Super-resolution and sensor calibration in imaging

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We consider source localization where a uniform array of sensors is set to collect propagating waves from a finite number of sources located on a continuous domain. The resolution of standard algorithms is limited by the Rayleigh length. Many interests in imaging center on inventing super-resolution algorithms that can resolve sources separated below the Rayleigh length. In this talk we will present the super-resolution limit of this problem, which is the relation between the number of sources and the noise level for which super-resolution is possible. In literature, many algorithms, such as MUSIC and ESPRIT, are well known for super-resolution, but their resolution limit has not been justified. We will characterize the resolution limit of MUSIC and provide a rigorous proof. We next study sensor calibration in source localization where each sensor has an unknown calibration parameter. Our goal is to use the measurements to recover the calibration parameters and the sources simultaneously. We will present the identifiability of the calibration problem, together with some algorithms with performance guarantees.