

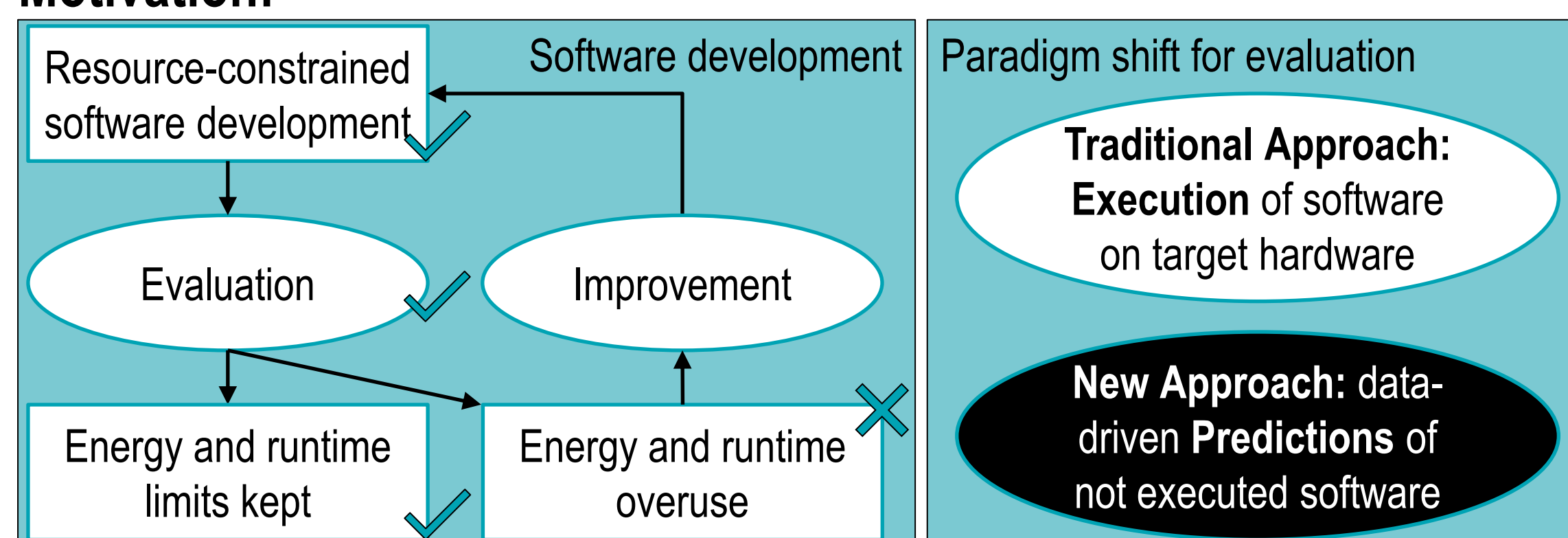
NN-Based Energy and Runtime Estimation of Software Execution

Maximilian Krentzien, Marc Reichenbach

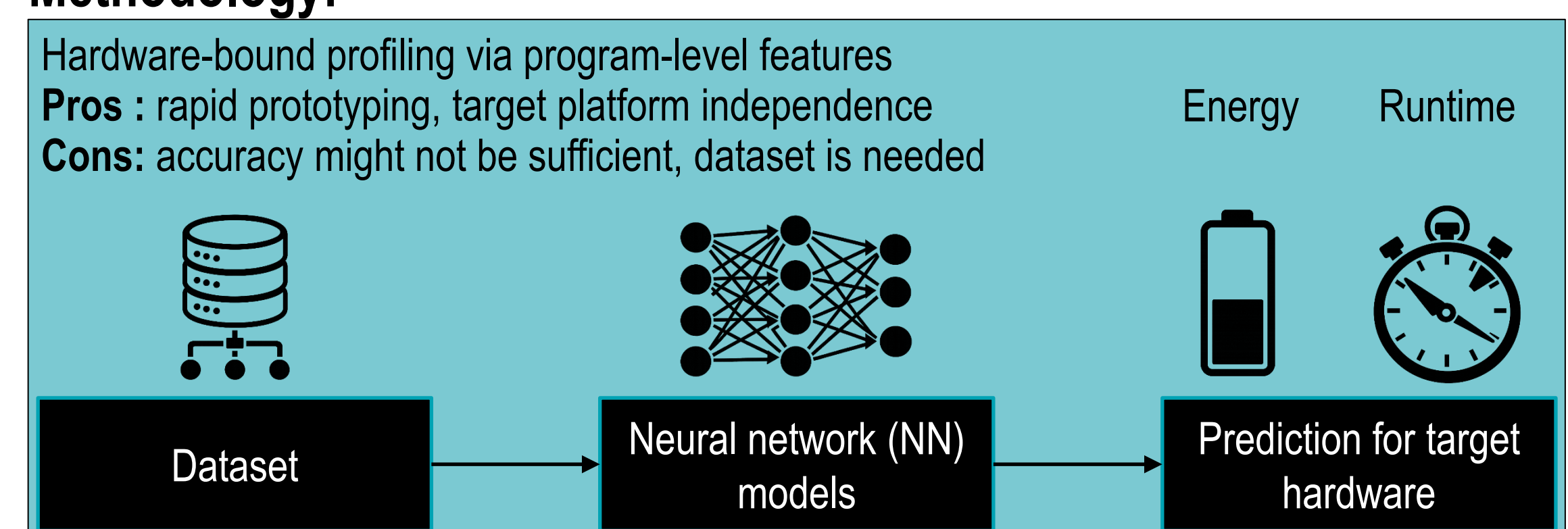
Resource Constrained Software Development

Paradigm Shift to Neural-Network-Based Estimation

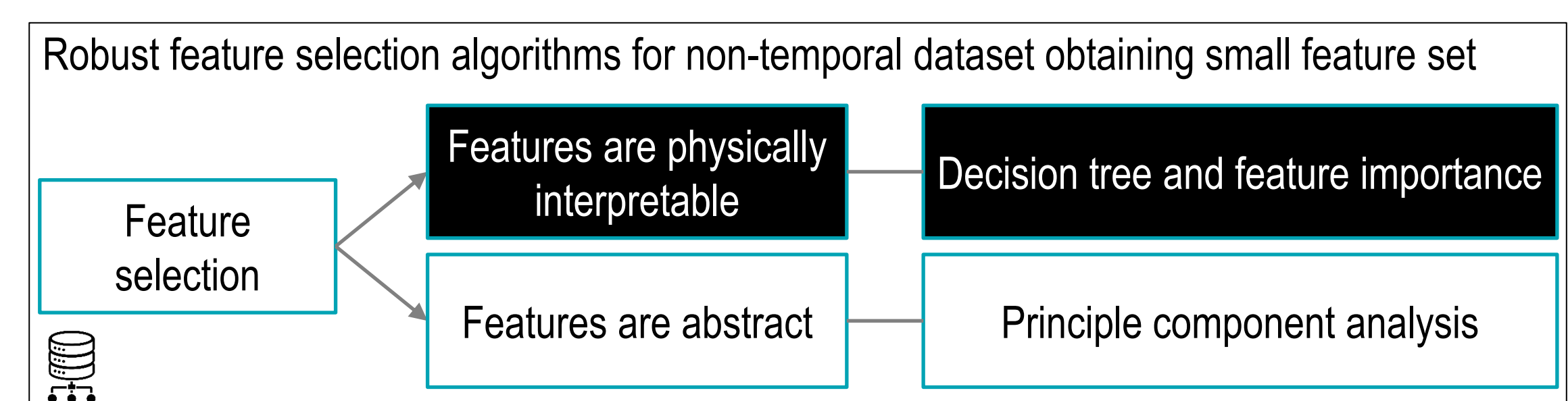
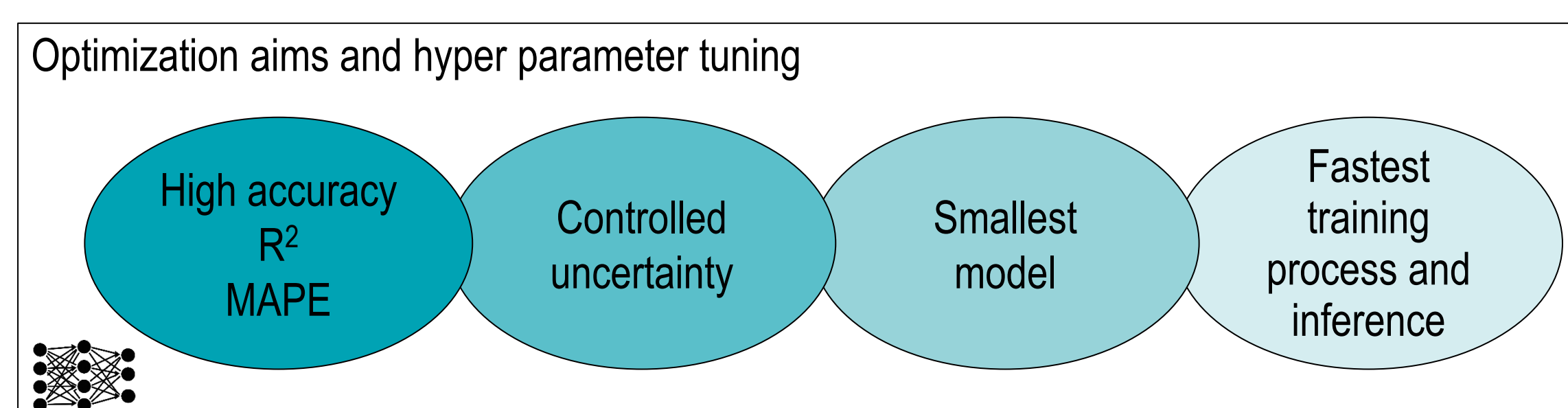
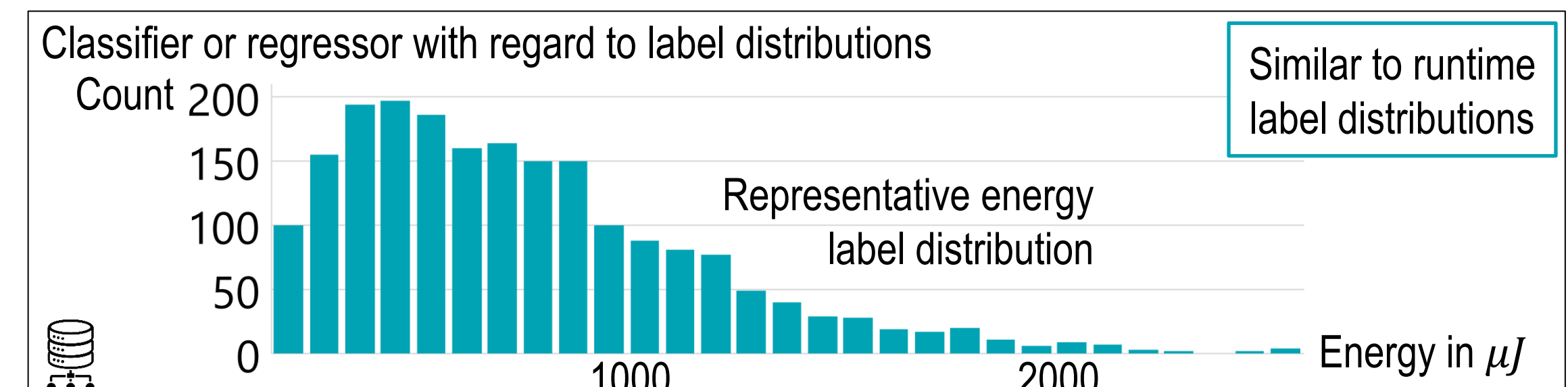
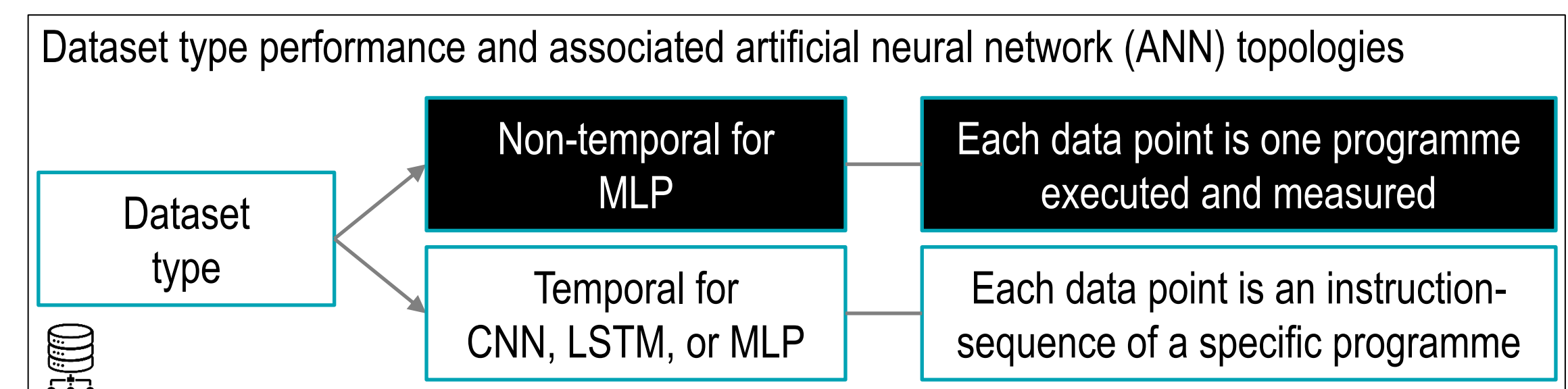
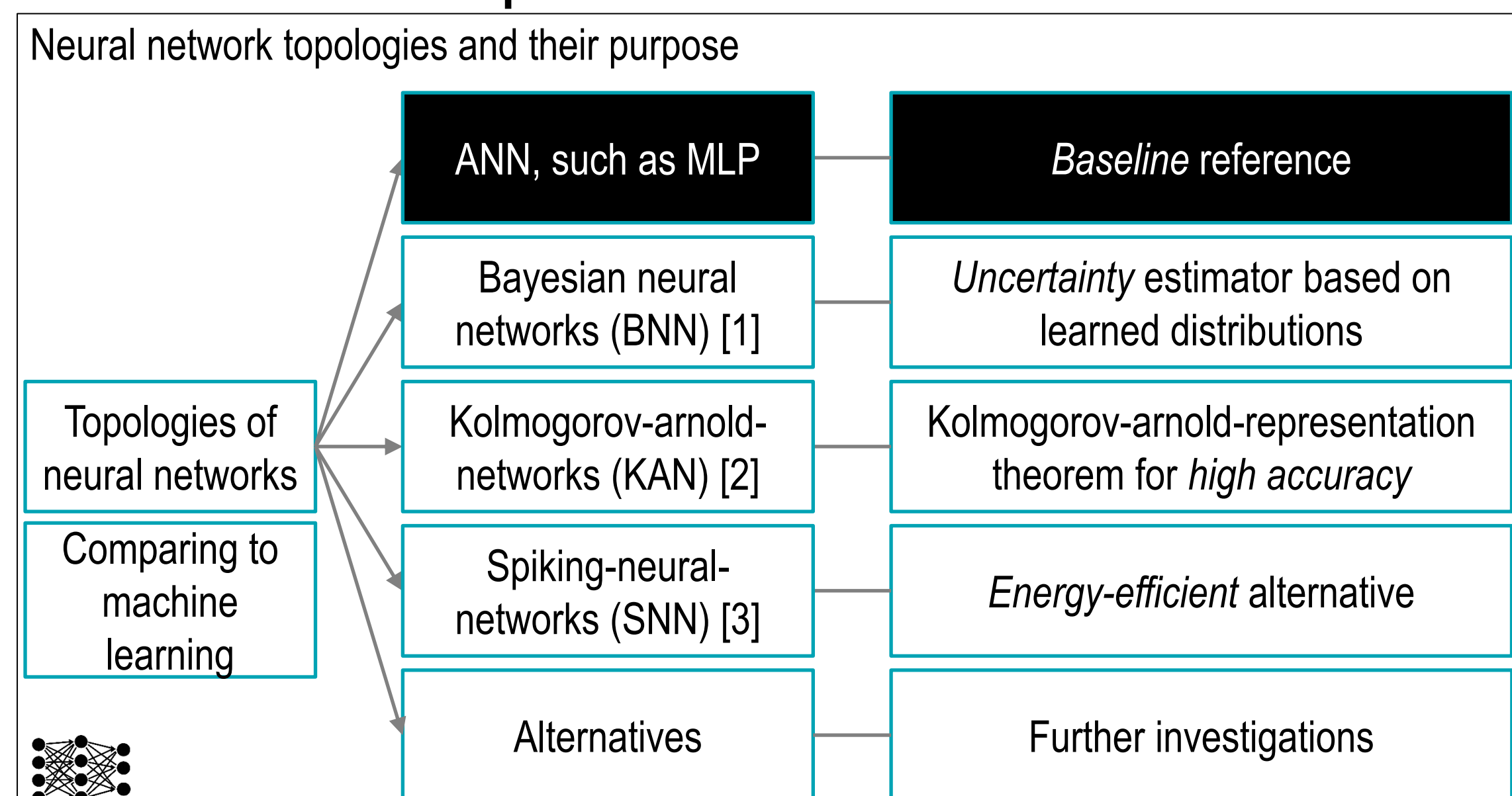
Motivation:



Methodology:



Selected Research Aspects:

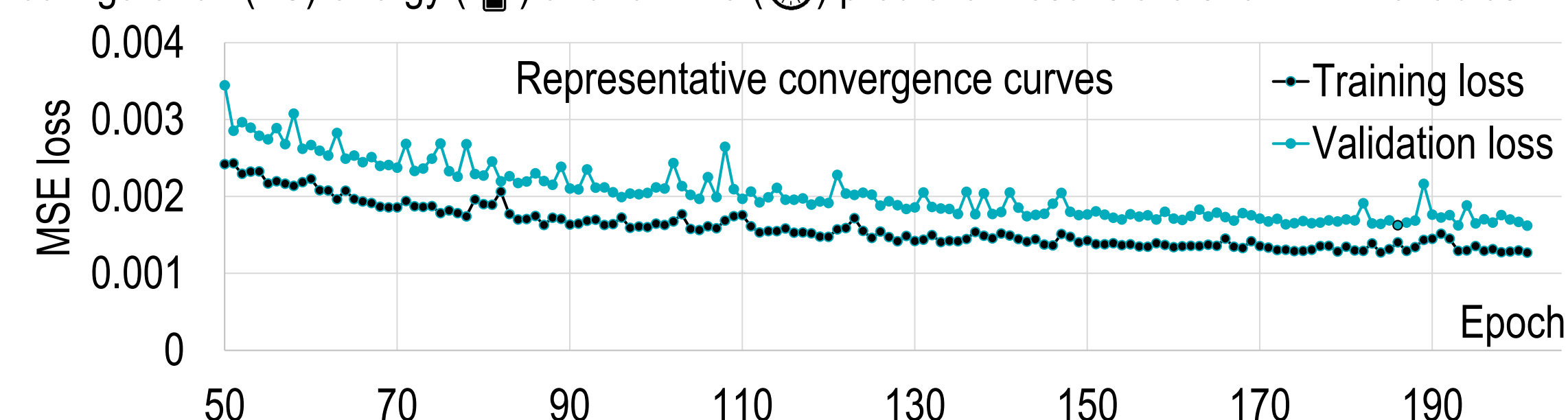


Results:

ESP32-C6 HP models	FC1	FC2	FC3	FC4	FC5	Final
Label						
Early stopping in epoch	121	114	427	504	430	568
Final best epoch	106	99	412	489	415	553
R² for best model [%]	99.5	99.9	99.8	100	99.6	99.8
MAPE for best model [%]	3.5	2.4	1.8	0.4	2.0	0.4

Ban. Pi BPI-F3 models	FC1	FC2	FC3	FC4	FC5	Final
Label						
Early stopping in epoch	259	251	363	423	442	367
Final best epoch	244	236	348	408	427	352
R² for best model [%]	94.9	94.4	95.4	95.7	96.4	95.8
MAPE for best model [%]	9.3	10.1	7.9	7.9	7.5	8.1

Model: MLP with fully-connected layers of the sequence 21-ReLU, 15-ReLU, 10-ReLU, 5-ReLU, and 1-linear for 21 features, more than 2000 data points, with Adam optimizer, learning rate of 0.001, early stopping, and the mean-squared-error (MSE) loss function. Per-fold-configuration (FC) energy () and runtime () prediction results are shown in the tables.



Conclusion and Future Work:

The models are *sufficient* for energy and runtime prediction specific for the selected target hardware presented. Further steps will address the research aspects presented.

Key References:

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- [2] Shriyank Somvanshi, Syed Aaqib Javed, Md Majharul Islam, Debasish Pandit, and Subasish Das, "A Survey on Kolmogorov-Arnold Network," *arXiv.org*, 2024, doi:10.48550/ARXIV.2411.06078.
- [3] João D. Nunes, Marcelo Carvalho, Diogo Cameiro, and Jaime S. Cardoso, "Spiking Neural Networks: A Survey," *IEEE Access*, vol. PP, 2022, doi: 10.1109/ACCESS.2022.3179968.



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