Bachelor's / Master's / Semester Project

Machine-Learning Assisted Intelligent Architectures

Modern processors employ numerous human-driven policies such as prefetching, cache-replacement, data management, and memory scheduling. These techniques rely on statically chosen design features that favor specific workload and/or device characteristics over the other. However, the complexity of designing a highly-effective, high-performance, efficient policy, which can effectively adapt to the changes in workload behavior for a broad range of workloads, usually is well beyond human capability. Yet, these policies have been traditionally designed and dictated by human architects [2]. Therefore, it is necessary to develop machine-learning-assisted policies that can provide a near-ideal, robust improvement across varying workloads and system conditions.

You will work with other researchers to develop, implement, and evaluate machine learning-based techniques for different aspects of computer architecture. In our group, we have demonstrated the benefits of designing machine learning-based techniques for computing systems such as using reinforcement learning (RL)-based memory scheduler [1] that can significantly outperform a human-designed memory scheduler; and the use of supervised learning [3] to enable fast early-stage design space exploration without having to rely on time-consuming simulations.

Requirements:

- Programming experience in C++ and Python
- Experience using machine learning packages (PyTorch, TensorFlow)
- Experience in deep learning or reinforcement learning
- Computer architecture background
- An interest in developing and evaluating new ideas
- Self-motivated and strong work ethics

For background and example past studies, please see:

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