Veranstaltungen im Wintersemester 2018/19

Das zweiunddreißigste Treffen des Rhein-Main Arbeitskreises findet am

Freitag, den 01. Februar 2019

an der

Universität Siegen, Department Mathematik,
Emmy-Noether-Campus(ENC),
Walter-Flex-Straße 3,
Großer Hörsaal ENC-D 114.

statt.

Programm

15:00 Uhr: Prof. Dr. Markus Bachmayr (Universität Mainz)
Stability of Low-Rank Tensor Representations and Structured Multilevel Preconditioning for Elliptic PDEs
Folding grid-value vectors into high-order tensors in combination with low-rank representation in the tensor-train format leads to highly efficient approximations for various classes of functions. These include solutions of elliptic PDEs on nonsmooth domains or with oscillatory data, for which simple discretizations parametrized by low-rank tensors have been shown to result in highly compressed, adaptive approximations. Straightforward choices of the underlying basis, such as piecewise multilinear finite elements on uniform tensor product grids, lead to the well-known matrix ill-conditioning of discretized operators. We demonstrate that for low-rank representations, the use of tensor structure can additionally lead to representation ill-conditioning, a new effect specific to computations in tensor networks. We then show that the issues of matrix ill-conditioning and representation ill-conditioning can be circumvented simultaneously by combining classical ideas of multilevel preconditioning and more recent techniques for the low-rank representation of matrices. Specifically, we construct an explicit tensor-structured representation of a BPX preconditioner with ranks independent of the number of discretization levels. Combined with a carefully constructed representation of differentiation and L^2-projection, it allows to avoid both matrix and representation ill-conditioning. Numerical tests, including problems with highly oscillatory coefficients, show that our result paves the way to reliable and efficient solvers that remain stable for mesh sizes near machine precision with up to 10^{15} nodes in each dimension.
This is joint work with Vladimir Kazeev.

15:45 Uhr: Tee/Kaffee

16:15 Uhr: M. Sc. Lukas Sawatzki (Universität Marburg)
Coorbit Theorie und ihr Kern-Problem
Since the 1980's the coorbit theory provides a unified approach to certain function spaces and atomic decompositions.

At the heart of this theory we always find a transform acting on L_2-functions, e.g. the wavelet, shearlet or Gabor transform. These transforms always have an underlying group structure and are strongly connected to square-integrable representations of these groups. With the help of these transforms we can now define associated smoothness spaces, where smoothness is measured by the decay properties of the so-called voice transform of given functions. In this manner we obtain a unified approach to define function spaces suitable for certain transforms. Additionally, by discretizing the representation, we can find atomic decompositions and Banach frames for these spaces. An application of the coorbit theory to the wavelet transform gives us, e.g., the well-known homogeneous Besov spaces.
In the coorbit theory an integral kernel, also called reproducing kernel, plays a fundamental role, and in the classical case it is assumed to be integrable. Unfortunately, this assumption is not always fulfilled. It is nevertheless possible to define meaningful coorbit spaces also in this setting. However, the atomic decomposition of these spaces and the construction of Banach frames call for additional assumptions on the integral kernel.

17:00 Uhr: Prof. Dr. Michael Möller (Universität Siegen)
Optimization Problems in Machine Learning Applications
Machine learning algorithms, most prominently techniques under the name of deep learning, are currently dominating many computer vision benchmarks. The success of such methods largely depends on the ability to train the desired network architectures, i.e. optimize the sum over millions of cost functions each of which is a deeply nested function of the desired parameters to optimize for. In this talk I will introduce some of our research on the efficient solution of such optimization problems including recent work on bi-level optimization problems.

anschließend: Nachsitzung im Früh bis spät, Fürst-Johann-Moritz-Str. 3, 57072 Siegen (ca. um 18:00 Uhr). Rückmeldung hierzu bitte spätestens bis zum Freitag, 18. Januar 2019 an Frau Mielke (mielke@mathematik.uni-siegen.de).

Informationen zur Anreise finden Sie auf dieser Seite.