Semiparametric point process modeling of blinking artifacts in photoactivated localization microscopy

Louis Gammelgaard Jensen

Aarhus University, Denmark, loga@math.au.dk

Photoactivated localization microscopy (PALM) is a powerful imaging technique for characterization of protein organization in biological cells. Due to the stochastic blinking of fluorescent probes, and camera discretization effects, each protein gives rise to a cluster of artificial observations. These blinking artifacts are an obstacle for quantitative analysis of PALM data, and tools for their correction are in high demand. We develop the Independent Blinking Cluster point process (IBCpp) family of models, and present results on the mark correlation function. We then construct the semiparametric PALM-IBCpp model for PALM data, and describe a procedure for estimation of blinking cluster parameters. We apply the model to real PALM data, and on simulated data, and consider the performance of the estimation procedures. Porous materials are widely used in industry, e.g., as packaging materials; in hygiene products; for pharmaceutical applications such as controlled drug release; and as electrodes controlling electrochemical processes in fuel cells and re-chargeable batteries. The properties of these materials (flow, diffusion and/or electrical conductivity) are determined by the 3D geometry of the pores. It is becoming more and more common to use 3D microscopy data of the material and models informed by that data when developing new materials. With this data, there is a need for new spatial statistical models that capture the features of the 3D geometry that are most relevant for the materials properties.