference.
- 4-8 Oct 2021 **LOD The Seventh International Conference on Machine Learning, Optimization, and Data Science**, Grasmere, Lake District, UK.
I presented a work titled: "Toward a new approach for tuning regularization hyperparameter in NMF", during the International Conference on Machine Learning, Optimization, and Data Science. (partially held online cause the Covid19 pandemic).
- 11-14 July 2021 **The 31st European Conference on Operational Research (EURO 2021)**, University of West Attica - Atene.
I have been invited to present a work titled: "The Hyperparameter Optimization Problem in Matrix Factorization" during the 31st European Conference on Operational Research.
- 26 Feb 2021 **Graduate Inter-university Math (GIM) Seminars**.
I have been invited to present a seminar titled: Hyperparameters Optimization in Learning Approaches, organized by a group of Italian PhD students. (held online cause the Covid19 pandemic).
- 11-13 Feb 2021 **BIOINFORMATICS 2021 – 12th International Conference on Bioinformatics Models, Methods and Algorithms**.
I presented a poster titled: "Anomalies Detection in gene expression matrices: towards a new approach" during the 12th International Conference on Bioinformatics Models, Methods and Algorithms. I was also invited to chair one session. (held online cause the Covid19 pandemic).
- 23 Dec 2020 **X-maths Workshop**, University of Bari Aldo Moro, Department of Mathematics.
I have been invited to present a seminar titled: "Methods for Hyperparameters Optimization in Learning Approaches: an overview", organized by the PhD students of the department of Mathematics. (held online cause the Covid19 pandemic).
- 19 - 23 Jul 2020 **LOD The Sixth International Conference on Machine Learning, Optimization, and Data Science**, Certosa di Pontignano, Siena – Tuscany, Italy.
I presented the work titled: "Methods for Hyperparameters Optimization in Learning Approaches: an overview", during the International Conference on Machine Learning, Optimization, and Data Science. (partially held online cause the Covid19 pandemic).
- 18 Oct 2019 **Machine Learning Meetup**.
I have been invited to present the work "Low Rank Approximation methods for indoor positioning", organized by Alumni Mathematica in collaboration with the Italian Association for Machine Learning and Sprint Lab.
- [Congress Participation](#)
- 30 March 2023 **L'intelligenza artificiale a tutela della salute in età pediatrica-implementazione di una piattaforma digitale per il design di farmaci pediatrici sicuri**, Aula Leogrande, Centro Polifunzionale Studenti, Bari.
- 27-29 June 2022 **Convegno e Assemblea GNCS**, Montecatini Terme.
- 6-8 April 2022 **Calcolo Scientifico e Modelli Matematici**, Sala Convegni CNR.
- 28 May 2021 **Giornata INdAM delle Unità di Bari "Matematica e Industria con lo sguardo della professoressa Rosa Maria Mininni"**.
Event organized by the two INdAM research units of the Università degli Studi di Bari Aldo Moro and of the Politecnico of Bari (held online cause the Covid19 pandemic).

- 3-7 Aug 2020 **Bath Symposium on the mathematics of Machine Learning**, *University of Bath*.
Conference organized by Philip Aston, Matthias Ehrhardt, Catherine Higham, and Clarice Poon (partially held online cause the Covid19 pandemic)

Events Organized

- Sep 20-21, 2023 **Post-graduate Researchers in Inverse Problems, Machine Learning, and Optimization (PRIMO) Workshop**.
I'm on the organizing committee of the third edition of this workshop held in Bari. (See our web page).
- Dec 21-22, 2022 **X-Maths Workshop 2022**.
I organized this workshop with my colleagues at the Department of Mathematics of the University of Bari Aldo Moro, Italy. The workshop was economically supported by INDAM (GNAMPA). (See our web page).
- Mar 14, 2022 **Machine Learning Meetup**.
Seminar organized by Alumni Mathematica entitled "Computer Quantistici e Complessità", held by Saverio Pascazio at the Department of Mathematics of University of Bari Aldo Moro, Italy.
- Dec 21-22, 2021 **X-Maths Workshop 2021**.
I organized this workshop with my colleagues at the Department of Mathematics of University of Bari Aldo Moro, Italy. The workshop was economically supported by INDAM (GNFM). (See our web page)
- June-Sep, 2021 **Alumni Science Camp-second edition**.
Summer camp organized by Alumni Mathematica for children from 8-11 years old to introduce them to a knowledge of STEM disciplines.

Research Activity

- Ongoing: From Sep 2023 **Multi-objective Optimization**.
This research arises from the problem of decision support in the context in which multiple sectors must communicate with each other to maximize results.
- Ongoing: From Sep 2023 **Topological Data Analysis**.
This research focuses on the use of the topological data analysis (TDA) to extract useful information about a water distribution system.
- Ongoing: From Mar 2021 **Penalty hyperparameters tuning in Factorization problems**.
This research focuses on the tuning of the penalty hyperparameters through a bi-level approach in factorization problems, in particular in nonnegative matrix factorizations (NMF).
- Jan 2022 - May 2023 **Statistical analysis of the effect of Preoperative Music Therapy on Anxiety, Sedation, and Stress**.
This research comes from the collaboration with Prof. Giordano on the effect of Preoperative Music Therapy Versus Intravenous Midazolam on Anxiety, Sedation, and Stress.
- Nov 2021 - Apr 2023 **Anomalies Detection in satellite data**.
This research comes from a collaboration with the Planetek Italia srl. The aim is the study of the anomalies in marine data with a framework for time series analysis.
- Ongoing: From Mar 2020 **Anomalies Detection in Gene Expression Matrices**.
This research comes from a collaboration with some biologists at the Department of Human Oncology of the Policlinico di Bari. The aim is the study the problem of Detecting Outlier Samples in Microarray Data with robust techniques and a clustering approach.

Oct 2019 - May 2023 **Ph.D. research project: Hyperparameter Optimization Problem.**

My Ph.D. research project was focused on the study of the hyperparameter search and tuning problem of machine learning algorithms and discuss its main challenges from an optimization point of view, focusing on Gradient-based Optimization and Many-objective Optimization.

March 2018 - June 2019 **Indoor Positioning techniques.**

This research is devoted to the study of the State-of-the-art and hardware problems for Indoor Positioning. In particular, the study and software development of methodologies: SVD, PCA, and Kalman filter, were applied to reduce the dimensionality and the electromagnetic noise on the starting data.

Mar 2016 - Jun 2016 **ProLog and Clarissa study.**

This research is devoted to the study of relational algebra and Parsing Problems through the analysis of Clarissa software.

Publications

Published

Theoretical aspects in penalty hyperparameters optimization, *authors: Esposito F., Selicato L., and Sportelli C.*, Mediterranean Journal of Mathematics, (2023).

Bi-level algorithm for optimizing hyperparameters in Penalized Nonnegative Matrix Factorization, *authors: Selicato, L., Del Buono, N., Esposito, F., and Zdunek, R.*, Applied Mathematics and Computation, 457, 128184, (2023).

Effect of Preoperative Music Therapy Versus Intravenous Midazolam on Anxiety, Sedation and Stress in Stomatology Surgery: A Randomized Controlled Study, *authors: Giordano F., Giglio M., Sorrentino I., Dell'Olio F., Lorusso P., Massaro M., Tempesta A., Limongelli L., Selicato L., Favia G., Varrassi G., Puntillo F.*, Journal of Clinical Medicine. 2023; 12(9):3215. <https://doi.org/10.3390/jcm12093215>.

Detecting anomalies in marine data: a framework for time series analysis, *authors: Del Buono, N., Esposito, F., Gargano, G., Selicato, L., Taggio, N., Ceriola, G., and Iasillo, D.*, In International Conference on Machine Learning, Optimization, and Data Science (pp. 485-500). Cham: Springer Nature Switzerland. (2022).

Toward a new approach for tuning regularization hyperparameter in NMF, *authors: Del Buono Nicoletta, Flavia Esposito, and Laura Selicato*, In International Conference on Machine Learning, Optimization, and Data Science (pp. 500-511). Cham: Springer International Publishing.

A New Ensemble Method for Detecting Anomalies in Gene Expression Matrices, *authors: Selicato L., Esposito F., Gargano G., Vegliante M. C., Opinto G., Zaccaria G. M., Ciavarella S., Guarini A., and Del Buono N.*, Mathematics 2021, 9, 882.

Anomalies Detection in gene expression matrices: towards a new approach, *authors: Esposito F., Del Buono N., Selicato L., and Vegliante M. C.*, In Proceedings of the 14th International Joint Conference on Biomedical Engineering Systems and Technologies - BIOINFORMATICS, pp 162-169 (2021).

Low rank approaches for the analysis of real data from pre to post processing, authors: *Esposito Flavia, Selicato Laura, and Del Buono Nicoletta*. (2021), PROCEEDINGS OF SIMAI 2020+ 21.

Non-negative Matrix Factorization models for knowledge extraction from biomedical and other real world data, authors: *Esposito Flavia, Nicoletta Del Buono, and Laura Selicato*, Proceedings in Applied Mathematics & Mechanics, 20(1), 20.1, (2021): e202000032.

Methods for Hyperparameters Optimization in Learning Approaches: an overview, authors: *Laura Selicato, Nicoletta Del Buono, and Flavia Esposito*, In Machine Learning, Optimization, and Data Science: 6th International Conference, LOD 2020, Siena, Italy, July 19–23, 2020, Revised Selected Papers, Part I 6 (pp. 100-112). Springer International Publishing.

Ph.D. Thesis **Bi-level optimization for hyperparameters tuning in sparse low-rank learning algorithms**, author *Laura Selicato*.

Department of Mathematics University of Bari Aldo Moro, September 2023, Italy

Master's Thesis **Low-Rank Approximation Methods for Indoor Positioning**, author *Laura Selicato*.

Department of Mathematics University of Bari Aldo Moro, July 2019, Italy

Thesis Degree **Computational Logic and ProLog: an application in the real world**, author *Laura Selicato*.

Department of Mathematics University of Bari Aldo Moro, July 2016, Italy

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Bari, November 6, 2023

Laura Selicato