

Title: Spatial Query Processing on Brain Simulation Data

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Abstract: Detailed analysis of experimental and simulation data is at the heart of today's eScience; the problem, however, is that our ability to process data does not scale with its increasing size, density, and complexity. A striking instance is brain simulation studies that produce data of arbitrary density and potentially unlimited size. Applications that require efficient access to the data are bounded by the lack of efficient spatial data structures. In this talk, I will describe the major challenges when processing queries on brain simulation data; I will then present a novel spatial index that defies density, a novel prefetching algorithm that follows neuron navigation patterns, and some other techniques, with which we were able to simulate a meaningful percentage of the human brain as well as access arbitrary brain regions fast, independently of increasing data size or density.

Bio: Anastasia Ailamaki is a Professor of Computer Sciences at the Ecole Polytechnique Federale de Lausanne (EPFL) in Switzerland. She earned her Ph.D. in Computer Science from the University of Wisconsin-Madison in 2000. Her research interests are in database systems and applications, and in particular (a) in strengthening the interaction between the database software and emerging hardware and I/O devices, and (b) in automating database management to support computationally-demanding and demanding data-intensive scientific applications. She has received a Finmeccanica endowed chair from the Computer Science Department at Carnegie Mellon (2007), a European Young Investigator Award from the European Science Foundation (2007), an Alfred P. Sloan Research Fellowship (2005), eight best-paper awards at top conferences (2001-2012), and an NSF CAREER award (2002). Her Ph.D. student Ryan Johnson received the 2012 ACM SIGMOD Dissertation Award. She is a senior member of the IEEE and a member of the ACM, and has also been a CRA-W mentor.