

Kernel matrix-vector multiplication, e.g. in Gaussian process prediction

Idea: Skilling's fast iterative method for Gaussian processes requires the multiplication $\underline{K} \underline{w}$, where \underline{K} is the kernel matrix and \underline{w} is an arbitrary vector (can contain negative values).

We can do this case with more complication.
No space to show it here.

Multipole methods

Idea: Use truncated series expansion to capture higher moments beyond centroid.
Developed for physics simulations. e.g.:

- Fast multipole method (Greengard&Rokhlin 1987)

Can be interpreted as a kind of dual-tree with certain cached sufficient statistics, but uses less adaptive hierarchical grid and non-recursive non-adaptive control flow. Uses spherical harmonics, but can be formulated with Cartesian Taylor expansions.

Main problem: $O(p^D)$.