RUMEN RUMENOV DANGOVSKI

Email: rumenrd@mit.edu Website: http://super-ms.mit.edu/rumen.html GitHub: rdangovs Orcid: 0000-0003-0814-8934

EDUCATION

Massachusetts Institute of Technology Feb 2019 - Jun 2023 (Expected)
PhD., M.S. EECS, advised by Prof. Marin Soljačić (Condensed Matter Theory) GPA: 4.8 (out of 5.0)
· Work on **principled** deep learning. Optimizing models on **noisy** data with less compute, fewer labels and more interpretability.
· Applications to ML optimization, NLP, computer vision, materials design, radiology, symbolic regression, economic models.
· Select Coursework: Optimization for ML, Inference and Information, Bayesian Modelling, Meta Learning.

Massachusetts Institute of Technology Graduated June 2018
B.S. Mathematics, B.S. Physics, Minor: Economics GPA: 4.7 (out of 5.0)
· Select Coursework: Grad ML, Stat Mech, Discr Prob, Compl Analysis, Game Theory, Grad Quantum Mech, Theory of Comp

EXPERIENCE

Meta Platforms Inc. May 2022 - Aug 2022
Software Engineering Intern – Supervised by Dr. Daniel Li, Research and Engineering Manager *New York, NY*
· Reducing the size and latency of **large pre-trained transformer speech models** by a **x30** factor.
· Contributed efficient models (about 2K lines of code) to the AI speech **production infra** of Meta's repository.

Lightelligence Inc. Jun 2018 – Feb 2019
AI Research Scientist – Supervised by Dr. Yichen Shen, CEO *Boston, MA*
· Joined the company at its early operations. Assisted **building the Algorithms team from scratch**;
· Developed and supported the **MNIST demo with CNN** for the first optical AI accelerator chip (press release).
· Built **high-performing kernels for optical deep learning ops** using the Eigen C++ library.

CERN, CMS (The European Organization for Nuclear Research) June – Aug 2016
Summer Data Analyst – Supervised by Dr. Chris Seez, Research Manager *Geneva, Switzerland*
· Identified a **bias problem in Monte Carlo simulations** and improved efficiency.
· Created tools for histograms in ROOT to **analyze detector's data to assist the analysis** of the 750GeV diphoton excess.

Undergraduate Research Opportunities Program (UROP) and Research Science Institute (RSI) 2016 - Pres.
Research Mentor and Project Supervisor *MIT, Cambridge, MA*
· Mentored **more than 20** high school and undergraduate students on topics in mathematics, machine learning and physics.
· Students **admitted at MIT and Stanford**, earned US Presidential fellowships and **won awards** at RSI, EUCYS and ISEF.

SELECT PUBLICATIONS

For a full up-to-date list of all 25+ electronic articles, see my Google Scholar.

Learning to Optimize Quasi-Newton Methods Nov 2022
Isaac Liao, ***Rumen Dangovski****, Jakob Foerster, Marin Soljačić* *Submitted to ICLR 2023.*
· **Learning an optimizer** for optimizing neural networks with theoretical guarantees.

On the Importance of Calibration in Semi-Supervised Learning Nov 2022
Charlotte Loh, ***Rumen Dangovski****, Shivchander Sudalairaj et al.* *Submitted to ICLR 2023.*
· Developing **approximate Bayesian techniques** for **calibrating** semi-supervised learning methods.

Equivariant Contrastive Learning Nov 2021
Rumen Dangovski*, Li Jing, Charlotte Loh, Seungwook Han et al.* *Published at ICLR 2022.*
· Training neural networks **without human annotation** by encouraging equivariance to certain transformations.

Surrogate- and Invariance-boosted Contrastive Learning for Data-scarce Applications in Science Oct 2021
Charlotte Loh, Thomas Christensen, ***Rumen Dangovski****, Samuel Kim et al.* *Published at Nature Communications.*
· Improving **data-scarce applications** in science with a new, efficient method for training neural networks.

We Can Explain Your Research in Layman's Terms: Towards Automating Science Journalism at Scale Feb 2021
Rumen Dangovski*, Michelle Shen, Dawson Byrd, Li Jing et al.* *Published at AAAI 2021.*
· New dataset and advances in **neural network training for abstractive summarization** of scientific articles to press releases.

Rotational Unit of Memory: A Novel Representation Unit for RNNs with Scalable Applications Feb 2019
Rumen Dangovski*, Li Jing, Preslav Nakov et al.* *Published at Transaction of the Association of Computational Linguistics.*
· New recurrent neural network with **long-term and associative** memory properties.

Weitzenböck Derivations of Free Metabelian Lie Algebras Feb 2013
Rumen Dangovski*, Vesselin Drensky and Şehmus Fındık* *Published at Linear Algebra and its Applications.*
· Understanding whether certain abstract algebras are finitely generated as vector spaces.

HONORS AND AWARDS

· **Extended Bulgarian Team for IOI** – Among the top 12, competing for the national team (of 4) for IOI. Spring 2012
· **Second Place (Silver Medal) at the National Informatics Olympiad, division B**. May 2012
· **Intel ISEF** (Second Place Category in Mathematics) – Awarded for my work at RSI 2013. May 2014
· **RSI** (Top 5 scholars for Outstanding Written Work) – Project on identities of certain abstract algebras. Summer 2013
· **John Atanasoff Awards** (Debut Category) – Awarded by the President of Bulgaria for contributions to EECS. Oct 2019

SKILLS

· **Coding** – Python, C/C++, Mathematica; PyTorch, JAX, TensorFlow, Numpy SkLearn, Pandas; unix, SLURM; LaTeX.
· **Teaching** – TA for MIT's 6.867 Graduate Machine Learning Class in Fall 2020; leading Sunday taekwondo practice at MIT.
· **Leading** – MIT Bulgarian and Korean Karate Clubs President; MLxMIT and MIT AI Physics Representative.