# Alexandru Meterez

https://alexandrumeterez.github.io

+40742433367 · alexandrumeterez@gmail.com · alexandru.meterez@inf.ethz.ch

## Research Interests

*Theoretical:* Deep Learning theory, Optimization, Theory of Large Language Models
*Applications:* AI in Healthcare, Bioinformatics

## Education

**ETH Zürich** — Zürich, Switzerland
MSc Data Science — 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)** — Bucharest, Romania
BSc Computer Science — 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.
» Work published at *RECOMB2023* and received an invitation for the *Journal of Genome Research*.

**[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.

*: 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 ($\mu$P), 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 built 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.

## Volunteering

**CaCTüS Internship at MPI Tübingen** 2024 (summer)
*Project advisor* for CaCTüS at MPI, addressed to talented students with financial or societal constraints.

## References

**Prof. Gunnar Rätsch, ETH Zürich**
*Contact*: raetsch@ethz.ch

**Prof. Francesco Orabona, KAUST**
*Contact*: francesco.orabona@kaust.edu.sa

**Prof. Iuliu Vasilescu, UPB**
*Contact*: iuliu.vasilescu@cs.pub.ro