Riccardo FINOTELLO

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Personal Data

Place of birth: Torino, Italy Date of birth: July, 13th 1993 Citizenship: Italian

Work address: Commissariat à l'Energie Atomique et aux énergies alternatives,
DRT/LIST/DIASI/SIALV/LVML,
Bât. 861 p. 42,
F-91120 Palaiseau,
France

Research interests: machine learning, artificial intelligence, computer vision, data science, spectroscopy, chemometrics, geometry, field theory

Description: My research interests cover physical and computational problems, the common thread being the relation between mathematics and artificial intelligence, from data acquisition to the analysis. At present, I focus on two principal research areas, related to computer vision. The first is the segmentation of hyperspectral images (often issued from spectroscopy techniques, such as laser-induced breakdown spectroscopy) using supervised and unsupervised methods to extract relevant information from complex and diverse data. The other is geometric deep learning and representation learning for computer vision: I study the properties of hyperspectral images using graph neural networks and geometry. I am also interested in applications of machine and deep learning to the theory of mathematics and physics, such as algebraic geometry and string theory, for their fascinating structures and their ability to provide geometrical insights on the behaviour of neural network architectures.

Personal website: https://riccardo.thesfinox.dev

Work Experience

12/2022 – present: **Research Scientist**
Commissariat à l'Energie Atomique et aux énergies alternatives, Saclay, France
Description: research on computer vision and AI for hyperspectral imagery at the laboratory SIALV/LVML.

09/2022 – 12/2022: **Post-doctoral Researcher**
Commissariat à l'Energie Atomique et aux énergies alternatives, Saclay, France
Description: research on tensor methods for AI and applications to hyperspectral imagery at the laboratory SIALV/LVML.

02/2021 – 08/2022: **Post-doctoral Researcher**
Commissariat à l'Energie Atomique et aux énergies alternatives, Saclay, France
Description: joint post-doc between the SEARS/LANIE and the SIALV/LVML on applications of AI to laser-induced breakdown spectroscopy.

10/2017 – 12/2020: **Ph.D. Graduate Researcher**
Università degli Studi di Torino, Italy
Description: research in theoretical physics (string theory) and AI applications.

10/2017 – 10/2020: **Scientific Associate Researcher**
I.N.F.N. (*National Institute for Nuclear Physics*), Torino, Italy
Description: scientific association as Ph.D. student.

10/2018 – 07/2020: **Teaching Assistant**
Università degli Studi di Torino, Italy
Description: tutorship and exercise sessions for students of the B.Sc. in Physics.

Education

10/2017 – 12/2020 **Ph.D. Fellow in Physics and Astrophysics**
Università degli Studi di Torino, Italy
Advisor: Igor Pesando
Thesis: *D-branes and Deep Learning: Theoretical and Computational Aspects In String Theory*
Defended: December, 18th 2020

10/2015 – 10/2017: **M.Sc. in Physics**
Università degli Studi di Torino, Italy
Curriculum: theoretical physics
Dissertation: *Standard Model–like Scenarios in String Theory: Non Abelian D-brane Rotations and the Classical Bosonic String*
Final grade: 110/110 *cum laude*

10/2012 – 07/2015: **B.Sc. in Physics**
Università degli Studi di Torino, Italy
Dissertation: *Perturbative Analysis: Resurgent Transeries and Hyperasymptotics*
Final grade: 110/110 *cum laude*

Teaching Experience and Outreach Activity

02/2023 – present: **Interns supervision**
Position: *Commissariat à l'Energie Atomique et aux énergies alternatives*
Role: supervision of M.Sc. interns

01/2020 – 07/2020: **Teaching Assistant in Physics**
Grant: *Università degli Studi di Torino*
Course: *Physics 1* (1st year B.Sc. in Physics)
Role: tutorials and exercise sessions

01/2019 – 07/2019: **Teaching Assistant in Physics**
Grant: *Università degli Studi di Torino*
Course: *Waves, Fluids and Thermodynamics* (1st year B.Sc. in Physics)
Role: tutorials and exercise sessions

11/2015: **Teaching Staff**
Course: *Physics at LHC* (outreach project for high school students)
Funds: *Piedmont* regional grant for Italian scientific schools
Role: lectures and exercises on high energy physics (in English)

Reviewing Activity

2023 – present: **Expert for the French National Agency for Research**
Role: expertise for the ANR (*Agence Nationale de la Recherche*)

2022 – present: **Referee for Machine Learning: Science and Technology**
Role: review and expertise for Mach. Learn.: Sci. Technol.

2022 – present: **Referee for Spectrochimica Acta Part B: Atomic Spectroscopy**
Role: review and expertise for Spectrochim. Acta B

Fellowships, Grants and Distinctions

2023: EU funding for the COST Action CA22130
(*Comprehensive Multiboson Experiment-Theory Action (COMETA)*)
Role: Representative of France in the **Management Committee**

2020: grant as teaching assistant of the *Università degli Studi di Torino* (6 months, from 01/2020)

2019: student elected in the *Department Council* as Ph.D. representative

2018: student elected in the *Department Council* as Ph.D. representative

2017: Ph.D. scholarship assigned by the *Università degli Studi di Torino* (3 years, from 10/2017)

Visits, Training and Internships

12/2018	**Winter school and research visit** Location: Galileo Galilei Institute for Theoretical Physics (Arcetri, Firenze, Italy)
12/2017 - 01/2018	**Winter schools and research visit** Location: Galileo Galilei Institute for Theoretical Physics (Arcetri, Firenze, Italy)
01/2017 - 10/2017:	**I.N.F.N. training for the M.Sc. degree** Location: National Institute for Nuclear Physics (I.N.F.N., Torino, Italy)
04/2015 - 06/2015:	**I.N.F.N. training for the B.Sc. degree** Location: National Institute for Nuclear Physics (I.N.F.N., Torino, Italy)

IT Skills

Programming languages:	Python, R, C++, PHP, Javascript, ROOT, Matlab/Octave, Maxima, Wolfram Mathematica, Java
Markup and scripting languages:	bash, HTML, Markdown, RMarkdown
Operating Systems and Distributions:	Ubuntu (main distribution), Arch Linux, Debian, CentOS, Microsoft Windows
Shell:	bash, zsh, PowerShell
Modules and libraries:	Scipy ecosystem, Scikit-learn, Scikit-optimize, Tensorflow (Keras), PyTorch, LightGBM, XGBoost, Tidyr, Caret, Leaflet, Plotly, GMP, MPFR
Frameworks:	Jupyter Lab and Notebook, RStudio, wxMaxima, Mathematica for scientific programming; VIM (with plugins), Spyder for software developments; Git for version control; GitBook for documentation
System Administration:	personal instance of Nextcloud, administration and web design of the journal club webpage on a Raspberry Pi Apache+PHP+MariaDB installation (GitHub)
Other certifications:	ECDL Core Full (*European Computer Driving Licence*, 04/2012)

Coursework and Certifications

12/2020: **Reinforcement Learning**
University of Alberta (via Coursera.org — credential ID: X6QTKFZDEGB2)

Fundamentals of Reinforcement Learning	(credential ID: SA4PFAGGR6B5)
Sample-based Learning Methods	(credential ID: KCPZAVVUT98A)
Prediction and Control with Function Approximation	(credential ID: 3L9BL5LH9K4H)
A Complete Reinforcement Learning System (Capstone)	(credential ID: C5JFZB5AGF4C)

10/2020: **Data Science Specialisation**
John Hopkins University (via Coursera.org — credential ID: QDGGFSKG8VVS)

The Data Scientist's Toolbox	(credential ID: J6VC2AZMGGUG)
R Programming	(credential ID: 8D7TP7FHQWK2)
Getting and Cleaning Data	(credential ID: E3KT2J9HPKGR)
Exploratory Data Analysis	(credential ID: 3GYQ9UQQS3JX)
Reproducible Research	(credential ID: 84LX7JZYKR9W)
Statistical Inference	(credential ID: 2CSSYG79AQ2W)
Regression Models	(credential ID: YGGYSZZXM46R)
Practical Machine Learning	(credential ID: J9MXMYRQ47ZD)
Developing Data Products	(credential ID: 2CEYYPDYG7PB)
Data Science Capstone	(credential ID: SCJFP5JM34HR)

06/2020: **AI for Medicine**
deeplearning.ai (via Coursera.org — credential ID: ZXW8Y3UU4UCY)

AI for Medical Diagnosis	(credential ID: GPNE8X3862JX)
AI for Medical Prognosis	(credential ID: 8NPQDS4UFMJF)
AI for Medical Treatment	(credential ID: 52YHADQMZCM8)

05/2020: **Deep Learning**
deeplearning.ai (via Coursera.org — credential ID: N2FWFZ9W42V2)

Neural Networks and Deep Learning	(credential ID: XFKPYRXVVEKN)
Improving Deep Neural Networks: Hyperparameter tuning, Regularization and Optimization	(credential ID: ED599JTBLVX2)
Structuring Machine Learning Projects	(credential ID: 8KXABGGZWRER)
Convolutional Neural Networks	(credential ID: 2ZBR9Q9JLVAL)
Sequence Models	(credential ID: LP9WPTVB4KV3)

04/2020: **Machine Learning**
University of Standford (via Coursera.org — credential ID: SDLSE9NP4XMH)

Talks and Posters

2023: **HyperPCA**
À l'interface entre la théorie des matrices aléatoires et la spectroscopie du plasma induit par laser
Talk — *SFPT-GH, Paris 2023, France*

Simulation-based Synthetic Data Augmentation and Multitask Learning
Poster — *ANIMMA 2023, Lucca, Italy*

Trustworthiness of Laser-Induced Breakdown Spectroscopy Predictions via Simulation-based Synthetic Data Augmentation and Multitask Learning
Poster — *ANIMMA 2023, Lucca, Italy*

2022: **Machine learning for complete intersection Calabi-Yau manifolds**
Poster — *NeurIPS 2022, Machine Learning and the Physical Sciences, New Orleans 2022 (hybrid)*

Helping AI Understand Physics
Trustworthy Approaches to Hyperspectral Imaging
Seminar — *Séminaire technique LVML, C.E.A. Paris–Saclay, France*

Computer Vision for Physics
Theory and Experiments
Seminar — *Webinaire AllegrIA, C.E.A. Paris–Saclay, France* (video conference)

Deep Multi-task Mining Calabi-Yau Manifolds
Seminar — *Learning to Discover 2022, Orsay, France*

HyperPCA
Une méthode d'analyse innovante pour l'imagerie hyperspectrale
Poster — *Journées Scientifiques de l'ISAS, C.E.A. Paris–Saclay, France*

2021: **Applying Machine Learning to String Theory**
Lecture — *XVII Avogadro Meeting, Firenze, Italy*

Sparse Representations and Kernel-based PCA
Powerful Tools to Extract Elemental Maps from Noisy Data Obtained in LIBS Mapping of Materials
Seminar — *EMSLIBS 2021, Gijón, Spain* (video conference)

HyperPCA
An Advanced Framework of Principal Components Analysis for Hyperspectral Images
Seminar — *PTC Meeting 2021, C.E.A. Grenoble, France*

Algebraic Geometry and Computer Vision
Inception Neural Network for Calabi-Yau Manifolds
Seminar — *Data, Numbers, and Geometry - DANGER - 2021* (video conference)

Algebraic Geometry and Computer Vision
Inception Neural Network for Calabi-Yau Manifolds
Seminar — *Seminari di Algebra e Geometria Algebrica, University of Torino, Italy* (video conference)

Computer Vision and Algebraic Geometry
AI for Theoretical Physics
Poster — *IDAI 2021* (video conference)

Intelligenza Artificiale tra Geometria e Fisica
Seminar — *Escuela Alessandro Manzoni*, Buenos Aires, Argentina (video conference)

An AI Perspective on Phenomenology and Strings
Seminar — *C.E.A. Paris–Saclay, France* (video conference)

2020: **Time Dependent Defect CFT and Excited Spin Fields**
Poster — *Cortona Young* (video conference)

2019: **Spin Fields as Point-like Defects on the Worldsheet**
Poster — *Università Federico II*, Napoli, Italy

Exploring Particle Physics in 2D BCFT
D-branes, Twist Fields and Defect CFT
Talk (Ph.D midterm seminar) — *Università degli Studi di Torino*, Italy

Organization

06/2023: **At the interface of physics, mathematics and artificial intelligence**
Pollica, Italy — https://agenda.infn.it/event/33851/

Schools and Workshops

07/2021: **INRIA-DFKI European Summer School on Artificial Intelligence**
Online event — https://idessai.inria.fr

05/2020: **Cortona Young**
Online event — https://www.ggi.infn.it/showevent.pl?id=377

12/2019: **XV Avogadro Meeting on Strings, Supergravity and Gauge Theories**
Napoli, Italy — https://agenda.infn.it/event/19816/overview

10/2019: **TFI 2019: Theories of Fundamental Interactions**
Torino, Italy — https://agenda.infn.it/event/20096/overview

03/2019: **String Theory from a Worldsheet Perspective**
Firenze, Italy — https://www.ggi.infn.it/showevent.pl?id=289

12/2018: **LACES 2018 - Lezioni Avanzate di Campi e Stringhe**
Firenze, Italy — http://laces.web.cern.ch/laces/LACES18/index18.html

05/2018: **XXXVI Convegno Nazionale di Fisica Teorica**
New Frontiers in Theoretical Physics
Cortona, Italy — https://agenda.infn.it/event/14362/

01/2018: **GGI Lectures on the Theory of Fundamental Interactions**
Fireze, Italy — http://webtheory.sns.it/ggilectures2018/

12/2017: **LACES 2017 - Lezioni Avanzate di Campi e Stringhe**
Firenze, Italy — http://laces.web.cern.ch/laces/LACES17/index17.html

Language Skills

Italian: native speaker
English: proficient user — certifications: Cambridge FCE (pass with A), EFCELT at European level C2
French: current — can communicate professional results both orally and written

Personal Interests

- Diploma in musical theory and melodic dictation (*Diploma di Solfeggio e Teoria Musicale*), and diploma in complementary piano studies (*Diploma di Pianoforte Complementare*) for violin
- 10 years experience as basketball player and 2 years experience as basketball coach for youth teams
- Blood donor for the AVIS (*Italian Association of Volunteer Blood Donors*)

Publications and Patents

Author profiles:

ArXiv ID:	finotello_r_1
InSpireHEP:	R.Finotello.1
OrcID:	0000-0002-8472-9004
ResearchGate:	Riccardo_Finotello2

List of publications:

Preprints:

R. Finotello, D. L'Hermite, C. Quéré, B. Rouge, , M. Tamaazousti, J.-B. Sirven *Trustworthiness of Laser-Induced Breakdown Spectroscopy Predictions via Simulation-based Synthetic Data Augmentation and Multitask Learning*, arXiv:2210.03762.

Published:

T. Völker *et al.* (with **R. Finotello**), *Interlaboratory comparison for quantitative chlorine analysis in cement pastes with laser induced breakdown spectroscopy*, *Spectrochim. Acta B: At. Spectrosc., 202 (2023), 106632*.

R. Finotello, M. Tamaazousti, J.-B. Sirven, *HyperPCA: a Powerful Tool to Extract Elemental Maps from Noisy Data Obtained in LIBS Mapping of Materials*, *Spectrochim. Acta B: At. Spectrosc., 192 (2022), 106418*.

* H. Erbin, **R. Finotello**, R. Schneider, M. Tamaazousti, *Deep multi-task mining Calabi-Yau four-folds*, *Mach. Learn. Sci. Tech. 3 (2021) 2, 015006*.

* H. Erbin, **R. Finotello**, *Inception neural network for complete intersection Calabi-Yau 3-folds*, *Mach. Learn. Sci. Tech. 2 (2021) 2, 02LT03*.

* H. Erbin, **R. Finotello**, *Machine learning for complete intersection Calabi-Yau: a methodological study*, *Phys. Rev. D 103 (2021) 12, 126014*.

* **R. Finotello**, I. Pesando, *2D fermion on the strip with boundary defects as a CFT with excited spin fields*, *Nucl. Phys. B 969 (2021) 115464*.

* A. Arduino, **R. Finotello**, I. Pesando, *On the origin of divergences in time-dependent orbifolds*, *Eur. Phys. J. C 80 (2020) 5, 476*.

* **R. Finotello**, I. Pesando, *The classical solution for the bosonic string in the presence of three D-branes rotated by arbitrary SO(4) elements*, *Nucl. Phys. B 941 (2019), 158–194*.

List of patents:

Public:

R. Finotello, M. Tamaazousti, J.-B. Sirven, *Méthode de validation des prédictions d'un modèle supervisé d'analyse quantitative multivariée de données spectrales*, no. FR2206060, *Commissariat à l'énergie atomique et aux énergies alternatives*, France.

R. Finotello, M. Tamaazousti, J.-B. Sirven, *Méthode de génération de données spectrales synthétiques*, no. FR2206069, *Commissariat à l'énergie atomique et aux énergies alternatives*, France.

R. Finotello, M. Tamaazousti, J.-B. Sirven, *Méthode de cartographie multi-espèces d'une zone à partir de données spectrales*, no. FR2111043, *Commissariat à l'énergie atomique et aux énergies alternatives*, France.

Personal notes on various subjects (mostly hand written) available on GitHub.

* Authors in alphabetical order.