Robert Bayer

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Skills

Research Interests — computer system performance and optimization, scalable machine learning, ML for systems, systems for ML, hardware acceleration

Education

08/2023 – 07/26 (expected) — **Ph.D.,** IT University of Copenhagen, Denmark
Thesis title: *Machine Learning on Resource-Constrained Hardware*
Supervised by: prof. Pinar Tozün
Current research topics: Performance analysis of complex ML pipelines, Smart resource management for edge ML, ML-enabled satellites

09/2021 – 06/2023 — **M.Sc. Computer Science,** IT University of Copenhagen, Denmark
Thesis title: *Techniques for Increasing Efficiency of Intel Neural Compute Stick 2.*

09/2018 – 06/2021 — **B.Sc. Data Science,** IT University of Copenhagen, Denmark
Thesis title: *Optimizing Resource Utilization of Sparse Neural Network Inference on FPGAs.*

Work Experience

01/2022 – 07/2023 — **Research Assistant,** IT University of Copenhagen, Denmark

- Designed and implemented an ML-based data reduction system for small satellites, reducing data transmission size by over 67%, leading to space deployment in April 2023. [1]
- Analyzed performance of machine learning tasks on edge devices and the differences to performance analysis on large-scale ML systems. [2]

01/2020 – 12/2021 — **Senior Software Engineer,** GlycoSpot, Denmark

- Led the engineering efforts, which led to a 10x size reduction of a standard spectrophotometer, enabling field deployment of enzyme activity measurement devices in agricultural and biotech settings, improving data collection efficiency. [3], [4]
- Oversaw the development of a cross-platform mobile application using Bluetooth LE for real-time control of the device, enabling seamless user interaction and reducing operational setup time by 50%.

10/2017 – 12/2019 — **Software Engineer,** GlycoSpot, Denmark

11/2016 – 06/2017 — **Full-Stack Web Developer,** upvision., Slovakia

- Designed and maintained a web platform serving over 10,000 users at the Slovak Economics University, a website for GQ magazine Portugal and a taxi-hailing mobile application.

Miscellaneous

Awards and Achievements

2023 **Best Computer Science Master Thesis in Denmark Award**

Teaching Experience

2024 Internet of Things, CubeSat 101, Master's / bachelor's thesis supervision

2023 Internet of Things, Master's thesis supervision

Invited Talks

2024 From Image Analysis in Space to Complex ML Pipelines at the Edge, **Microsoft GSL Talk Series**

From Image Analysis in Space to Complex ML Pipelines at the Edge, **Google Compiler ML Forum**

Shipping up to Space, **HPTS**, Gong Show

No Resource Left Behind: Machine Learning at the Edge, **EuroSys**, Doctoral Workshop

2023 Image Analysis in Space and Hardware Efficiency, **Center for Climate IT**, Denmark

Image Analysis in Space, **AI Pioneer Center**, Denmark

Publications

Conference Proceedings

1. **R. Bayer**, J. Priest, and P. Tözün, "Reaching the edge of the edge: Image analysis in space," in *Proceedings of the Eighth Workshop on Data Management for End-to-End Machine Learning*, ser. DEEM '24, , Santiago, AA, Chile, Association for Computing Machinery, 2024, pp. 29–38, ISBN: 9798400706110. DOI: 10.1145/3650203.3663330.

2. **R. Bayer**, J. V. Tøttrup, and P. Tözün, "TPCx-AI on NVIDIA Jetsons," in *Performance Evaluation and Benchmarking*, R. Nambiar and M. Poess, Eds., ser. Lecture Notes in Computer Science, Cham: Springer Nature Switzerland, 2023, pp. 49–66, ISBN: 978-3-031-29576-8. DOI: 10.1007/978-3-031-29576-8_4.

Patents

1. J. Schückel, **R. Bayer**, R. Parés Viader, *et al.*, "Enzyme activity assay systems and methods," U.S. Patent 2023313263A1, Jun. 25, 2021.

2. J. Schückel, **R. Bayer**, R. Parés Viader, *et al.*, "System and method for determining enzyme activity in grain material," U.S. Patent 2023272451A1, Jun. 25, 2021.