

Alexandru Meterez

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Research Interests

Theoretical: Deep Learning theory, Optimization, Theory of Large Language Models

Applications: AI in Healthcare, Bioinformatics

Education

ETH Zürich

MSc Data Science

Zürich, Switzerland

2020 - Present

- *Advisors:* Prof. Gunnar Rätsch, Prof. Francesco Orabona (KAUST)
- *GPA:* 5.7/6
- *Thesis topic:* Avoiding gradient explosion in orthogonal neural networks with batch normalization
- *Selected courses:* Advanced Machine Learning, Fundamentals of Mathematical Statistics, Computational Biology, Statistical Models in Computational Biology

University Politehnica of Bucharest (UPB)

BSc Computer Science

Bucharest, Romania

2016 - 2020

- *Advisor:* Prof. Iuliu Vasilescu
- *GPA:* 9.58/10 (top 7%)
- *Selected courses:* Probability and Statistics, Linear Algebra, Signal Processing, Numerical Methods, Data Structures and Algorithms, Algorithm Design, Programming Paradigms

Research

Publications

[BIO] Aligning Distant Sequences to Graphs using Long Seed Sketches

RECOMB2023 & Genome Research (2023): gr-277659.123

A. Joudaki*, **Alexandru Meterez***, H. Mustafa, R. Groot Koerkamp, A. Kahles, G. Rätsch

- » Designed a novel seeding algorithm based on tensor sketching for aligning highly mutated queries to De Bruijn graphs in quasi-logarithmic time.

[APP] Towards Workflows for the Use of AI Foundation Models in Visual Inspection

Applications

EUROSTRUCT 2023

M. Rigotti, D. Antognini, R. Assaf, K. Bakirci, T. Frick, I. Giurgiu, K. Janoušková, F. Janicki, H. Jubran, C. Malossi, **Alexandru Meterez**, F. Scheidegger

- » An application of Foundation Models to one-shot detection of various key civil infrastructure components from drone images.

Preprints

[THY] Towards Training Without Depth Limits: Batch Normalization Without Gradient Explosion

arXiv preprint, 2023 (under review)

Alexandru Meterez*, A. Joudaki*, F. Orabona, A. Immer, G. Rätsch, H. Daneshmand

- » Theoretically proving that very deep feed-forward neural networks with batch normalization layers initialized with orthogonal weight matrices have bounded gradients at infinite depth.

[APP] An effective machine learning approach for predicting ecosystem CO₂ assimilation across space and time

EGUsphere 2023, 1-31 (under review)

P. De Bartolomeis*, **Alexandru Meterez***, Z. Shu*, B. D. Stocker

- » An application of recurrent models to predict the gross primary production of an ecosystem based on FLUXNET measurements.

*: Equal first authors

Labels correspond to: [BIO] - bioinformatics, [APP] - applications, [THY] - theory.

Experience

- Max Planck Institute for Intelligent Systems (MPI Tübingen)** Tübingen, Germany
Research Intern Nov. 2023 - Feb. 2024
» Research in Deep Learning theory, specifically on the optimization landscape of models under Maximal Update Parametrization (μP), supervised by Dr. Antonio Orvieto.
- IBM Research** Zürich, Switzerland
Research Intern Sept. 2022 - Feb. 2023
» Used Neural Radiance Fields to inspect civil infrastructure for defects in the 3D domain and segment the defects on the surfaces, supervised by Dr. Florian Scheidegger and Dr. Cristiano Malossi.
- Adobe** Bucharest, Romania
Software Engineering Intern Jul. 2019 - Oct. 2019
» Built the Frontend Regression Validator (FRED), a tool that uses deep learning for visual regression testing the layout of a website between deployments, supervised by Dr. Tiberiu Boros.
» Deployed FRED using Docker and build a web-based graphical user interface.
- CAMPUS Research Institute, UPB** Bucharest, Romania
Student Researcher Jul. 2018 - Jul. 2020
» Worked on computer vision for robotics, supervised by Prof. Iuliu Vasilescu.
- Sparktech Software** Bucharest, Romania
Software Engineering Intern Jul. 2018 - Oct. 2018
» Used NLP to build a recommender system for users in a social media platform designed for researchers.
» Used Kafka and Redis to connect the inference process between backend and frontend.

Teaching Experience

- Big Data & Big Data for Engineers, ETH Zürich** Zürich, Switzerland
Teaching Assistant for 100+ students 2021 and 2022
Wrote exercises, held weekly teaching sessions and worked on [RumbleDB](#). Courses taught by Prof. Ghislain Fourny.
- Analog Electronics & Digital Electronics, UPB** Bucharest, Romania
Teaching Assistant for 50+ students 2018 and 2019
Wrote exercises, held weekly teaching sessions and built electronic circuits. Courses taught by Prof. Iuliu Vasilescu.

Awards

- Grade I Scholarship** 2017
Granted by UPB to students with the best grades in the year ($GPA \geq 9.5$).
- Performance Scholarship** 2018
Granted by UPB to students with the best grades in the year ($GPA \geq 9.7$) that participated in extracurricular research and contests.
- 3rd place at the Robotics Student Science Fair** 2018
Granted by UPB for building a system that a drone can use to plot its trajectory using optical flow, combining data from several sensors using a Kalman filter.
- Qualified at the Romanian National Mathematics Olympiad** 2014 and 2015
Qualified in high-school during my 11th grade and 12th grade.

Skills

- » **Proficient:** PyTorch, C, SQL, Bash
- » **Intermediate:** Docker, C++

References

- Prof. Gunnar Rätsch, ETH Zürich**
Contact: raetsch@ethz.ch
- Prof. Francesco Orabona, KAUST**
Contact: francesco.orabona@kaust.edu.sa
- Prof. Iuliu Vasilescu, UPB**
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