Daniel Becking (he/him)

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Working Experience

- **Fraunhofer Heinrich-Hertz-Institute (HHI)** *2019-present*
  Ph.D. Candidate & Research Associate (full-time since 2020), Student Research Assistant (part-time 2019) Berlin
  – Efficient Deep Learning Group (Artificial Intelligence Dept.)
  – Research: Neural data compression, efficient transmission of neural data, explainable AI
  – Activities: Project management, standardization, supervision, software development and maintenance

- **Fraunhofer Institute for Reliability and Microintegration (IZM)** *2014-2019*
  Student Research Assistant (part-time) Berlin
  – Sensor Nodes & Embedded Microsystems Group (RF & Smart Sensor Systems Dept.)
  – Activities: System development of (wireless) multi-sensor nodes

Education

- **Technical University of Berlin** *2021-present*
  Doctoral Degree
  – Compression Methods for Neural Network Data & Efficient Neural Compressors

- **Technical University of Berlin** *2016-2020*
  M.Sc., Biomedical Engineering
  – Thesis: Finding Storage- and Compute-Efficient Convolutional Neural Networks
  – Project: Deep learning-based prediction of swallowing events from bioimpedance and EMG signals
  – Founding member of the student initiative "SEI - socially engaged engineers"

- **HTW Berlin** *2012-2016*
 *B.Eng., Microsystems Technology*

Projects / Activities

- **Standardization activities in the Moving Picture Experts Group (MPEG)** *2020-present*
  Contribution to the Neural Network Coding (NNC) ISO/IEC 15938-17 standard
  – Proponent and (co-)author of several adopted technologies and high-level syntax, including quantization parameter optimization, sparsification methods, temporal coding tools for the DeepCABAC entropy encoder, federated BatchNorm folding, filter re-scaling, parameter update tree
  – Organization and evaluation of core experiments and author of the NCTM conformance test and reference software

- **Efficient Federated Learning for Autonomous Network Cells** *2024-present*
  Technology exploration project together with a German telecommunications company

- **Berlin Digital Rail Operations (BerDiBa)** *2020-2024*
  Project leader on behalf of the consortium partner Fraunhofer HHI, Artificial Intelligence Dept.
  – Efficient semantic segmentation of photo/video recordings on the edge for autonomous trains
  – Development of XAI-assisted neural network compression methods

- **MicroNet Challenge - scored among Top-5 with "EC2T: Entropy-constrained Trained Ternarization"** *2019*
  Hosted at NeurIPS, organized by Google, DeepMind, OpenAI & Facebook

- **Supervision**
  – K. Ton-That's Master Thesis, "Explainability-driven Quantization Methods for LLMs" (*2024-present*)
  – N. Harder's Master Thesis, "Mixture-of-Relevant-Experts" & Relevant Low-Ranks for LLMs (*2022-present*)
  – K. Kutzke's Bachelor Thesis "Knowledge Distillation for Compression of Semantic Segmentation Networks" (*2022*)

Relevant Publications

[1] D. Becking, K. Müller, P. Haase, H. Kirchhoffer, G. Tech, W. Samek, H. Schwarz, D. Marpe, and T. Wiegand, "Neural network coding of difference updates for efficient distributed learning communication," *IEEE Transactions on Multimedia*, vol. 26, pp. 6848–6863, 2024.

[2] D. Becking, P. Haase, H. Kirchhoffer, K. Müller, W. Samek, and D. Marpe, "NNCodec: An open source software implementation of the neural network coding ISO/IEC standard," in *ICML 2023 Workshop Neural Compression: From Information Theory to Applications [spotlight]*, 2023.

[3] D. Becking, M. Dreyer, W. Samek, K. Müller, and S. Lapuschkin, "ECQ^x: Explainability-Driven Quantization for Low-Bit and Sparse DNNs," in *xxAI - Beyond Explainable AI, Lecture Notes in Computer Science (LNAI Vol. 13200), Springer International Publishing*, 2022, pp. 271–296.

[4] D. Becking, H. Kirchhoffer, G. Tech, P. Haase, K. Müller, H. Schwarz, and W. Samek, "Adaptive differential filters for fast and communication-efficient federated learning," in *Proc. of the IEEE/CVF Conf. on Computer Vision and Pattern Recognition (CVPR) Workshops [oral]*, 2022, pp. 3367–3376.

[5] S. Wiedemann, S. Shivapakash, D. Becking, P. Wiedemann, W. Samek, F. Gerfers, and T. Wiegand, "FantastIC4: A hardware-software co-design approach for efficiently running 4bit-compact multilayer perceptrons," *IEEE Open Journal of Circuits and Systems*, vol. 2, pp. 407–419, 2021.

[6] P. Haase, D. Becking, H. Kirchhoffer, K. Müller, H. Schwarz, W. Samek, D. Marpe, and T. Wiegand, "Encoder optimizations for the NNR standard on neural network compression," in *2021 IEEE Int. Conf. on Image Processing*, 2021, pp. 3522–3526.

[7] A. Marban, D. Becking, S. Wiedemann, and W. Samek, "Learning sparse & ternary neural networks with entropy-constrained trained ternarization (EC2T)," in *Proc. of the IEEE/CVF Conf. on Computer Vision and Pattern Recognition (CVPR) Workshops [oral]*, June 2020.

Find the complete list on Google Scholar ⑤.

Miscellanea

- **Reviewing:**
  - Journals:
    * IEEE Transactions on Neural Networks and Learning Systems (TNNLS)
    * Elsevier Pattern Recognition
    * IEEE Open Journal of Circuits and Systems (OJCAS)
  - Conferences: IEEE International Conference on Image Processing (ICIP)

- **Languages:**
  - German (native)
  - English (C)

- **Personal Interests:**
  - Collecting and playing records; visiting record stores around the world
  - Synthesizers & electronic music history