



Einladung zum Oberseminar Mathematik des Maschinellen Lernens und Angewandte Analysis

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Gradual smoothing effects

How does the regularity of solutions to diffusion equations improve as time goes by? For the heat equation the answer is well known: solutions become smooth instantaneously. At the other extreme, if the Laplacian is replaced by a bounded operator, solutions do not improve at all and keep the regularity of the initial datum.

In this talk we explore what happens in between, namely for nonlocal operators whose kernel behaves like $|x - y|^{-N}$ at short distances, which we call 0^+ -order operators; a typical example is $\log(I - \Delta)$. In this case a rather unusual behaviour emerges: the regularity of solutions improves gradually over time. First they improve in integrability, eventually belonging to every L^p space with p finite; then they become bounded; and finally, under appropriate conditions, they start gaining differentiability. A key idea is that this gain of integrability is equivalent to a family of logarithmic Sobolev inequalities. Since such inequalities are energy estimates, they pass easily from the model case $\log(I - \Delta)$ to any operator with a comparable kernel; as a by-product, we obtain logarithmic Sobolev inequalities in settings not previously considered in the literature. We also show that this gradual behaviour is exclusive to 0^+ -order operators: more singular kernels produce instantaneous smoothing, while less singular ones fail to produce any significant regularization.

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Zu diesem Vortrag laden wir Sie herzlich ein.

gez. Leon Bungert