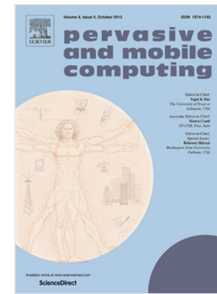


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Optimizing the Performance of Sensor Network Programs through Estimation-Based Code Profiling

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Abstract

With the development of sensor technology and embedded systems, building large-scale, low-cost sensor networks, which is a critical step to facilitating the application of pervasive sensing in the future, becomes possible. One of the major challenges in developing sensor network applications is to improve the execution efficiency of programs running on power-constrained embedded devices. While profiling-guided code optimization has been widely used as a compiler-level optimization technique for improving the performance of programs running on general-purpose computers, it has not been applied to sensor network programs due to some defects. In this paper, we overcome these defects and design a more effective profiling-guided code placement approach for sensor network programs. Specifically, we model the execution of sensor network programs taking nondeterministic inputs as discrete-time Markov processes, and propose a novel approach named *Code Tomography* to estimate parameters of the Markov models that reflect sensor network programs' dynamic execution behaviors by only using end-to-end timing information measured at the start and end points of each procedure in the source code. The parameters estimated by *Code Tomography* are fed back to compilers to optimize the code placement. The evaluation results demonstrate that *Code Tomography* can achieve satisfactory estimation accuracy with low profiling overhead and the branch misprediction rate can be reduced after reorganizing the code placement based on the profiling results. Besides, *Code Tomography* can also be useful for purposes such as post-mortem analysis, debugging and energy profiling of sensor network programs.

Keywords:

Code Profiling, Compiler Optimization, Sensor Network Program

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