FRIEDRICH-ALEXANDER
UNIVERSITÄT
ERLANGEN-NÜRNBERG

TECHNISCHE FAKULTÄT

Elektrotechnik-Elektronik-Informationstechnik

EEI KOLLOQUIUM

Super-Resolution of Positive Sources

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Freitag, der 08.07.2016, 9^{30} Uhr
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Diskussionsleitung: Dr. R. Müller

The resolution of all microscopes is limited by diffraction. The observed signal is a convolution of the emitted signal with a low-pass kernel, the point-spread function (PSF) of the microscope. The frequency cut-off of the PSF is inversely proportional to the wavelength of light. Hence, the features of the object that are smaller than the wavelength of light are difficult to observe. In single-molecule microscopy the emitted signal is a collection of point sources, produced by blinking molecules. The goal is to recover the location of these sources with precision that is much higher than the wavelength of light. This leads to the problem of super-resolution of positive sources in the presence of noise. We show that the problem can be solved using convex optimization in a stable fashion. The stability of reconstruction depends on Rayleigh-regularity of the support of the signal, i.e., on how many point sources can occur within an interval of one wavelength. The stability estimate is complemented by a converse result: the performance of the convex algorithm is nearly optimal. I will also give a brief summary on the ongoing project, developed in collaboration with the group of Prof. W.E. Moerner, where we use the theoretical ideas to improve microscopes.