**Marts 2009**

**MADALGO seminar by Kasper Dalgaard Larsen, Aarhus University**

**Towards Optimal Three-Dimensional Range Search Indexing**

Abstract:

In this talk I will show how we improve both the upper and lower bounds for three-dimensional range search indexing, the problem of storing a set of points in three dimensions such that the points in a three-dimensional axis-parallel query hyper-rectangle can be found efficiently.

I first describe a disk based index structure for three-dimensional range searching that answers queries in optimal $O(\log_B N+T/B)$ I/Os using $O(N (\log N/(\log\log_B N))^3)$ space, where B is the disk block size, N the number of points, and T the query output size. The previously best known structure uses $O(N (\log N)^3)$ space. I will also describe improved structures for several infinite range variants of the problem.

Next I will show how we apply the theory of indexability to show that any d-dimensional range search index answering queries in $O(PolyLog N+T/B)$ I/Os has to use $Omega(N (\log N/(\log\log_B N))^{(d-1)})$ space. The previously best known lower bound was $Omega(N (\log B /(\log\log_B N))^{(d-1)})$ space.

Our results narrows the space gab between the lower and upper bound to a factor of $\log N/\log\log_B N$, thus moving us closer to optimal three-dimensional range search indexing.

Joint work with: Lars Arge