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#This demo includes different types of kriging: block kriging, indicator kriging,
#simple kriging, and universal kriging

#setting the working directory where you store "barn.csv"
all <- read.csv("barn.csv", header=TRUE)
library(gstat)
library(sp)
coordinates(all) <- ~ East+North
var1 <- variogram(pH ~ 1, all)
plot(var1)
vgm1 <- vgm(0.35, "Exp", 2.5, 0.05)
plot(var1, vgm1)
var1.fit1 <- fit.variogram(var1, vgm1)
plot(var1.fit1)

data.grid <- expand.grid(x=seq(8.5,8.5,0), y=seq(10.5,10.5,0))
names(data.grid) <- c("X", "Y")
coordinates(data.grid) <- ~X+Y

# Here I will show the prediction using block kriging system is the same as
# the average of predictions at the discretized points using ordinary kriging
system

# compare the prediction of krig1_block and average of predictions of krig1

krig1_block <- krige(pH ~ 1, all, data.grid, model=var1.fit1, block=c(2,2),
set=list(nblockdiscr=3))
krig1_block

data.grid3 <- expand.grid(x=seq(7.833,9.167,0.667),y=seq(9.833,11.167,0.667))
coordinates(data.grid3) <- ~x+y
krig1 <- krige(pH ~ 1, all, data.grid3,model=var1.fit1)
krig1
summary(krig1)

# compare the prediction of krig2_block and average of predictions of krig2

krig2_block <- krige(pH ~ 1, all, data.grid, model=var1.fit1, block=c(2,2),
set=list(nblockdiscr=4))
krig2_block

data.grid4 <- expand.grid(x=seq(7.75,9.25,0.5),y=seq(9.75,11.25,0.5))
coordinates(data.grid4) <- ~x+y
krig2 <- krige(pH ~ 1, all, data.grid4, model=var1.fit1)
krig2
summary(krig2)

# start indicator kriging
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library(sp)
library(gstat)
#setting working directory where you store "barn.csv"
all <- read.csv("barn.csv", header=TRUE)
attach(all)

data.grid <- expand.grid(x=seq(8.5,8.5,0), y=seq(10.5,10.5,0))
names(data.grid) <- c("X", "Y")
coordinates(data.grid) <- ~X+Y

P_ind <- ifelse(all$P <= 1.6, 1,0)
# or all$P_ind <- ifelse(all$P <= 1.6, 1,0) you can continue to use "all" as
spatial dataframe

P_ind_df <- c(all$East, all$North, P_ind)
dim(P_ind_df) <- c(length(P_ind),3)
P_ind_df <- as.data.frame(P_ind_df)
names(P_ind_df) <- c("x", "y", "P_ind")
coordinates(P_ind_df) <- ~ x+y
var2 <- variogram(P_ind ~ 1, P_ind_df)
plot(var2)
vgm2 <- vgm(0.08, "Exp", 1, 0.05)
var2.fit <- fit.variogram(var2, vgm2)
var2.fit
plot(var2, var2.fit)
krig3 <- krige(P_ind ~ 1, P_ind_df, data.grid, model=var2.fit)
krig3

# The following are simple kriging and universal kriging
library(gstat)
library(sp)
data(meuse)

#Simple kriging
coordinates(meuse) <- ~ x+y
var1 <- variogram(log(zinc) ~ 1, meuse)
plot(var1)
vgm1 <- vgm(0.6, "Sph", 700, 0.05)
var1.fit <- fit.variogram(var1, vgm1)
plot(var1, var1.fit)
data(meuse.grid)
coordinates(meuse.grid) <- ~ x+y
simple1 <- krige(log(zinc) ~ 1, meuse, meuse.grid, var1.fit, beta=5.9)
spplot(simple1["var1.pred"])

# universal kriging
data(meuse)
data(meuse.grid)
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```
coordinates(meuse) <- ~x+y
coordinates(meuse.grid) <- ~x+y
gridded(meuse.grid) <- TRUE
var4 <- variogram(log(zinc) ~ sqrt(dist), meuse)
vt.fit <- fit.variogram(var4, vgm(1, "Exp", 300, 1))
lz.uk <- krige(log(zinc) ~ sqrt(dist), meuse, meuse.grid,vt.fit)
spplot(lz.uk["var1.pred"])
```