The LGCP package

Peter J Diggle

School of Health and Medicine, Lancaster University
and
Department of Epidemiology and Population Health, University of Liverpool

Overview

Package developed by Ben Taylor (Lancaster) with support from Tilman Davies (Otago), Barry Rowlingson and Peter Diggle (Lancaster)

- **inference for spatial and spatio-temporal log-Gaussian Cox processes**
- **second-order summary statistics**
- **plug-in prediction with minimum contrast parameter estimates**
- **new release will include multivariate processes and Bayesian methods for parameter estimation and prediction**

Gabriel E., Rowlingson B., Diggle P. (2013) stpp: An R package for plotting, simulating and analysing Spatio-Temporal Point Patterns. *Journal of Statistical Software*, **53, 1–29.**

Initialisation

```
# load required libraries
library(lgcp)
library(spatstat)
library(sp)
library(ncdf)
library(splancs)
#
# read data
ixyt<-read.table("../aegiss_ixyt.txt",header=T)
hampshire<-read.table("../aegiss_poly.txt",header=F)
```

Simple plotting

```
par(pty="s")
polymap(hampshire)
pointmap(ixyt[,2:3],pch=19,cex=0.25,add=T)
# simplified boundary will speed up some computations
# (not recommended in real applications)
poly<-getpoly()
win<-owin(poly=poly)
# extract first six months' data only, jitter to avoid duplicate
# locations and convert to kilometres
data<-ixyt[ixyt$t<=181,2:4]
data[,1]<-jitter(data[,1],amount=0.05)/1000
data[,2]<-jitter(data[,2],amount=0.05)/1000
tlim<-c(0,182)
xyt <-stppp(list(data=data,tlim=tlim,window=win))
par(mfrow=c(1,2),pty="s")
plot(xyt); plot(sort(xyt$t),1:length(xyt$t),pch=19,cex=0.5)
```

First moment properties

```
#
# estimate marginal spatial intensity (kernel estimator)
#
OW<-selectObsWindow(xyt,cellwidth=2) # grid-cells of width 2km
den <- lambdaEst(xyt,axes=TRUE)
plot(den)
#
# convert to spatial-at-risk object
#
sar <- spatialAtRisk(den)
#
# estimate temporal intensity (lowess of square-root-counts)
mut <- muEst(xyt,f=0.6)
plot(mut,ylim=c(0,10))
```

Spatial second moment properties

```
gin<-ginhomAverage(xyt,spatial.intensity=sar,
         temporal.intensity=mut,rvals=0.025*(0:250))
plot(gin$r,gin$iso,type="l",xlab="r",ylab="g(r)")
kin <- KinhomAverage(xyt,spatial.intensity=sar,
         temporal.intensity=mut,rvals=0.05*(0:250))
plot(kin$r,kin$iso-kin$theo,type="l",xlab="r",ylab="K(r)")
```

Minimum contrast estimation

```
#
# minimum contrast parameter estimation: new code for next
# release of lgcp
#
source("minimumContrast.R")
minc <- minimum.contrast.spatiotemporal(xyt, model="exponential",
        method="g",transform=log,spatial.dens=den,
        temporal.intens=mut)
```

Exercise. **Experiment with the AEGISS dataset:**

- **go to** `http://www.lancs.ac.uk/staff/diggle`
- **clink on spatial point pattern data-sets**
- **download the three AEGISS data-files**

Spatial and spatio-temporal prediction

- current release uses plug-in for model parameters
- prediciton compoutations are slow
- next release will include:
  - Bayesian estimation and prediction
  - multivariate models