

# Riccardo FINOTELLO

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## Personal Data

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

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

Research interests: ML/AI, data science, computer vision, spectroscopy, chemometrics, geometry, field theory

Description: My research interests cover physical and computational problems, the common thread being the relation between applied mathematics and artificial intelligence, from data acquisition to the analysis. At present, I focus on two principal research areas, related to [computer vision](#) and data science. The first is the analysis of hyperspectral images (often issued from spectroscopy techniques, such as [LIBS](#) or [NIR](#) imagery) using supervised and unsupervised methods for object detection and (panoptic) segmentation of scenes. In particular, I am interested in geometric deep learning and [representation learning](#) for computer vision: I study the properties of hyperspectral images using [graph neural networks](#) and geometry, in order to recover the full extent of the information present in the images. The other is the application of ML and AI to experimental physics. Specifically, I took an interest in [explainable AI](#) methods and the definition of uncertainties in deep learning. I actively work in the development of deep learning techniques capable of characterize each measurement, in order to exploit statistical models in order to reject outliers and to provide a measure of the uncertainty of the prediction. 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

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- 12/2022 – present: **Research Engineer**  
*Commissariat à l'Énergie 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'Énergie 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'Énergie 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

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- 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

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- 02/2023 – present: **Interns supervision**  
Position: *Commissariat à l'Énergie 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

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- 2023 – present: **Expert for the French National Agency for Research**  
Role: expertise for the [ANR](#) (*Agence Nationale de la Recherche*)
- 2022 – present: **Referee and reviewer**  
Role: review and expertise for [Mach. Learn.: Sci. Technol.](#)  
review and expertise for [Spectrochim. Acta B](#)  
review and expertise for [J. Phys. Comm.](#)

## Fellowships, Grants and Distinctions

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- 2023: EU funding for the COST Action [CA22130](#) [4 years]  
(*Comprehensive Multiboson Experiment-Theory Action (COMETA)*)  
Role: **Representative** of France in the **Management Committee**  
**Co-leader** of the *WG2 Technological innovation in data analysis*
- 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)

## Organization of Workshops and Conferences

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

## Visits, Training and Internships

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

## IT Skills

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Programming languages:	Python, R, C++, ROOT, Matlab/Octave, PHP, Javascript, Maxima, Wolfram Mathematica, Java
Markup/scripting languages:	bash, HTML, Markdown, RMarkdown
OSs and Distributions:	Ubuntu (main distribution), Arch Linux, Debian, CentOS, Microsoft Windows
Shell:	bash, zsh, PowerShell
Deep learning ecosystem:	Detectron2, PyTorch, PyTorch Geometric, PyTorch Lightning, JAX, Tensorflow, Keras, Optuna, Scikit-optimize
Data Analysis ecosystem:	Scipy/Numpy/Sympy ecosystem, Statsmodels, Scikit-learn, LightGBM, XGBoost, Pandas
Visualization:	Matplotlib, Seaborn, Plotly, Open3D, Tensorboard, TidyR, Caret, Leaflet
Frameworks:	VSCode, Jupyter Lab and Notebook, RStudio; VIM (with plugins); Git for version control; GitBook and Sphynx 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 ( <a href="#">GitHub</a> )
Other certifications:	ECDL Core Full ( <i>European Computer Driving Licence</i> , 04/2012)

## Language Skills

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Italian:	native speaker
English:	proficient user — certifications: Cambridge FCE (pass with A), EFCELT at European level C2
French:	proficient user

## Personal Interests

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- Passioned by latest advances in AI/ML and their applications to real world scenarios
- 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*)

## Coursework and Certifications

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### 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: [J9MXYRQ47ZD](#))

*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 Stanford (via Coursera.org — credential ID: [SDLSE9NP4XMH](#))

## Talks and Posters

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- 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
- 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

# Training Schools

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- 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 Worksheet 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**  
Firenze, 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>

# Publications and Patents

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## Author profiles:

ArXiv ID: [finotello\\_r\\_1](#) InSpireHEP: [R.Finotello.1](#)  
OrcID: [0000-0002-8472-9004](#) ResearchGate: [Riccardo\\_Finotello2](#)

## List of publications: ○

Preprints: \* H. Erbin, **R. Finotello**, B. W. Kpera, V. Lahoche, D. Ousmane Samary, *Functional renormalization group for signal detection and stochastic ergodicity breaking*, [arXiv:2310.07499](#).

Book chapters: \* H. Erbin, **R. Finotello**, *Deep Learning Complete Intersection Calabi-Yau Manifolds*, in [Machine Learning in Pure Mathematics and Theoretical Physics](#), World Scientific, pp. 151-181 (2023), edited by Y.-H. He (London Institute for Mathematical Sciences, UK; Merton College, University of Oxford, UK; City, University of London, UK; Nankai University, China).

Published: **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*, [EPJ Web Conf.](#), **288 (2023)**, [01005](#) in *ANIMMA 2023 - Advancements in Nuclear Instrumentation Measurement Methods and their Applications*. Full version at [arXiv:2210.03762](#).

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:

Filed: **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.

Public: **R. Finotello**, M. Tamaazousti, J.-B. Sirven, *Méthode de cartographie multi-espèces d'une zone à partir de données spectrales*, no. EP4166931, *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.

○ Posters are listed in a previous [section](#).

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