Stat 534 Project: Point Process Intensity Surface Models

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1 Introduction

unobserved point processes – only observe events in subregions selected by practitioner but want to make inference about inhomogeneous intensity over entire region

know something is in the vicinity but want to know where specifically – examples: endangered clustered plant species in underbrush of thick forest, conservationists want to know where the clusters are; subsurface geomagnetic anomalies that could be unexploded ordnance – concerned with mapping the intensity of this realization, not estimating parameters of the process

2 Surface Fitting

Berman and Turner (1992), Diggle (2013), and Flagg (2016)

3 Simple Examples

log-linear example from HW4

simulate from
$$\log(\lambda(x, y)) = 5x + 2y; \quad (x, y) \in (0, 1)^2$$
but do not observe any events in $(0.5, 0.8)^2$. Then fit

$$\log(\lambda(x, y)) = \beta_0 + \beta_1 x + \beta_2 y$$
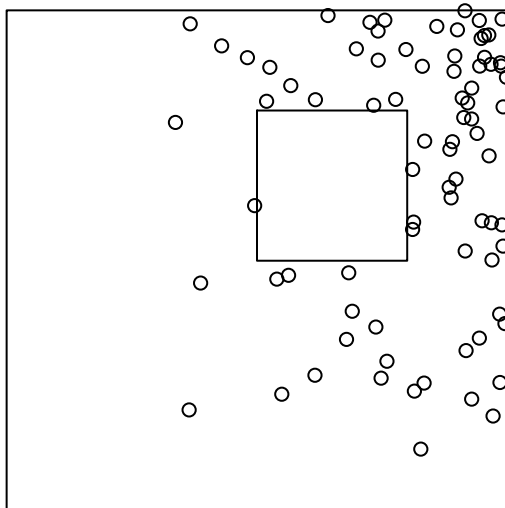
and predict on $(-0.5, 1.5)^2$.

Event Locations

Figure 1: One realization of the loglinear intensity on a subset of the unit square.

	Estimate	S.E.
$\widehat{\beta}_0$	0.09	0.55
$\widehat{\beta}_1$	4.58	0.56
$\widehat{\beta}_2$	2.29	0.42

Table 1: Estimated coefficients for the log-linear trend model.

$$\log\big(\hat{\lambda}(x,\,y)\big)$$ $$\log\big(\mathrm{SE}\big(\hat{\lambda}(x,\,y)\big)\big)$$
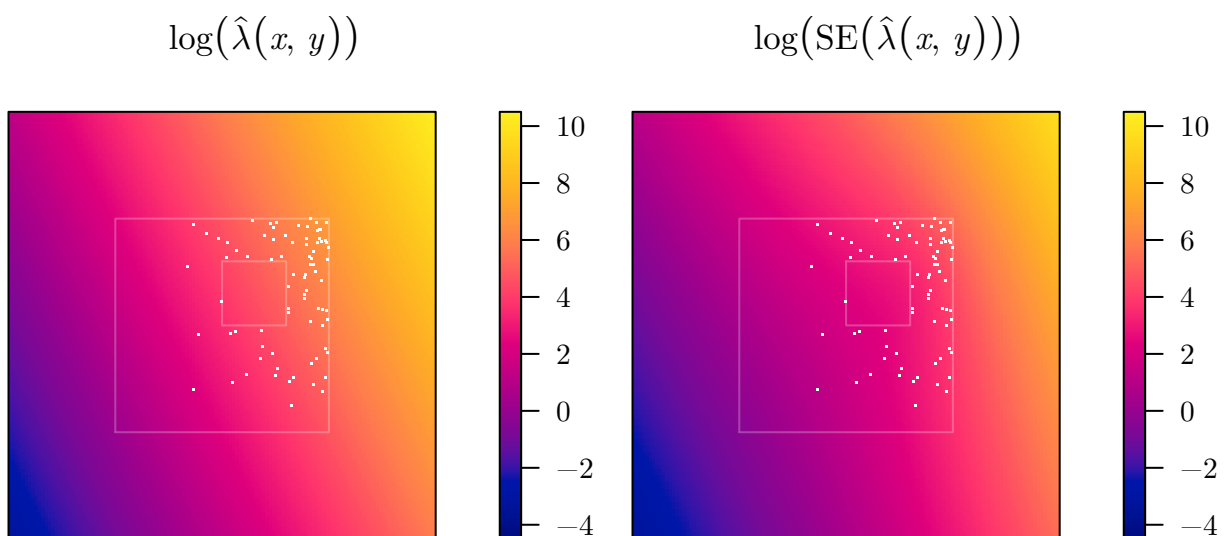

Figure 2: Estimated log-intensity surface and log-scale prediction standard errors.

easy site, realization 2,000, 390 ft spacing

4   Simulation Study

5   Discussion and Conclusion

A   R Code Appendix

References

Berman, Mark and Rolf Turner (1992). "Approximating point process likelihoods with GLIM". In: *Applied Statistics*, pp. 31–38.

Diggle, Peter J. (2013). *Statistical Analysis of Spatial and Spatio-Temporal Point Patterns.* 3rd ed. CRC Press.

Flagg, KA (2016). "Visual Sample Plan and Unexploded Ordnance: What do we need to know to find UXO?" M.S. writing project. Montana State University, Bozeman. URL: `https://github.com/kflagg/vspuxo`.