

## 311 Data Universal Kriging Report

### 1. Choosing semivariogram model

Codes for UK:

```
v <- variogram(num.incidents~population, dataset, cutoff=15000, width = 2000)
```

```
vm <- vgm(psill = 0.05, model = "Exp", range = 15000, nugget = 0.01)
```

```
vmf <- fit.variogram(v,vm)
```

```
dev.new()
```

```
plot(v, pl=T, model = vmf)
```

Replacing “Exp” with “Gau”, “Exc”, “Mat”, and etc. to find out the best model form, and the criterion is the goodness-of-fit by subjective visual assessment. Since “Exp” model fits well, and this model is also used in the codes provided, it is chosen as the best model.

### 2. UK variogram compared to OK variogram

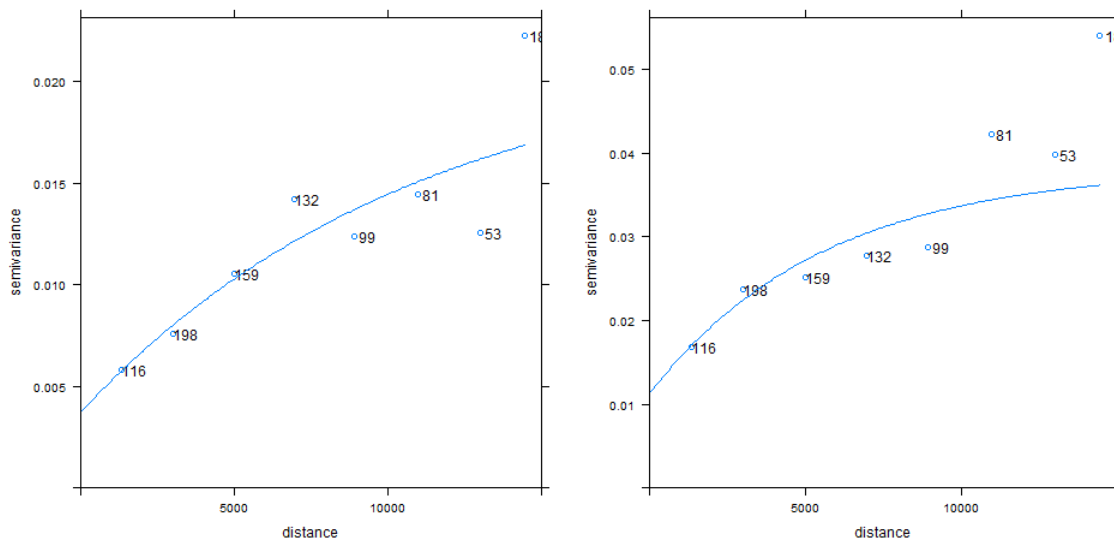


Figure 1, UK and OK variograms, from left to right

The UK variogram has lower sill and nugget, but larger range. Lower sill and nugget indicate that point pairs have different incidents also have different populations, the variances of incidents partly brought by the variances of populations; larger range means that point pairs are correlated through a longer distance.

### 3. UK prediction compared to OK prediction

Codes for UK:

```
x.range <- range(dataset@coords[,1])
y.range <- range(dataset@coords[,2])
grd <- expand.grid(x=seq(from=x.range[1], to=x.range[2], by=500),
y=seq(from=y.range[1], to=y.range[2], by=500) )
coordinates(grd) <- ~ x+y
gridded(grd) <- TRUE
krigpred <- krige(population~1, locations=dataset, newdata=grd, model=vmf)
a <- krigPred$var1.pred
grd <- expand.grid(x=seq(from=x.range[1], to=x.range[2], by=500),
y=seq(from=y.range[1], to=y.range[2], by=500) )
grd[“population”] <- a
coordinates(grd) <- ~ x+y
gridded(grd) <- TRUE
krigPred <- krige(num.incidents~population, locations=dataset, newdata=grd,
model=vmf)
print(plot(spplot(krigPred, "var1.pred", asp=1, col.regions=bpy.colors(64), main = "KED
prediction"))))
```

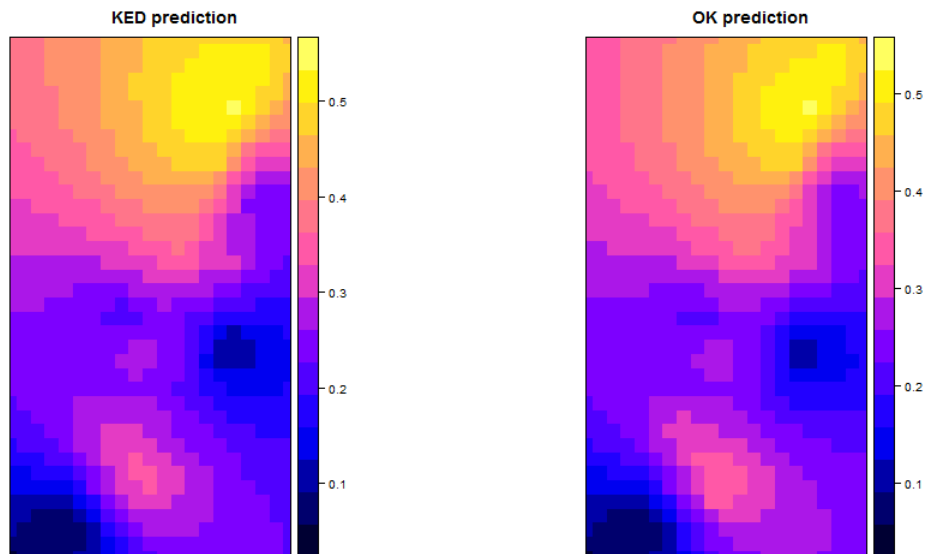


Figure 2, UK and OK predictions, from left to right

At first glance, the two predictions seem almost the same, but the “cold” and “hot” spots are a little bigger in UK prediction due to a larger range. Adding population attribute doesn’t make a big difference, because the population and incident almost follow the same pattern in the data. The plots are as following:

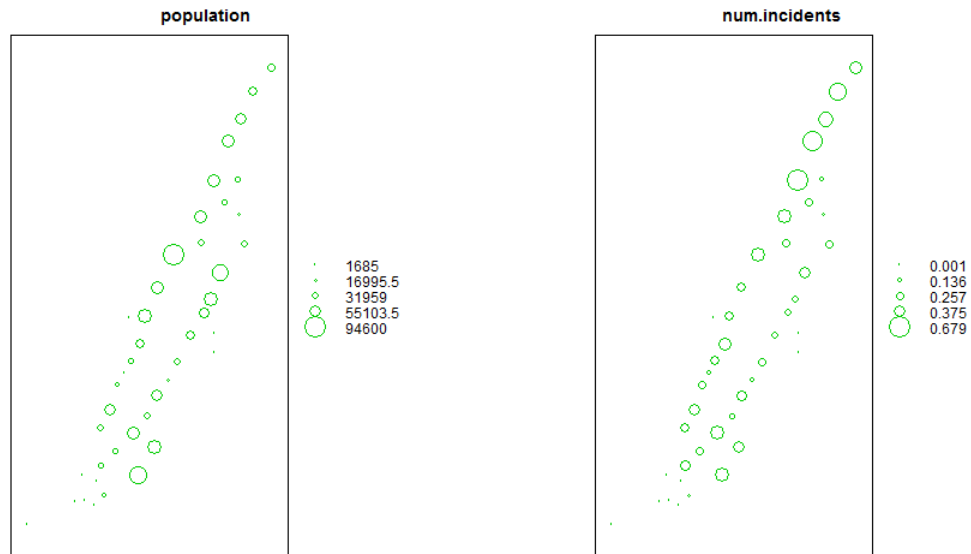


Figure 3, population and incident, from left to right

#### 4. UK variance compared to OK variance

Codes for UK:

```
print(plot(sppplot(krigPred, "var1.var", asp=1, main = "KED prediction variance")))
```

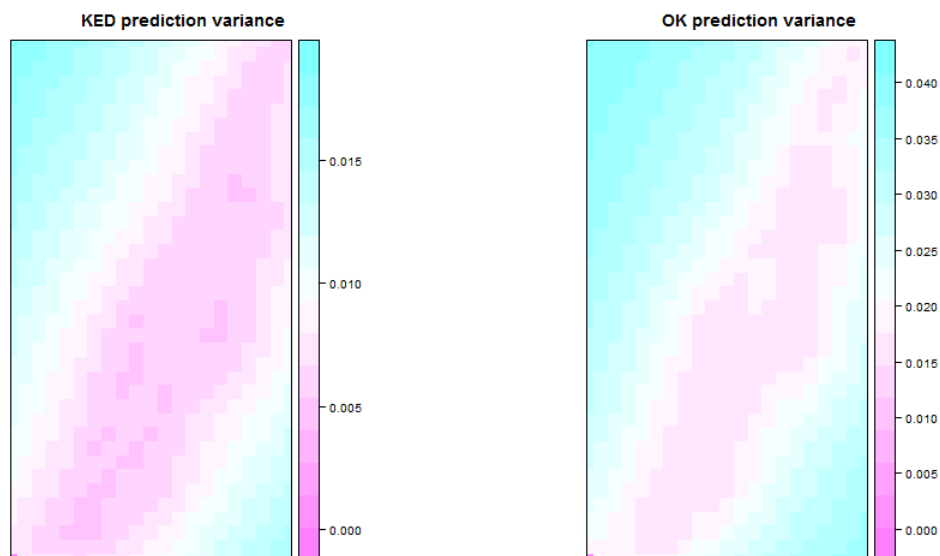


Figure 4, UK and OK variances, from left to right

In UK variance, the prediction variances become lower with the observation points, and a much larger area is covered since there are similar variances around grids with similar population.