

Curriculum Vitae

Contact Details

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Research Interests

Machine learning, deep learning, focusing on their applications in life sciences. I am particularly interested in applications of large transformers in various domains, and in studying the geometry of data representations arising from deep learning.

Current Position

2022– **Permanent Researcher**, *Istituto di Ricerca e Innovazione Tecnologica, AREA Science Park, Trieste, IT.*

Professional Experience

2020–2022 **Postdoctoral Researcher**, *Istituto di Ricerca e Innovazione Tecnologica, AREA Science Park, Trieste, Italy.*

2019–2020 **Postdoctoral Researcher**, *Istituto Officina dei Materiali, Consiglio Nazionale delle Ricerche, Trieste, Italy.*

2017–2018 **Claude Leon Postdoctoral Fellow**, *African Institute of Mathematical Sciences and Stellenbosch University, Cape Town, South Africa.*

2016 **Postdoctoral researcher**, *African Institute of Mathematical Sciences, Cape Town, South Africa.*

2015 **Stipendiary Lecturer**, *Hertford College, Oxford, United Kingdom.*

Education

- 2019–2020 **Master in High Performance Computing, SISSA and ICTP, Trieste.**
Thesis title: Representation learning and hierarchical clustering for microscopy images.
Supervisors: Dr. Stefano Cozzini, Dr. Alessio Ansuini.
- 2011–2015 **DPhil in Mathematics, Algebraic Geometry, University of Oxford, Lincoln College.**
Thesis title: On some computations of refined Donaldson-Thomas invariants.
Supervisor: Prof. Balazs Szendrői.
- 2010–2011 **MRI Masterclass in Moduli Spaces, Utrecht University.**
- 2008–2010 **Msc in Mathematics, Università degli Studi di Milano.**
- 2005–2008 **Bsc in Matematica, Università degli Studi di Milano-Bicocca.**

Prizes and Fellowships

- 2020 **Best Thesis Award, travel grant.**
Master in High Performance Computing (SISSA-ICTP), Italy
- 2017–2018 **Claude Leon Award, Postdoctoral grant and travel grant.**
Claude Leon Foundation, Stellenbosch University, SA
- 2011–2015 **EPSRC Grant within MICA, Fully funded fellowship.**
EPSRC, University of Oxford, UK
- 2011–2015 **Mathematical Research Institute (MRI) Grant, Fully funded fellowship.**
MRI, Utrecht University, NL

Publications

Google Scholar

ORCID: 0000-0001-6271-3303

Responsibility roles

- 2024–2025 *Responsible of Operative Unit and Substitute PI (AREA Science Park), PRIN PNRR: Machine learning algorithms for single-cell genomics from long-reads sequencing. Budget (€): 110K OU (250K total).*
- 2023–2026 *Work Package Leader for PNRR Project PRPCeric, WP11 FAIR data approaches and advanced management services. Budget (€): 2.2M WP11 (41M total).*
- 2023–2026 *Responsible of Operative Unit (AREA Science Park), FVG Regional Project Support for the diagnosis of rare diseases through Artificial Intelligence. Budget (€): 1.1M OU (3.4M total).*

Supervision

PhD Thesis Supervision

- 2023-2026 *Supervisor, joint with A. Ansuini and G. Caravagna*, of L. Valeriani at UniTS (Applied Data Science & Artificial Intelligence). Lucrezia is currently studying statistical methods for long-reads sequencing.
- 2023-2026 *Supervisor, joint with A. Ansuini and S. Cozzini*, of T. Rodani at UniTS (Applied Data Science & Artificial Intelligence). Tommaso is currently studying deep learning methods to detect and remove defects from Scanning Tunnelling Microscope images.
- 2022-2025 *Supervisor, joint with A. Ansuini*, of F. Barone at UniTS (Applied Data Science & Artificial Intelligence). Federico is currently studying unsupervised learning methods for protein family classification.

Msc Thesis Supervision

- 2022 *Supervisor, joint with A. Ansuini*, of L. Valeriani at UniTS (Data Science and Scientific Computing). Lucrezia is a PhD student at UniTS funded by AREA Science Park.
- 2021 *Co-supervisor, joint with A. Lerario*, of A. Rosana at UniTS and SISSA (Mathematics). Andrea is a PhD student at SISSA (Trieste, IT).
- 2018 *Supervisor, joint with B. Szendrői*, of J. M. Menjanahary at AIMS-SA (Mathematics). Jean Michel has a Marie Skłodowska-Curie PhD scholarship at Vilnius University (LT).
- 2018 *Supervisor, joint with D. Martinelli*, of M. Ratsisetraïna Ravelonanosy at AIMS-SA (Mathematics). Mahefa is a PhD student at TU Eindhoven (NL).
- 2017 *Supervisor, joint with Prof. B. Szendrői*, of A. Ramanantoanina at AIMS-SA (Mathematics). Mahenina has a Marie Skłodowska-Curie PhD scholarship at USI (Lugano, CH).
- 2016 *Supervisor, with Prof. B. Szendrői*, of S. Kadedesya at AIMS-SA (Mathematics). Stephen is a Lecturer at Busitema University (UG).
- 2016 *Supervisor, joint with Prof. B. Szendrői*, of H. Ravelomanantsoa Andriantsilavo at AIMS-SA (Mathematics). Heritiana is a teacher at an international school in Antananarivo (MG).

Talks and Conferences (selected)

- July 2023 What is the probability that a symmetric tensor is close to rank-one?, *Joint Geometry and Probability seminar*, University of Pavia, IT.
- July 2023 On the geometry of large transformers representations, *Workshop "Applications of Topological Data Analysis in Cosmology and Beyond"*, ICTP, IT.
- November 2022 The geometry of hidden representations of protein language models and Adversarial Attacks on Protein Language Models (posters), *NIPS, Workshop MLSB*, New Orleans, US.
- September 2022 The impact of remote homology on deep learning models for protein structure predictions (poster), *EMBO Workshop "When predictions meet experiments: the future of structure determination"*, Palermo, IT.
- March 2021 Representation learning and hierarchical clustering for microscopy images, *"MHPC Day"*, SISSA-ICTP, IT.

- August 2018 On some computations of refined DT-invariants, "*Nairobi Workshop in Algebraic Geometry*"), University of Nairobi, KE.
- December 2017 Motivic Donaldson-Thomas invariants of (some) noncommutative threefolds, "*Counting Problems in Quantum Field Theories and String Theory*", WITS Rural Facility, Kruger Park, SA.
- May 2016 Higher rank refined DT-invariants and invariants of surfaces, "*Giornate di Geometria Algebrica e Argomenti Correlati*", Catania, IT.
- Gennaio 2015 Towards an example of DT-Nekrasov correspondence, *MICA Workshop*, University of Oxford, UK.
- Luglio 2014 Higher rank phenomena in (refined) DT theory, "*Workshop on instanton counting, moduli spaces and integrable systems*", Lorenz Center, Leiden, NL.

Teaching

- August 2023 On the geometry of self-supervised learning representations (1.5 hours, 3 hours tutorial), *PhD Summer School, Technical University of Denmark, DK*.
- Fall 2023 Natural language modeling: deep learning methods (32 hours), *Master in Data Science and Scientific Computing, UniTS, IT*.
- April 2023 Introduction to representation learning and generative models (10 hours), *Master in High-Performance Computing HPC, SISSA & ICTP, IT*.
- May 2022 Introduction to representation learning and generative models (10 hours), *Master in High-Performance Computing HPC, SISSA & ICTP, IT*.
- August 2018 Elliptic curves, "*Nairobi Pre-Workshop in Algebraic Geometry*" (introductory lecture and exercise session), *University of Nairobi, KE*.
- March 2017 Moduli spaces of quiver representations (3 lectures), *AIMS, SA*.
- 2016 Teaching assistant and tutor for several courses of the Master in Pure and Applied Mathematics, *AIMS, SA*.
- 2015 Tutor for Geometry I, Algebra I, Analysis I, and Algebra II, *Hertford e Lincoln College, University of Oxford, UK*.
- 2012-2015 Teaching assistant for Algebraic geometry, Algebraic curves (two editions). Tutor for Geometry of Surfaces (two editions), Algebraic curves, *Andrew Wiles Mathematical Institute, University of Oxford, UK*.

Other activities and Outreach

- 2016-today Reviewer for several Scientific Journals and Workshops/Conferences.
- 2023 Introduction to chatGPT, Ai2S and Synapser Student Society, UniTS.
- 2021-2022 Organisation of the IncontrinRETe seminar series, AREA Science Park, Trieste, IT.
- August 2018 Co-organiser PhD School in Algebraic Geometry, University of Nairobi, KE.
- 2017 Scientific Facilitator at National Science Week 2017, Khayelitsha, Cape Town, SA.
- December 2015 Member of admission committee Herford College, University of Oxford.
- December 2013 Member of admission committee St. Peter's College, University of Oxford.