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Title:

Parallel Sparse Fourier Transform on Multicore and Manycore Architectures

Abstract:

The Fast Fourier Transform (FFT) is one of the most important numerical algorithms widely used in many scientific and engineering applications. The algorithm performs $O(N \log N)$ operations on N input data points in order to calculate only small number of K large coefficients, while the rest of $N - K$ numbers are zero or negligibly small. The algorithm is clearly inefficient, when the output is sparse in the transformed domain. The sparse FFT (sFFT) algorithm provides a solution to this challenge. Since sFFT is a fairly new numerical algorithm and it is of key importance to numerous scientific applications, it is a natural path to enhance its performance through parallel computing techniques on state-of-the-art parallel multicore and manycore architectures. In this presentation, we explore the challenges and propose effective solutions to port sFFT to three parallel architectures including multicore CPUs, GPGPUs and heterogeneous multicore embedded systems. The experiment results show that the parallel sparse FFT algorithm largely outperforms the state-of-the-art FFT libraries.

Bio:

Cheng is a Ph.D. candidate in HPCTools Group of Department of Computer Science at University of Houston, advised by Dr. Barbara Chapman. His main research interests are high-performance computing, parallel programming and big data analytics. Cheng is also particularly interested in performance optimizations for irregular and sparse applications.. He received his Bachelor degree in Telecommunication Engineering at Xidian University in 2010.