Senior Thesis

Robert Taintor
Advisor (Dan Rockmore)

Efficient Hermite Transforms

Abstract

In this paper we present an algorithm that for the efficient computation of a Discrete Hermite Transform and its inverse. Because the Hermite functions are well-behaved under rotation, this transform has applications to protein structure determination and image processing. Our result takes a function evaluated at 2n+1 uniform points and computes the first n Hermite coefficients in $O(n \log^2 n)$ time by manipulating the 3-term recurrence satisfied by the Hermite polynomials. We also provide an implementation of this algorithm and analyze it in terms of stability, speed, and scalability.