

July 18 2024

Work Experience

2021 – **NESAP Postdoctoral Fellow**, *Lawrence Berkeley National Laboratory*.

Research **New Methodologies to Improve Precision and Accelerate Discovery in Collider Physics.**

Developed and applied new methodologies incorporating deep learning into collider physics applications, overcoming the limitations from traditional approaches and improving upon state-of-the-art methods.

- **Fast Detector Simulation:** Developed several algorithms to accelerate standard simulation routines, achieving calorimeter simulation routines hundreds to thousands of times faster than traditional algorithms. Developed algorithms include the first application of diffusion generative models in collider physics, documented in five publications in peer review journals.
- **Anomaly Detection of New Physics Processes:** Led the development of different strategies to identify new physics processes through the identification of deviations from Standard Model predictions within a high-dimensional setting. These efforts led to four published papers in peer reviewed journals with one paper selected for the Editors' Suggestion in the Physical Review D journal.
- **Unfolding:** Developed and improved methods for high dimensional and unbinned unfolding. Applied the improvements to a jet substructure measurement using electron-proton scattering data collected by the H1 detector to achieve high precision and resulting in one of the first science results with the Perlmutter supercomputer. These advancements have been documented in three published works in peer reviewed journals.

Event Organization and Tutorials

2023, 2024 **NeurIPS**, New Orleans, United States of America.

Organizer of the Machine Learning and the Physical Sciences Workshop, responsible for organizing the logistics of the event and appointed Guest Editor of an upcoming focus collection publication covering results presented in the workshop.

2023 **AI4EIC**, Catholic University of America, United States of America.

Convener of the AI/ML for Data Analysis and Theory, responsible for inviting the speakers, moderating the session, and reporting the activities performed during the workshop.

2023 **BOOST23**, Lawrence Berkeley National Laboratory, United States of America.

Part of the local event organizing committee, responsible for moderating the Tagger Resilience session.

- 2023 **PhysTeV 2023**, Les Houches, France.
Machine learning convener of the Standard Model session, responsible for inviting relevant participants, documenting the activities, and organizing the talks during the event.
- 2022 **AI4EIC**, William and Mary, Raymond A. Mason School of Business, Alan B. Miller Hall, United States of America.
Tutorial given on machine learning-based unfolding for the EIC.
- 2022 **Snowmass 2021**.
Organized the Snowmass contribution on fast detector simulation and differentiable programming for collider physics, responsible for inviting participants and editing the document submitted for the Snowmass community study.
- 2022, 2023 **ATLAS ML training program**, Lawrence Berkeley National Laboratory, United States of America.
Tutorial given on anomaly detection for new physics searches using the CORI and perlmutter Supercomputers.
- 2021 **UZH Machine learning workshop**, University of Zurich, Switzerland.
Main organizer of the first interdisciplinary machine learning workshop at the University of Zurich, responsible for secure funding, selecting speakers, and moderating the talks.
- 2021 - 2023 **Machine Learning and Science Forum**, Berkeley Institute for Data Science, United States of America.
Co-organizer of the Machine Learning and Science Forum responsible for the invitation of speakers, organization, and moderation of seminars.

Referee Activities

- Journal of High Energy Physics
- Computing and Software for Big Science
- Physical Review journals and Reviews of Modern Physics
- European Physical Journal
- Frontiers in Big Data: Big Data and AI in High Energy Physics
- SciPost Physics
- Machine Learning: Science and Technology
- NeurIPS Workshop: Machine Learning and the Physical Sciences

Teaching Assignments

- 2019-2020 **Teaching assistant of Physics II**, 20 hrs/wk, University of Zurich.
- 2019-2020 **Teaching assistant of Physics I**, 20 hrs/wk, University of Zurich.
- 2018 **Teaching assistant of Physics I Lab for physicists**, 10 hrs/wk, University of Zurich.
- 2017 **Teaching assistant of Physics I Lab for physicists**, 5 hrs/wk, University of Zurich.
- 2016 **Teaching assistant of Physics I**, 10 hrs/wk, University of São Paulo.
- 2015 **Teaching assistant of Modern Physics II**, 5 hrs/wk, University of São Paulo.

Student Supervision

- 2024 - **Lark Wang**, Graduate student, University of California Berkeley.
Fast surrogate models for telescope image generation.

- 2024 - **Dung Hoang**, *Undergraduate student*, University of California San Diego.
Benchmarking state-of-the-art point cloud generation in High Energy Physics.
- 2023 - **Jack Harrison**, *Graduate student*, IFAE.
Density estimation with diffusion generative models respecting the Fokker-Plank equation.
- 2023 - **Nathan Suri**, *Graduate student*, Yale University.
Pileup mitigation at the LHC using optimal transport.
- 2023 - **Thandi madula**, *Graduate student*, University College London.
Diffusion generative models in latent space for calorimeter simulation.
- 2023 - **Yash Melkani**, *Undergraduate student*, University of California Berkeley.
Faster diffusion generative models for jet generation.
- 2022 **Jason Wong**, *Undergraduate student*, University of California Berkeley.
Score-based generative models using graph neural networks for collider physics.
- 2022 **Chirag Furia**, *Undergraduate student*, Rutgers University.
Calorimeter detector simulation with continuous normalizing flows.
- 2022 **Haoxing Du**, *Graduate student*, University of California Berkeley.
Maximum likelihood inference with neural density estimation.
- 2022 **Alp Altug**, *Undergraduate student*, University of California Berkeley.
Resonant anomaly detection with continuous normalizing flows.
- 2021 **Vikas Ummadisetty**, *Undergraduate student*, University of California Berkeley.
Domain adaptation strategies for collider physics.
- 2021 **Eduardo Ploerer**, *Master student*, University of Zurich.
Jet flavor tagging using graph neural networks.

Education

- 2017 – 2021 **PhD in physics**, *University of Zurich*.
- 2015 – 2017 **Master in physics**, *University of São Paulo*.
- 2013 **Internship**, *University of Glasgow*.
- 2011 – 2015 **Bachelor in theoretical and experimental physics**, *University of São Paulo*.

PhD Thesis

- Institute University of Zurich, Switzerland.
- Title **Collider Physics Measurements in High Jet Multiplicity Final States.**
- Supervisor Prof. Florencia Canelli.
- Description Performed the first search for vector-like leptons to third generation fermion final states and the first measurement of the top quark pair production cross section with additional b jets in the all hadronic final state. Machine learning techniques were developed and used to improve the signal sensitivity. Developed the ABCNet algorithm, the first transformer based model used in Collider Physics, applied to the separation of quark-gluon jets. In addition, UCluster, an anomaly detection algorithm, and PCT, a graph neural network combined with a transformer architecture, were developed in the context of jet flavor tagging and searches for new physics interactions. Organized the first University of Zurich interdisciplinary ML workshop.

Master thesis

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| Institute | University of São Paulo, Brazil and CERN, Switzerland. |
| Title | Measurement of cosmic ray electrons and positrons with the AMS-02 experiment. |
| Supervisor | Prof. Manuela Vecchi. |
| Description | Measured the time-dependent flux of cosmic ray electrons using the data collected by the AMS-02 experiment during the first 5 years of operations. Particular attention was given to low energy cosmic rays to further characterize the impact of the solar activity on the cosmic ray spectrum. |

Presentations at International Conferences

- 2024 **GTC 2024**, California, USA, [Click here to access the website.](#)
Using Generative AI To Enable Complex Physics Discovery at CERN.
- 2024 **ML at HEP**, KEK, Japan, [Click here to access the website.](#)
Review: Low-level object reconstruction and simulation using ML.
- 2023 **ML4Jets 2023**, Hamburg University, Germany, [Click here to access the website.](#)
High-Dimensional Diffusion Generative Models in Collider Physics.
- 2023 **QCD@LHC**, Durham, UK, [Click here to access the website.](#)
Jet substructure observables and azimuthal angular asymmetry in deep-inelastic scattering with H1.
- 2023 **EPS-HEP2023**, Hamburg, Germany, [Click here to access the website.](#)
Multi-differential Jet Substructure Measurement in High Q² ep collisions with HERA-II Data.
- 2023 **BOOST23**, California, USA, [Click here to access the website.](#)
Multi-differential Jet Substructure Measurement in electron-proton Collisions.
- 2023 **Aspen Winter Conference**, *Invited speaker in the Machine Learning session*, Aspen, USA, [Click here to access the website.](#)
Anomaly detection.
- 2022 **NeurIPS 2022**, *Invited speaker in the Machine Learning and the Physical Sciences Workshop*, New Orleans, USA, [Click here to access the website.](#)
Collider Physics Innovations Powered by Machine Learning.
- 2022 **ML4Jets 2022**, Rutgers University, USA, [Click here to access the website.](#)
Score-based Generative Models for Calorimeter Shower Simulation and Multi-differential Jet Substructure Measurement in High Q² Deep-Inelastic Scattering with the H1 Detector.
- 2022 **DIS2022**, Santiago de Compostela, Spain, [Click here to access the presentation.](#)
Multi-differential Jet Substructure Measurement in High Q² Deep-Inelastic Scattering with the H1 Detector.
- 2022 **Learning to Discover**, Orsay, France, [Click here to access the presentation.](#)
Online-compatible unsupervised nonresonant anomaly detection.
- 2020 **QCD20**, Montpellier, France, [Click here to access the presentation.](#)
Highlights on top quark measurements from CMS.
- 2020 **ML4jets 2020**, New York University, USA, [Click here to access the presentation.](#)
Quark-gluon discrimination with point clouds.
- 2019 **CMS TOP workshop**, DESY, Germany, [Click here to access the presentation.](#)
b-tagging: status, ways to improve uncertainty, expectation from UL.

- 2019 **3rd CMS Machine Learning Workshop**, CERN, Switzerland, [Click here to access the website.](#)
Deep neural networks for point cloud segmentation applied to low- p_T τ lepton reconstruction and Using Classification Without Labels (CWoLa) for multijet background rejection.
- 2019 **LHCP 2019**, BUAP, Mexico, [Click here to access the presentation.](#)
Latest CMS measurements of inclusive and differential top quark pair production.

Research Grants

- 2024 **NERSC AY 2024**, awarded by NERSC - USA, 20'000 GPU Hours.
Computing allocation grant to use the Perlmutter Supercomputer for scientific research.
- 2020 **Forschungskredit Candoc**, awarded by University of Zurich - Switzerland, CHF 57'546.
Research grant from the Physik Institut of the University of Zurich to carry independent research for 12 months.
- 2019 **GRC Short Grant: Interdisciplinary Workshop on Machine Learning at UZH**, awarded by University of Zurich - Switzerland, CHF 3'226.
Graduate Campus Short Grants funds for junior researchers to organize events at the University of Zurich.

Honors and Awards

- 2022 **Praemierung hervorragender wissenschaftlicher Arbeiten**, awarded by University of Zurich - Switzerland.
Ph.D. thesis award for outstanding scientific work.
- 2016 **Bolsa Estágio de Pesquisa no Exterior (BEPE)**, awarded by FAPESP (São Paulo Research Foundation) - Brazil.
Scholarship granted to masters students to carry out part of their research at any international institution for 6 months.
- 2015 **Masters research scholarship**, awarded by FAPESP.
Scholarship awarded to master students with excellent research achievements and academic records.
- 2015 **Masters research scholarship**, Declined, awarded by CNPq (National Council of Technological and Scientific Development) - Brazil.
Competitive scholarship awarded to master students. Declined in favour of the FAPESP scholarship.
- 2015 **Ilumina tu mundo competition**, Declined, awarded by Lund University - Sweden.
Third place in the competition sponsored by Lund University, opened to all students in Latin America. The prize granted full tuition fees for a Masters course at Lund University.
- 2015 **Summer student program at CERN**, awarded by CERN - Switzerland.
Selected student from the summer program at CERN.
- 2014 **Research scholarship for undergraduate students**, awarded by CNPq.
Scholarship given in a competitive basis to undergraduate students to carry out a research project.
- 2013 **Science without borders**, awarded by CNPq .
Highly competitive scholarship sponsored by the Brazilian government covering tuition and living fees for 1 academic year to undergraduate students in any partner university around the world.

Research Group Participation and Roles

June to **ATLAS Group at Univerisity of Glasgow, *United Kingdom*.**

August Summer intern at the University of Glasgow.

2013

July to **LHCb Group at CERN, *Switzerland*.**

August CERN Summer student at CERN.

2015

2015 - 2017 **Astroparticle Physics group at University of Sao Paulo, *Brazil*.**

Master student at the University of Sao Paulo.

2017 - 2021 **High Energy Physics Group at the University of Zurich, *Switzerland*.**

PhD Candidate at the University of Zurich.

2021 - **Machine Learning for Physics group at Lawrence Berkeley Laboratory, *USA*.**

Postdoctoral Scholar at Lawrence Berkeley Laboratory.