VirginiaTech
VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

Computer Science Seminar Series, 2010

National Capital Region

The Kronecker Product:

On ways to verify and optimize Tensor operations in languages like MATLAB

Speaker: Prof. Lenore Mullin
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Friday, April 23, 2010
1:00PM- 2:00PM, NVC 325

Abstract

The pervasiveness of matrix decompositions and tensor operations in knowledge representation, and the sciences: biological, chemical, physical, have renewed an interest in domain specific algorithms. Consequently, there also exists a renewed interest in domain specific computing: libraries (Flame), languages (Spiral), symbolic/numeric computing, expression templates, compilers, operating systems, and processor/memory hierarchies. The transformational nature of matrix (2-d tensors) operations and tensor operations in general, pro- vides a prudent, hopeful, and deterministic way to reason about computation. The determinism arises from the data structure, i.e. memory layout (contiguous), and the linear (and multiinear) operations applied to the data structure. It also comes from using the same tensor operations to abstract the processor/memory/network hierarchy. This talk will discuss how to optimize multiple Kronecker Products using A Mathematics of Arrays and Psi Calculus, an algebra of multi-dimensional arrays and an index calculus. Ways to augment existing languages will also be discussed.

Biography

Prof. Mullin is a leading expert in array-based High Performance Scientific Computing. Her main contributions to the field include the development of an array formalism known as the Mathematics of Arrays (MoA), and later Conformal Computing; theoretical tools to aid in the reasoning and efficient manipulation of array-based computations. From October 2006 to January 2010, Dr. Mullin was a member of CISE as the Program Director for Theoretical Foundations in Numeric, Symbolic and Algebraic Computing and Optimizations. Mullin, also a professor of Computer Science and Physics, came to the University at Albany, SUNY, in 1995 with NSF's Presidential Faculty Fellow (PFF), which allowed her to begin both an UG and Graduate program in Computational Science and High Performance Scientific Computing. Before joining academia she spent 14 years at IBM TJ Watson Research Center as both an applications and systems programmer in the APL Design Group and Real Time Speech Recognition Group. She spent a post doc at Oxford University and sabbatical at MIT Lincoln Laboratory supported by DARPA's Polymorphic Computing Architecture (PCA) project. Her degrees are in Mathematics Education, Solid State Physics-Materials Science and Computer Science.