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Sequential Thinning subsampling method for learning Large-Size Latent-Marked Point Processes

In numerous fields, understanding the characteristics of a large-scale marked point process (called the ground process) is crucial, particularly when the marks are latent and can only be inferred through sampling. To achieve this, we need to gather an efficient sample, which involves thinning the ground process. To address this challenge, we introduce a sequential thinning approach tailored for diverse goals, such as estimating the mark distribution. For each objective, a loss function is defined on the space of thinnings of the ground process. Since this loss relies on unknown elements like the marks or the ground process, it remains unknown itself. We minimize this loss by sequentially minimizing an estimate of it. This involves coupling two distinct sequential thinning processes: initially employing uniform sampling for error estimation, followed by non-uniform sampling aimed at minimizing this estimated error. We illustrate our approach through a case study in plant disease surveillance. Here, the point process denotes the spatial locations of plants, with the binary mark indicating infection status. Our method facilitates the estimation of spatial mark distribution and the delineation of infected and non-infected regions.

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