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 — 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.

[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 CO_2 assimilation across space and time
Biogeosciences Journal ***(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 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