

CURRICULUM VITAE

Luca Zanni

(17/07/2025)

Luca Zanni was born in Italy in 1965. He graduated in Mathematics *cum laude* in 1990 at the University of Modena, Italy. From 1992 to 2000, he was researcher in Numerical Analysis at the University of Modena and Reggio Emilia, Faculty of Sciences. From 2000 to 2005, he was associate professor in Numerical Analysis at the University of Modena and Reggio Emilia, Faculty of Sciences, and since 2005, he is full professor in Numerical Analysis at the same faculty. From 2010 to 2012 he was Director of the Department of Mathematics, from 2012 to 2015 he was Vice-Director of the Department of Physics, Informatics and Mathematics at the University of Modena and Reggio Emilia and from 2018 to 2024 he was Director of the same Department. From 2018 to 2024, he was a member of the academic senate of the University of Modena and Reggio Emilia. Since 2014, he is a member of the Working Group “Inverse Problems and Imaging”, International Federation for Information Processing (IFIP) and, since 1992, he joined the “Gruppo Nazionale per il Calcolo Scientifico” (GNCS-INdAM) of which he is a member of the scientific board since 2021.

His research fields are mathematical programming, parallel computing, statistical learning and inverse problems. In the field of mathematical programming, theoretical and computational results are obtained for gradient projection iterative methods for variational inequalities and nonlinear programming problems; in particular, steplength selection rules are proposed in both the deterministic and the stochastic framework. Furthermore, results on the numerical stability of direct elimination methods for quadratic programming and least squares problems are also obtained. In the field of statistical learning, new methods have been introduced for the solution of large-scale optimization problems, such as those arising in training the learning methodology Support Vector Machines. Numerical solvers for the optimization problems in regularization approaches to ill-posed inverse problems are designed and applied to improve image deconvolution and denoising techniques. For the problems above, methods suited for multiprocessor architecture have been also developed; relating software is available at the websites:

- <http://www.unife.it/prin/software>
 - SGP-IDL: An Interactive Data Language (IDL) package for the single and multiple deconvolution of 2D images corrupted by Poisson noise, with the optional inclusion of a boundary effect correction
 - SGP-dec: A Matlab package for the deconvolution of 2D and 3D images corrupted by Poisson noise

- <http://dm.unife.it/gpdt/>
 - GPDt: A gradient projection-based decomposition technique for large quadratic programs in training Support Vector Machines: serial and parallel software

He is author of more than 60 papers on national and international journals, he presented several seminars at international congresses and at universities and research centers; he is referee for national and international journals in Numerical Analysis, Applied Mathematics and Computer Science. He also contributed to the organization of scientific meetings and he was member of scientific committees.

He was principal investigator of research unit in the projects:

- PRIN 2022: *Numerical Optimization with Adaptive Accuracy and Applications to Machine Learning*
- GNCS-INdAM 2018: *Metodi di ottimizzazione stocastica per problemi di apprendimento automatico a larga scala*
- Far2016 – University of Modena and Reggio Emilia: *Optimization techniques for image reconstruction*
- Spinner Consortium - European Social Fund 2007-2013: *High-complexity inverse problems in biomedical applications and social systems*
- PRRIITT 2008: *Machine Learning Algorithms for Text Categorization*
- PRIN 2008: *Optimization Methods and Software for Inverse Problems*
- PRIN 2006: *Inverse Problems in Medicine and Astronomy*
- PRRIITT 2005: *Machine Learning Technologies for Banknote Recognition*
- FIRB-Project 2001: *Statistical Learning: Theory, Algorithms and Applications*
- MURST-Project 1997: *Numerical Analysis: Methods and Mathematical Software*

He was also involved in other national and international projects:

- PRIN 2022 PNRR: *Advanced optimization METHods for automated central veIn Sign detection in multiple sclerosis from magneTic resonAnce imaging (PI Federica Porta)*
- PNRR – Future Artificial Intelligence Research (FAIR): Spoke 8, WP 8.2, Task 8.2.5
- Progetti COFIN2004, C.N.R., GNCS, INdAM, CINECA
- PASCAL network of excellence (2006): *Pattern Analysis, Statistical Modelling and Computational Learning*
- HPC-EUROPA 2004: *Pan-European Research Infrastructure on High Performance Computing*
- FIRB 2001: *Algoritmi Paralleli e Ottimizzazione non Lineare Numerica*

His teaching activities concern courses in numerical analysis, numerical optimization, machine learning, parallel computing at the University of Modena and Reggio Emilia.

He supervised 7 PhD Thesis in Mathematics, about 60 Thesis in Mathematics and 7 Thesis in Computer Science.

Further information is available at <https://sites.google.com/view/luca-zanni>

Selected Publications

1. G. Franchini, F. Porta, V. Ruggiero, I. Trombini, L. Zanni, *A stochastic gradient method with variance control and variable learning rate for Deep Learning*, Journal of Computational and Applied Mathematics, 451, 116083 (2024)
2. G. Franchini, V. Ruggiero, F. Porta, L. Zanni, *Neural architecture search via standard machine learning methodologies*, Mathematics in Engineering, 5(1) (2023).
3. S. Crisci, F. Porta, V. Ruggiero, L. Zanni, *Hybrid limited memory gradient projection methods for box-constrained optimization problems*, Computational Optimization and Applications (2022).
4. S. Bonettini, F. Porta, V. Ruggiero, L. Zanni, *Variable metric techniques for forward-backward methods in imaging*, Journal of Computational and Applied Mathematics, (2021), 385, 113192.
5. S. Crisci, F. Porta, V. Ruggiero, L. Zanni, *Spectral properties of Barzilai-Borwein rules in solving singly linearly constrained optimization problems subject to lower and upper bounds*, SIAM J. Optim, 30 (2) (2020), 1300-1326.
6. R. Cavicchioli, J. Cheng Hu, E. Loli Piccolomini, E. Morotti, L. Zanni, *GPU acceleration of a model-based iterative method for Digital Breast Tomosynthesis*, Scientific Reports 10, 43 (2020).
7. S. Crisci, V. Ruggiero, L. Zanni, *Steeplength selection in gradient projection methods for box-constrained quadratic programs*, Applied Mathematics and Computation 356 (2019), 312-327.
8. E.L. Piccolomini, V.L. Coli, E. Morotti, L. Zanni, [Reconstruction of 3D X-ray CT images from reduced sampling by a scaled gradient projection algorithm](#), Computational Optimization and Applications 71 (2018), 171-191.
9. D. di Serafino, V. Ruggiero, G. Toraldo, L. Zanni, [On the steplength selection in gradient methods for unconstrained optimization](#), Applied Mathematics and Computation 318 (2018), 176-195.
10. S. Rebegoldi, L. Bautista, L. Blanc-Féraud, M. Prato, L. Zanni, A. Plata, *A comparison of edge-preserving approaches for differential interference contrast microscopy*, Inverse Problems 33 (8) (2017), 085009.
11. F. Porta, M. Prato, L. Zanni, *A new steplength selection for scaled gradient methods with application to image deblurring*, Journal of Scientific Computing, 65 (2015), 895-919
12. L. Zanni, A. Benfenati, M. Bertero, V. Ruggiero, *Numerical methods for parameter estimation in Poisson data inversion*, Journal of Mathematical Imaging and Vision, 52 (2015), 397-413.
13. A. Cornelio, F. Porta, M. Prato, L. Zanni, *On the filtering effect of iterative regularization algorithms for discrete inverse problems*, Inverse Problems 29 (2013), 125013.
14. R. Zanella, G. Zanghirati, R. Cavicchioli, L. Zanni, P. Boccacci, M. Bertero, G. Vicidomini, *Towards real-time image deconvolution: application to confocal and STED microscopy*, Scientific Reports 3 (2013), 2523.
15. M. Prato, R. Cavicchioli, L. Zanni, P. Boccacci, M. Bertero, *Efficient deconvolution methods for astronomical imaging: algorithms and IDL-GPU codes*, Astronomy & Astrophysics 539 (2012), A133.
16. M. Prato, S. Favilla, L. Zanni, Carlo A. Porro, P. Baraldi, *A regularization algorithm for decoding perceptual temporal profiles from fMRI data*, NeuroImage 56 (2011), 258-267.
17. M. Bertero, P. Boccacci, G. Talenti, R. Zanella, L. Zanni, *A discrepancy principle for Poisson data*, Inverse Problems 26 (2010), 105004.
18. V. Ruggiero, T. Serafini, R. Zanella, L. Zanni, *Iterative regularization algorithms for constrained image deblurring on graphics processors*, Journal of Global Optimization 48 (2010), 145-157.
19. I. Loris, M. Bertero, C. De Mol, R. Zanella, L. Zanni, *Accelerating gradient projection methods for l_1 -constrained signal recovery by steplength selection rules*, Applied and Computational Harmonic Analysis 27 (2009), 247-254.
20. R. Zanella, P. Boccacci, L. Zanni, M. Bertero, *Efficient gradient projection methods for edge-preserving removal of Poisson noise*, Inverse Problems 25 (2009), 045010.
21. S. Bonettini, R. Zanella, L. Zanni, *A scaled gradient projection method for constrained image deblurring*, Inverse Problems 25 (2009), 015002.
22. G. Frassoldati, L. Zanni, G. Zanghirati, *New adaptive stepsize selections in gradient methods*, Journal of Industrial and Management Optimization 4(2) (2008), 299-312.

23. L. Zanni, T. Serafini, G. Zanghirati, *Parallel software for training large scale support vector machines on multiprocessor systems*, Journal of Machine Learning Research 7 (2006), 1467-1492.
24. L. Zanni, *An improved gradient projection-based decomposition technique for support vector machines*, Computational Management Science 3(2) (2006), 131-145.
25. T. Serafini, G. Zanghirati, L. Zanni, *Gradient projection methods for quadratic programs and applications in training support vector machines*, Optim. Meth. Soft. 20 (2005), 353-378.
26. G. Zanghirati, L. Zanni, *A parallel solver for large quadratic programs in training support vector machines*, Parallel Computing 29(4) (2003), 535-551.
27. V. Ruggiero, L. Zanni, *A Modified projection algorithm for large strictly convex quadratic programs*, J. Optim. Theory Appl. 104 (2000), 281-299.
28. E. Galligani, L. Zanni, *Error analysis of an algorithm for equality-constrained quadratic programming problems*, Computing 58 (1997), 47-67.
29. E. Galligani, V. Ruggiero, L. Zanni, *Splitting methods for constrained quadratic programs in data analysis*, Computers Math. Applic. 32 (1996), 1-9.
30. L. Zanni, *On the convergence rate of two projection methods for variational inequalities in R^n* , Calcolo 29 (1992), 193-212.

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