Mattia Opper

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mopper97.github.io

Experience:

Researcher (Contract via Allegis), Microsoft Research (Part-Time, Remote)
10.2024 - 02.2025

- Focussing on reasoning and generalisation in decoder only transformers
- Designed novel attention mechanism that improves long context utilisation and length generalisation

Research Intern, Microsoft Research (Full-Time, Redmond WA)
06.2024 - 09.2024

- Contributed to the development of a programming language which represents transformer information flow and allows us to model what kinda of reasoning LLMs are theoretically capable of representing
- Created a theoretical model of scratchpad (i.e., chain-of-thought) symbolic reasoning in transformers
- Mentored by Paul Smolensky and Roland Fernandez

Research Scientist, Popoulos Analytics (Part-Time, Remote)
09.2023 - 09.2024

- Developed LLM based legal agents
- Utilised domain specific finetuning, multilingual transfer and agentic graph RAG to create specialised models for the Danish legal domain

Machine Learning Engineer, Edina (Part-Time, Edinburgh)
09.2022 - 06.2024

- Developed a NLP tool to help automate systematic reviews for academic researchers
- Tool utilises RAG, Named Entity Recognition and Classification and has been successfully applied across several academic disciplines including engineering, veterinary science and medicine

Education:

PhD Machine Learning / NLP, University of Edinburgh 2022 - 2026

- Focussing on using cognitively inspired inductive biases to make ML architectures that are more efficient and interpretable (learning graph structures and representations)
- Supervised by Siddharth Narayanaswamy and Ivan Titov

MSc Speech and Language Processing, University of Edinburgh
2020- 2021, Grade: Distinction (4.0 GPA)

Publications:

TRA: Better Length Generalisation with Threshold Relative Attention
M.Opper, R.Fernandez, P. Smolensky, J.Gao - **TMLR**

Banyan: Improved Representation Learning with Explicit Structure
M.Opper, N.Siddharth - **ICML 25**

Mechanisms of Symbol Processing for In-Context Learning in Transformer Networks
P.Smolensky, R.Fernandez, ZH.Zhou, **M.Opper**, J.Gao - **JAIR**

Compositional Generalisation Across Distribution Shifts With Sparse Tree Operations
P.Soulos, H.Conklin, **M.Opper**, P.Smolensky, J.Gao, R.Fernandez - **NeurIPS 24** (Spotlight)

Making Self-Structuring AutoEncoders Learn More with Less
M.Opper, N.Siddharth - **SemEval 24**

StrAE: AutoEncoding for Pre-Trained Embeddings using Explicit Structure
M.Opper, V.Prokhorov, N.Siddharth - **EMNLP 23** (Main)

On the Effect of Curriculum Learning with Developmental Data for Grammar Acquisition
M.Opper, J.Morrison, N.Siddharth - **CoNLL 23** (BabyLM)

Skills:

Technical: Python, Java, Pytorch, Transformers, Geo-Opt, DGL, Langchain, NLTK, Spacy, Prodigy
Languages: English (fluent), German (fluent), Serbian (fluent), Spanish (B1)