Curriculum vitae of Luigi Ambrosio

1. Personal details

Name: Luigi Ambrosio
Date of birth: January 27, 1963
Nationality: Italian
Family status: Married, 3 daughters

Online resources: https://cvgmt.sns.it/person/3/,
https://scholar.google.com/citations?user=2Y5aC0sAAAAJ Google Scholar,
https://arxiv.org/search/?searchtype=author&query=Ambrosio%2C+L ArXiv.
https://orcid.org/0000-0001-5077-159X ORCID.

2. Current position

1997 – pres. Professor of Mathematical Analysis, Scuola Normale Superiore, Pisa, (Italy)

3. Previous positions

1995 – 1997 Full Professor, University of Pavia (Italy)
1994 – 1995 Full Professor, University of Benevento (Italy)
1992 – 1994 Associate Professor, University of Pisa (Italy)
1988 – 1992 Research Assistant, University of Rome "Tor Vergata" (Italy)

4. Education

1995 – 1988 Corso di Perfezionamento (Ph.D.), Scuola Normale Superiore, Pisa (Italy)
1981 – 1985 Scuola Normale Superiore, Pisa (Italy)
1981 – 1985 Laurea in Matematica (B.S.), University of Pisa (Italy), Summa cum laude

5. Research achievements and peer recognition

To date, according to the MathSciNet database, Luigi Ambrosio has more than **230** published papers and monographs with more than **16000** citations. Besides several Lecture Notes, the monographs [6] ($\sim$ 3200 citations), on the theory of BV functions and free discontinuity problems, and [7] ($\sim$ 2100 citations), on the theory of gradient flows in the space of probability measures, have been particularly influential. The high level of originality, innovation and impact, as well as the academic leadership, is reflected in the quality and variety of the journals hosting the publications, international awards, editorial responsibilities and the continued supervision activity over the years, all detailed below.

Twelve selected research outputs. Citation numbers are from MathSciNet as of October 2025. Research monographs are not included.

- [13]. **441** citations. This paper provides a phase-field approximation of the celebrated Mumford-Shah functional, proposed in the context of a variational approach to egde detection and image processing. It has inspired many subsequent results, in particular in the context of applied mathematics and fracture mechanics.
- [1]. **152** citations. This paper provides the compactness theorem of special functions of bounded variation, the basic ingredient of the theory of free discontinuity problems, fully developed in other papers and in the monograph [6].
- [8]. **321** citations. This is a foundational paper, where several tools of Analysis in metric spaces are revisited, in particular with the introduction of the novel concept of "test plans", a class of probability measures on absolutely continuous curves that can be used, in alternative to the classical concept of p-modulus, to build a theory of Sobolev functions in metric measure spaces. In particular, several equivalence results are recovered without any doubling and Poincaré assumption on the metric measure structure. Eventually these tools are applied to recover, in the class of $CD(K,\infty)$ metric measure spaces (introduced and studied independently by Lott-Villani and Sturm), the equivalence of the L^2 heat flow with the gradient flow of the Entropy with respect to the 2-Wasserstein distance. This result, inspired by the classical paper of Jordan-Kinderlehrer-Otto [19] in Euclidean spaces, has been the basis of much more research in this area, in particular leading to stability of the heat flow with respect to measured Gromov-Hausdorff convergence.
- [9]. **382** citations. In this paper, building in part on [8], the new class $RCD(K,\infty)$ of metric measure spaces satisfying a synthetic lower bound $CD(K,\infty)$ on the Ricci tensor and a measure-theoretic "Riemannian" condition based on the quadraticity of the Cheeger energy functional, is introduced. Several structural and crucial properties of this class of spaces, including tensorization, regularizing properties of the heat flow and stability with respect to measured Gromov-Hausdorff convergence, are proved.
- [10]. **256** citations. This foundational paper provides a full extension of the classical Federer–Fleming theory to metric spaces, providing at the same time novel and more powerful proofs even of the Euclidean results and strong compactness theorems with respect to Gromov–Hausdorff convergence of the metric structures. In particular these results enable, for the first time, the extension of the Federer-Fleming theory to infinite-dimensional ambient spaces.
- [11]. **208** citations. This paper provides a full extension of the classical results of Geometric Measure Theory (area and coarea formulas, rectifiability criteria) to the setting of rectifiable sets in metric spaces. It provides also rigidity results and examples that motivated the subsequent research in this area and, in particular, the search for intrinsic rectifiability notions.

- [4]. **460** citations. In this paper the realm of validity of the Di Perna-Lions theory [17], dealing with well-posedness of ODE's associated to Sobolev vector fields in Euclidean spaces, is extended to vector fields of bounded variation. This result has found applications to systems of conservation laws, one of the fields where this class of essentially discontinuous fields appears in a natural way. In addition, independently of the regularity of the class of vector fields under consideration, in the paper it is proposed a new axiomatization, more suitable for the link with pathwise uniqueness principles in Probability theory and with the theory of Young measures, under the name of *Regular Lagrangian Flows*.
- [14]. **63** citations. This paper provides an extension of the theory [4] of Regular Lagrangian Flows to the case when even the ambient space is not regular. In particular the new theory, covering all metric measure spaces satisfying the $RCD(K,\infty)$ condition and gradient vector fields (for instance associated to solutions to Poisson's equation), has found application in the proof of structure [16] as well as geometric rigidity results [15].
- [3]. **134** citations. The fine structure of sets of finite perimeter in metric measure spaces for which the Poincaré inequality holds is understood for the first time in this paper. In particular, a suitable notion of codimension one Hausdorff measure $\mathcal{H}$ is introduced, proving concentration of the perimeter measure on the measure-theoretic boundary and its representation in terms of $\mathcal{H}$, in line with the classical theory. The asymptotic doubling property of the perimeter measure, proved in this paper at an high level of generality, made possible more specific investigations for sub-Riemannian metric structures, in the direction of intrinsic notions of rectifiability (as Euclidean rectifiability can be thought of as an extrinsic one), as in [18].
- [5]. **100** citations. This paper uses the functional analytic tools already developed in the Sobolev setting to provide equivalence between two definitions of the space of functions of bounded variation in metric measure spaces. The first, traditional, one based on approximation by Lipschitz functions with slope controlled in L^1, the second one based on quantitative BV property along "almost every" line. The quantification of the latter requires a novel concept of "measure upper gradient".
- [12]. **70** citations. This paper provides the first positive result of existence of optimal transport maps in sub-Riemannian geometry, in the case when the cost is the square of the Carnot-Carathéodory distance or the square of the gauge distance, relying on fine differentiability properties of the Kantorovich potentials. Stability of the maps with respect to the Riemannian approximations is also achieved.
- [2]. **130** citations. This paper establishes the foundations of the theory of functions of bounded variation from an Euclidean domain to a metric space, proving several structural properties and a Γ-convergence result. The definition, based on left composition with

1-Lipschitz maps, also extends to the Sobolev setting, where it was independently rediscovered by Y.G. Reshetnyak [20]. Later, this theory contributed to the metric theory of currents and the Sobolev theory for Q-valued maps, a cornerstone of the regularity theory of minimal currents.

Additional information.

6. Fellowships, academic recognitions and Awards

2025 National Member, National Academy of the Lincei (Italy)
2024 Frederic Esser Nemmers Prize, Northwestern University
2022 Riemann Prize, Riemann International Mathematics School
2019 Blaise Pascal Medal, European Academy of Sciences
2019 Balzan Prize for Contributions to the Theory of Partial Differential Equations
2015 Gold Medal for Achievements in Mathematics, XL National Academy of Sciences (Italy)
2015 Honorary Ph.D., ENS Lyon
2013 Member of Academia Europaea
2013 Séminaire Bourbaki, exposè 1065 on the work with Gigli and Savaré on gradient flows [7, 8, 9]
2010 ERC Advanced Grant, GEMETHNES, call ERC-2009-AdG
2007 Séminaire Bourbaki, exposé 972 on the work on flow of BV vector fields [4]
2006 Corresponding Member, Lombard Institute, Academy of Sciences and Letters, Milan
2005 Corresponding Member, National Academy of the Lincei (Italy)
2003 Fermat Prize, University of Toulouse (France)
1999 Caccioppoli Prize, Italian Mathematical Union
1996 National Prize for Mathematics and Mechanics, Italian Ministry of Education
1991 Bartolozzi Prize, Italian Mathematical Union

7. Main invited lectures

2018 Plenary Speaker, International Congress of Mathematicians, Rio de Janeiro
2015 Séminaire Bourbaki, to illustrate De Lellis–Spadaro's works on regularity of currents
2008 Plenary Speaker, 5^{th} European Congress of Mathematics, Amsterdam
2002 Invited Speaker, International Congress of Mathematicians (PDE Session), Beijing
1996 Invited Speaker, 2^{nd} European Congress of Mathematics, Budapest

8. Organization of scientific meetings

1995 – pres. Organizer of several scientific meetings. In particular, the biennial *Optimal Transportation and Applications* in Pisa (since 2011, XI

edition in 2024) and the *School on Analysis and Geometry in Metric Spaces* (XIV edition in 2026).

9. Supervision of Ph.D. students

Since 1999 has supervised several Ph.D. students, some of them now working at major institutions such as IAS Princeton, ETH Zurich, SISSA Trieste, EPFL Lausanne, University of Basel, and University of Wien.

2024 Camillo Brena
2022 Gioacchino Antonelli
2020 Giovanni Comi; Giorgio Stefani; Elia Bruè; Daniele Semola (D.S. *co-supervised* with A. Mondino)
2018 Federico Stra; David Tewodrose
2015 Maria Colombo, *co-supervised* with A. Figalli
2014 Simone Di Marino; Dario Trevisan; Carlo Mantegazza
2013 Nicolas Bonnotte
2012 Francesco Ghiraldin; Guido De Philippis
2009 Edoardo Mainini
2008 Gianluca Crippa; Nicola Gigli
2007 Alessio Figalli, *co-supervised* with C. Villani
2006 Stefania Maniglia; Davide Vittone
2003 Aldo Pratelli
2002 Valentino Magnani
2001 Matteo Focardi; Camillo De Lellis
1999 Francois Ebobisse

10. Committees and other leading responsibilities

2025 Member of the PE1 Mathematics Panel .
2019 – 2025 Rector (Direttore) of the Scuola Normale Superiore, six-year mandate.
2019 – 2022 Member-at-Large of the Executive Committee of the International Mathematical Union.
2020 Member of the Committee for the International Shaw Prize in Mathematics.
2019 Member of the Scientific Committee of the VIII European Congress of Mathematics.
2015 – 2016 Member of the Committee of the Abel Prize in Mathematics.
2013 Member of the IMU Committee for the Fields Medals 2014.
2009 Member of the Selection Committee for the ICM 2010, PDE Session.
2003 Member of the Scientific Committee of the 4^{th} European Congress of Mathematics.

11. Editorial activities

2025 – pres. Editor of the Journal of the Ecole Polytechnique
2011 – pres. Editor of Geometric and Functional Analysis
2006 – pres. Editor of Mathematical Models and Methods in Applied Sciences
2005 – 2025 Editor of Communications in Partial Differential Equations
2005 – 2016 Chief Editor of Calculus of Variations and Partial Differential Equations

2000 – 2011 Editor of Archive for Rational Mechanics and Analysis
1999 – 2011 Editor of Interfaces and Free Boundaries
1999 – 2011 Editor of the Journal of the European Mathematical Society

12. Reviewing activity

1988 – pres. Referee services for several funding bodies including European Research Council (ERC), and for several international journals including: *Ann. Math.*, *Comm. Pure Appl. Math.*, *Duke Math. J.*, *Invent. Math.*, *J. Amer. Math. Soc. (JAMS)*, *J. Eur. Math. Soc. (JEMS)*, *Mem. Amer. Math. Soc.*, among others.

References

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[2] L. Ambrosio, *Metric space valued functions of bounded variation*, Ann. Scuola Norm. Sup. Pisa Cl. Sci. (4), 17 (1990), pp. 439–478.

[3] ———, *Fine properties of sets of finite perimeter in doubling metric measure spaces*, vol. 10, 2002, pp. 111–128. Calculus of variations, nonsmooth analysis and related topics.

[4] ———, *Transport equation and Cauchy problem for non-smooth vector fields*, in Calculus of variations and nonlinear partial differential equations, vol. 1927 of Lecture Notes in Math., Springer, Berlin, 2008, pp. 1–41.

[5] L. Ambrosio and S. Di Marino, *Equivalent definitions of BV space and of total variation on metric measure spaces*, J. Funct. Anal., 266 (2014), pp. 4150–4188.

[6] L. Ambrosio, N. Fusco, and D. Pallara, *Functions of bounded variation and free discontinuity problems*, Oxford Mathematical Monographs, The Clarendon Press, Oxford University Press, New York, 2000.

[7] L. Ambrosio, N. Gigli, and G. Savaré, *Gradient flows in metric spaces and in the space of probability measures*, Lectures in Mathematics ETH Zürich, Birkhäuser Verlag, Basel, 2005.

[8] ———, *Calculus and heat flow in metric measure spaces and applications to spaces with Ricci bounds from below*, Invent. Math., 195 (2014), pp. 289–391.

[9] ———, *Metric measure spaces with Riemannian Ricci curvature bounded from below*, Duke Math. J., 163 (2014), pp. 1405–1490.

[10] L. Ambrosio and B. Kirchheim, *Currents in metric spaces*, Acta Math., 185 (2000), pp. 1–80.

[11] ———, *Rectifiable sets in metric and Banach spaces*, Math. Ann., 318 (2000), pp. 527–555.

[12] L. Ambrosio and S. Rigot, *Optimal mass transportation in the Heisenberg group*, J. Funct. Anal., 208 (2004), pp. 261–301.

[13] L. Ambrosio and V. M. Tortorelli, *Approximation of functionals depending on jumps by elliptic functionals via* Γ*-convergence*, Comm. Pure Appl. Math., 43 (1990), pp. 999–1036.

[14] L. Ambrosio and D. Trevisan, *Well-posedness of Lagrangian flows and continuity equations in metric measure spaces*, Anal. PDE, 7 (2014), pp. 1179–1234.

[15] E. Bruè, A. Naber, and D. Semola, *Boundary regularity and stability for spaces with Ricci bounded below*, Invent. Math., 228 (2022), pp. 777–891.

[16] E. Brué and D. Semola, *Constancy of the dimension for* $\mathrm{RCD}(K,N)$ *spaces via regularity of Lagrangian flows*, Comm. Pure Appl. Math., 73 (2020), pp. 1141–1204.

[17] R. J. DiPerna and P. L. Lions, *Ordinary differential equations, transport theory and Sobolev spaces*, Invent. Math., 98 (1989), pp. 511–547.

[18] B. Franchi, R. Serapioni, and F. Serra Cassano, *On the structure of finite perimeter sets in step 2 Carnot groups*, J. Geom. Anal., 13 (2003), pp. 421–466.

[19] R. Jordan, D. Kinderlehrer, and F. Otto, *The variational formulation of the Fokker-Planck equation*, SIAM J. Math. Anal., 29 (1998), pp. 1–17.

[20] Y. G. Reshetnyak, *Sobolev classes of functions with values in a metric space*, Sibirsk. Mat. Zh., 38 (1997), pp. 657–675, iii–iv.