

LGCP with PC priors

Patrick Brown

June 30, 2025

The data

```
library("geostatsp")
data('murder')
data('torontoPop')
murder = unwrap(murder)
torontoBorder = unwrap(torontoBorder)
torontoPdens = unwrap(torontoPdens)
torontoIncome = unwrap(torontoIncome)

covariates

theCrs = paste0("+proj=omerc +lat_0=43.7117469868935 +lonc=-79.3789787759006",
" +alpha=-20 +gamma=0 +k=1 +x_0=0 +y_0=0 +datum=WGS84 +units=m +no_defs")
murderT = project(murder, theCrs)
borderT = project(torontoBorder, crs(murderT))
borderC = crop(borderT, ext(-12700, 7000, -7500, 3100))

covList = list(
pop=torontoPdens,
inc = log(torontoIncome) )

formulaHere = ~ inc + offset(pop, log=TRUE)
```

LGCP with priors given by quantiles

gamma priors.

```
resG=lgcp(
formula = formulaHere,
data=murderT,
grid=squareRaster(borderC, 30),
covariates=covList,
```

```

border=borderC,
buffer=2000,
prior = list(
sd = c(lower = 0.2, upper = 2),
range = c(lower = 2, upper=20)*1000),
control.inla=list(strategy='gaussian'))

if(!is.null(resG$parameters)) {
knitr::kable(resG$parameters$summary, digits=3)
}

```

LGCP with penalised complexity prior

$pr(sd > 1) = 0.05$ and $pr(phi < 0.2) = 0.95$

```

resP=lgcp(formulaHere, data=murderT,
grid=squareRaster(borderC, 30),
covariates=covList,
border=borderC, buffer=2000,
prior = list(
sd = c(u=0.5, alpha=0.05),
range = c(u=10*1000, alpha = 0.4)),
control.inla = list(strategy='gaussian')
)

if(!is.null(resP$parameters)) {
knitr::kable(resP$parameters$summary, digits=3)
}

```

LGCP with table priors

```

sdSeq = seq(0,4,len=501)
rangeSeq = seq(0,15*1000, len=501)
resT=lgcp(formulaHere,
data=murderT,
grid=squareRaster(borderC, 30),
covariates=covList,
border=borderC, buffer=2000,
prior = list(
sd = cbind(sdSeq, dexp(sdSeq, 2)),
range = cbind(rangeSeq, dexp(rangeSeq, 1/5000))),
control.inla = list(strategy='gaussian')
)

```

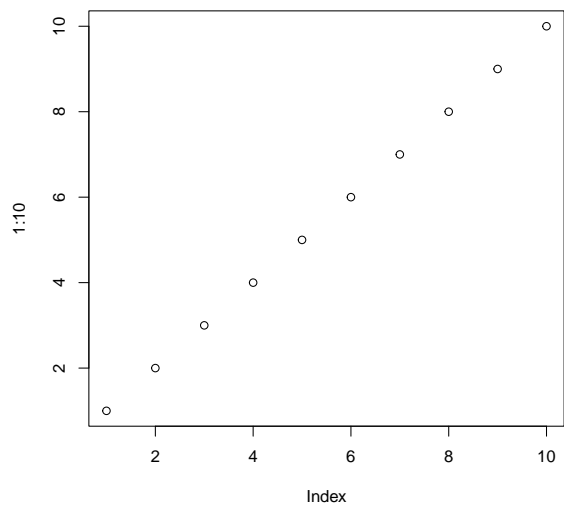


Figure 1: Priors and posteriors

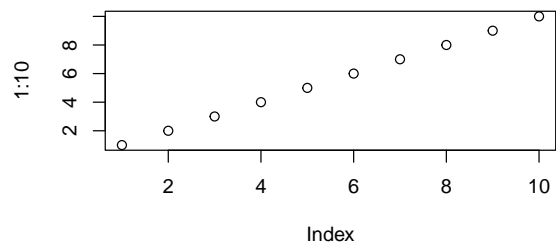


Figure 2: Random effects and fitted values

```
if(!is.null(resT$parameters)) {
knitr::kable(resT$parameters$summary, digits=3)
}
```

Maps