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

- Advisor: Prof. Gunnar Rätsch
- Thesis topic: Avoiding gradient explosion in orthogonalizing neural networks with batch normalization
- Selected courses: Advanced Machine Learning, Fundamentals of Mathematical Statistics, Computational Biology
- Current GPA: 5.57/6

Politehnica University of Bucharest — Bucharest, Romania
BSc Computer Science — 2016 - 2020

- Advisor: Prof. Iuliu Vasilescu
- Selected courses: Data Structures and Algorithms, Algorithm Design, Programming Paradigms
- GPA: 9.58/10

Research

Publications

[BIO] Aligning Distant Sequences to Graphs using Long Seed Sketches
RECOMB2023 & Genome Research (2023): gr-277659.123
A. Joudaki, **A. Meterez***, H. Mustafa, R. Groot Koerkamp, A. Kahles, G. Rätsch*

» Using tensor sketching, we design a new seeding algorithm for aligning very high mutation rate sequences 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, **A. 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
A. 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
EGUsphere 2023, 1-31
P. De Bartolomeis, **A. Meterez***, Z. Shu*, B. D. Stocker*

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

*: Equal contribution
Labels correspond to: **[BIO]** - bioinformatics, **[APP]** - applied paper, **[THY]** - theoretical paper.

Teaching Experience

Big Data, ETH Zürich Zürich, Switzerland
Teaching Assistant for 100+ *students* *2021,2022*
Writing exercises, weekly teaching sessions and working on RumbleDB. Course taught by Prof. Ghislain Fourny.

Analog/Digital Electronics, Politehnica University of Bucharest Bucharest, Romania
Teaching Assistant for 50+ *students* *2018,2019*
Writing exercises, weekly teaching sessions and building electronic circuits. Courses taught by Prof. Iuliu Vasilescu.

Experience

IBM Research Zürich, Switzerland
Research Intern Sept. 2022 - Feb. 2023

- Use Neural Radiance Fields to inspect civil infrastructure for defects in the 3D domain and segment the defects on the surfaces.

Adobe Bucharest, Romania
Software Engineering Intern Jul. 2019 - Oct. 2019

- Build the Frontend Regression Validator (FRED), a tool that uses deep learning for visual regression testing the layout of a website between deployments.
- Deploy FRED using Docker and build a web-based graphical user interface.

Sparktech Software Bucharest, Romania
Software Engineering Intern Jul. 2018 - Oct. 2018

- Use NLP to build a recommender system for users in a social media platform designed for researchers.
- Use Kafka and Redis to connect the inference process between backend and frontend.

Awards

Participant at the Romanian National Mathematics Olympiad 2014, 2015

3rd place at the Robotics Student Science Fair 2017

» 3rd place (individual) out of 10+ students in teams of 1-5 people.
» Built a system that a drone can use to plot its trajectory using optical flow, combining data from several sensors using a Kalman filter.

Student Scholarship 2017, 2018
Scholarship awarded in my BSc by the university for academic performance.

References

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

Prof. Francesco Orabona, KAUST
Contact: francesco@orabona.com

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

Prof. Ghislain Fourny, ETH Zürich
Contact: gfourny@inf.ethz.ch