Theo **Olausson**

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Summary

PhD student and **Presidential Fellow** at MIT with an exceptional academic record and **3+ years of experience in research**. Interested in the intersection of **programming languages** and **machine learning**, e.g. neuro-symbolic approaches to program synthesis, probabilistic programming, and applying techniques from symbolic methods to build ML-based systems which are safe, transparent, and reliable.

Education

Massachusetts Institute of Technology — *Cambridge, MA, USA*
PH.D. IN COMPUTER SCIENCE — *September 2021 - May 2027 (Expected)*

- Member of Professor Arvind's group in the Computer Science and Artificial Intelligence Lab
- In the early stages of several projects at the intersection of AI/ML/PL
- Research areas of interest include neuro-symbolic models, program synthesis, program embeddings, robustness and interpretability
- Taking classes in PL and algorithms for probabilistic inference

University of Edinburgh — *Edinburgh, United Kingdom*
MASTER OF INFORMATICS, FIRST CLASS (HONOURS) — *September 2016 - May 2021*

- Graduated **rank 1** out of the entire cohort
- Coursework highlights:
  - Natural Language Understanding, Generation, and Machine Translation: Built a transformer-based neural machine translation system. Learned about self-supervised training and fine-tuning of large language models such as GPT and BERT, and applying these to downstream tasks such as summarization and semantic parsing.
  - Types & Semantics for Programming Languages: Formalized PL theory such as properties of the typed and untyped lambda calculi in the theorem prover Agda.
  - Machine Learning Practical: Deep learning with PyTorch. Constructed, trained and optimized deep CNNs and ResNets for various computer vision tasks. Later carried out a substantial group project investigating image recognition techniques for memory-constrained devices, which lead to a publication (see next page).

Research Experience

Institute for Computing Systems Architecture, Univ. of Edinburgh — *Edinburgh, United Kingdom*
RESEARCH ASSISTANT — *March 2020 - May 2021, May 2018 - August 2018*

- Member of the Consistency, Availability, Persistency via Synthesis group led by Dr. Vijay Nagarajan
- Conducted research into design automation & debugging aids for cache coherence protocols

Arm — *Cambridge, United Kingdom*
RESEARCH INTERN, MEMORY & SYSTEMS ARCHITECTURE — *June 2019 - August 2019*

- Developed a novel method for verifying the Armv8 Memory Persistency Model
- Implemented the method into the in-house memory model verification tool suite
- Gave an hour-long talk on my research, which was open to all staff in Arm's research division

Skills

PROGRAMMING LANGUAGES Python OCaml Haskell C/C++ Kotlin Java

TOOLS/FRAMEWORKS Git VCS Linux PyTorch Murphi Coq Agda

THEORY Deep Learning Probabilistic Graphical Models Lambda Calculus Type Theory Game Theory

LANGUAGES English (fluent) Swedish (native)

Awards, Studentships & Grants

2021	**Presidential Fellowship**, Massachusetts Institute of Technology	*$92,123*
2020	**ICSA Studentship**, Institute for Computing Systems Architecture, Univ. of Edinburgh	*£25,620*
2016/7	**Grants for Pursuing Further Education Abroad**, Hempel Foundation	*€3,500 + €2,000*

Teaching & Service

Winter '21	**Vice President of Student Life**, EECS Graduate Student Association, MIT
Fall '18	**Tutor**, Informatics 1 – Introduction to Computation, Univ. of Edinburgh

Publications

Peer Reviewed Papers

S. Müksch*, **T. Olausson***, J. Wilhelm*, P. Andreadis. Benchmarking the Accuracy of Algorithms for Memory-Constrained Image Classification. The First Workshop on Edge Computing and Communications (EdgeComm) at the Fifth ACM/IEEE Symposium on Edge Computing (SEC 2020), San Jose CA, November 11-13, 2020. *Note: * = **co-first author**.*

This paper compared several different approaches to memory-constrained image classification from across the literature. Architectures considered ranged from decision trees to gated recurrent and convolutional neural networks. I pre-processed the dataset, added several regularization techniques to the models discussed, implemented the Multi-FastGRNN model discussed in the paper, and designed and ran all RNN-related experiments.

Preprints

S. Müksch*, **T. Olausson***, J. Wilhelm*, P. Andreadis. Quantitative Analysis of Image Classification Techniques for Memory-Constrained Devices. arXiv preprint 2005.04968, May 2020. Available online: `https://arxiv.org/pdf/2005.04968.pdf`. *Note: * = **co-first author.***

This is a longer version of the workshop paper presented at SEC'20.

Dissertations

T. Olausson. Generating Gem5 Cache Coherence Controllers from Atomic Specifications. Master of Informatics (Part 2) dissertation, School of Informatics, University of Edinburgh, May 2021.

Extended the ProtoGen cache coherence protocol synthesis tool with a compiler targeting gem5. This enabled users to rapidly develop protocols which were not only correct, but also efficient. The generated protocols even supported advanced features such as DMA, and thus allowed for full system simulation (e.g. booting a Linux kernel and executing arbitrary workloads).

T. Olausson. Towards the Automatic Synthesis of Cache Coherence Protocols. Master of Informatics (Part 1) dissertation, School of Informatics, University of Edinburgh, May 2020. **Nominated for best undergraduate dissertation.**

Investigated bugs in cache coherence protocol designs. Invented, implemented and evaluated two novel heuristic methods for bug localisation. Our results indicated that the two methods were able to identify bugs in protocols at a finer granularity than is done with standard model checking engines, thus relieving the programmer of some of the debugging burden.