Elisa Riccietti | PhD

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Research interests

My research revolves around optimization and machine learning. Since 2014, I investigate the solution of least-squares problems with noisy function and gradient. I am particularly interested in ill-posed problems, and large-scale problems with inexact function and gradient. More recently, as postdoc at ENSEEIHT, IRIT, Toulouse, in collaboration with TOTAL R&D, I have investigated multilevel and machine learning techniques for the numerical solution of Partial Differential Equations. I am now working on second order optimization methods for machine learning.

Short bio

Associate professor (maître de conférences) — **Lyon, France**
Ecole Normale Superieure (ENS) de Lyon , LIP — *2020–ongoing*

Postdoc researcher — **Toulouse, France**
Institut de Recherche en Informatique de Toulouse (IRIT), ENSEEIHT — *2017–2020*

PhD in Applied Mathematics — **Firenze, Italy**
Università degli Studi di Firenze, Department of Mathematics — *2014–2017*

Awards

- July 2019, Award for the best paper: *'On the approximation of PDEs solution by ANNs trained by a multilevel Levenberg-Marquardt method'*, Summer School on Optimization, Big Data and Applications (OBA), Veroli, Italy.
- July 2017, Honorable mention for the talk: *'Parametric design of a family of centrifugal pumps: dealing with unbalancedness of geometries dataset'*, given for award session of the Summer School on Optimization, Big Data and Applications (OBA), Veroli, Italy.
- May 2016, Winner of the degree award 'Hansjörg Wacker Memorial Prize', jointly funded by ECMI (European Consortium of Mathematics in Industry) and by a consortium of institutions from Linz.
- October 2015, Winner of the degree award 'Premio Laurea Magistrale o Specialistica in Matematica ed Informatica', by Università degli Studi di Firenze.
- October 2015, Winner of the degree award 'Premio di Laurea Magistrale Mario Negri', by Fondo Mario Negri.

Publications

In most of the publications the authors are listed in alphabetical order, with the exception of [J1], [J2] et [P1].

Articles published in international journals

[J1] E. Riccietti, S. Bellavia, and S. Sello. Sequential Linear Programming and Particle Swarm Optimization for the optimization of energy districts. *Engineering Optimization* (2018), 1–17.

[J2] E. Riccietti, J. Bellucci, M. Checcucci, M. Marconcini, and A. Arnone. Support Vector Machine classification applied to the parametric design of centrifugal pumps. *Engineering Optimization* (2017), 1–21.

[J3] S. Bellavia, B. Morini, and E. Riccietti. On an adaptive regularization for ill-posed nonlinear systems and its trust-region implementation. *Comput. Optim. Appl.* 64.1 (2016), 1–30.

[J4] S. Bellavia and E. Riccietti. On an elliptical trust-region procedure for ill-posed nonlinear least squares problems. *J. Optim. Theory Appl.* 158.3 (2018), 824–859.

[J5] S. Bellavia, S. Gratton, and E. Riccietti. A Levenberg-Marquardt method for large nonlinear least-squares problems with noisy functions and gradients. *Numer. Math.* 140.3 (2018), 791–825.

[J6] H. Calandra, S. Gratton, E. Riccietti, and X. Vasseur. On the iterative solution of the extended normal equations. *SIAM J. Matrix Anal. Appl.* (2020). To appear.

[J7] H. Calandra, S. Gratton, E. Riccietti, and X. Vasseur. On a multilevel Levenberg-Marquardt method for the training of artificial neural networks and its application to the solution of partial differential equations. *Optim. Methods Softw.* (2020), 1–26.

[J8] S. Bellavia, M. Donatelli, and E. Riccietti. An inexact non stationary Tikhonov procedure for large-scale nonlinear ill-posed problems. *Inverse Probl.* 36.9 (2020).

Proceedings

[P1] E. Riccietti, S. Bellavia, and S. Sello. Numerical Methods for Optimization Problems Arising in Energetic Districts. *Progress in Industrial Mathematics at ECMI 2016*. Springer International Publishing, 2016, 35–42.

Submitted articles

[S1] H. Calandra, S. Gratton, E. Riccietti, and X. Vasseur. On high-order multilevel optimization strategies. *SIAM J. Optim.* (2019).

[S2] A. L. Custodio, Y. Diouane, R. Garmanjani, and E. Riccietti. Worst-case complexity bounds of directional direct-search methods for multiobjective derivative-free optimization. *J. Optim. Theory Appl.* (2019).

PHD thesis

[T1] E. Riccietti. Levenberg-Marquardt methods for the solution of noisy nonlinear least squares problems. PhD thesis. University of Florence, 2018.

Professional activities

Paper reviews

- I have reviewed papers for the following journals: IMA Journal of Numerical Analysis, Optimization Methods and Software, Computational Optimization and Applications, SIAM Journal on Scientific Computing, Mathematics.

Events organization

- Co-organizer of the mini-symposium *Iterative linear algebra for optimization problems* at IMA Conference on Numerical Linear Algebra and Optimization 2020.
- Co-organizer of the summer school on artificial intelligence "IAoundé" at Yaoundé University (Cameroun), March 2020.

- Co-organizer of the mini-symposium *Efficient numerical solution of nonconvex problems* at ICCOPT 2019.
- Co-organizer of the mini-symposium *Inverse Problems in Geophysics* at University of Florence, 2016.

Talks

- I have given more than 20 talk in international symposia, such as Computational Science Engineering, Data Science and Artificial Intelligence by Total R&D (MATHIAS), SIAM Conference on Optimization (SIOPT), International Conference on Continuous Optimization (ICCOPT), Franco–German–Swiss (FGS) Conference on Optimization, IMA and OR Society Conference on Mathematics of Operational Research, European Conference on Operational Research (EURO), Conference of the International Linear Algebra Society (ILAS), European Conference on Mathematics for Industry (ECMI), International Symposium on Mathematical Programming (ISMP). Please, refer to my web page for the full list.

Teaching

I am currently teaching the Optimization and Approximation course at the Informatics department of ENS Lyon. In the past, I have been teaching assistant for the following courses:

- Data science and big data, Formation Toulouse Tech, Toulouse, 2018/2019 and 2019/2020. Designer and supervisor of the final project: 'A machine learning challenge' (140h). Topics: introduction to statistics, principal component analysis, regression, classification, optimisation, random forests, neural networks, support vector machines, gradient boosting.
- Scientific Computing, IRIT, Toulouse, 2018-2020 (48h). Topics: linear algebra, LU factorization, relaxation methods, Hessenberg matrices, iterative methods and preconditioning.
- Integration and Applications, IRIT, Toulouse, 2018 (7h). Topics: Fourier transform, distributions.
- Scientific Computing, degree course in Mechanical Engineering at Università degli Studi Firenze, 2016 (22h). Topics: exercises in Matlab (interpolation, last-squares approximation, solution of linear systems, Gauss, Jacobi, Gauss-Seidel) and 2 hours of frontal lesson (numerical solution of linear systems, Gauss method and pivoting).

Supervision of students

- Supervisor for the master thesis of a student at IRIT, Toulouse. Collaboration with TOTAL R&D. Subject: solution of PDEs by artificial neural networks, a study in Tensorflow, 2019.
- Supervisor for the internship of a student at IRIT, Toulouse. Collaboration with TOTAL R&D. Topic: study of the potential of generative adversarial networks (GAN) for the solution of PDEs, 2018.
- Co-supervisor for the master thesis of a student of Università degli Studi di Firenze. Topic: use of machine learning techniques (self-organizing maps (SOM) and feedforward artificial neural networks) to improve the parametric design of a turbomachinery component, 2017.