



The University of Chicago
Departments of Computer Science,
Mathematics, and Statistics

Scientific and Statistical Computing Seminar

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Stable Computation with Reproducing Kernels

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133 Eckhart Hall, 5734 S. University Avenue (unless announced otherwise).

ABSTRACT

Positive definite kernels and their associated reproducing kernel Hilbert spaces provide a very flexible and powerful tool for the solution of many typical problems of numerical analysis and scientific computing such as function approximation, numerical integration or the numerical solution of PDEs. I will provide a brief introduction to positive definite reproducing kernels, mention some typical applications, and then focus on stable computation with Gaussian kernels. The latter is motivated by the fact that, on the one hand, interpolation with flat Gaussian kernels provides a generalization of (multivariate) polynomial interpolation with spectral convergence rates for smooth functions, while, on the other hand, flat Gaussian kernels lead to notoriously ill-conditioned linear systems. Our work demonstrates that this so-called *uncertainty principle* can be avoided by representing the space of functions used for the approximation by a “better” basis. A set of MATLAB routines implementing these ideas for Gaussian kernels have been developed together with Mike McCourt.

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