Minisymposium 13 - Approximationsmethoden für Probleme auf der Sphäre

Fast summation of radial functions on the sphere

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Radial functions are a powerful tool in many areas of multidimensional approximation, especially when dealing with scattered data. We present a fast approximate algorithm for the evaluation of linear combinations of radial functions on the sphere $\mathbb{S}^2$. The approach is based on a particular rank approximation of the corresponding Gram matrix and fast algorithms for spherical Fourier transforms. The proposed method takes $\mathcal{O}(L)$ arithmetic operations for L arbitrarily distributed nodes on the sphere. In contrast to other methods, we do not require the nodes to be sorted or pre-processed in any way, thus the pre-computation effort only depends on the particular radial function and the desired accuracy. We establish explicit error bounds for a range of radial functions and provide numerical examples covering approximation quality, speed measurements, and a comparison of our particular matrix approximation with a truncated singular value decomposition.
This talk is based on joint work with J. Keiner (University of Lübeck) and S. Kunis (Chemnitz University of Technology).