Group A15 Machine Learning Lab 3

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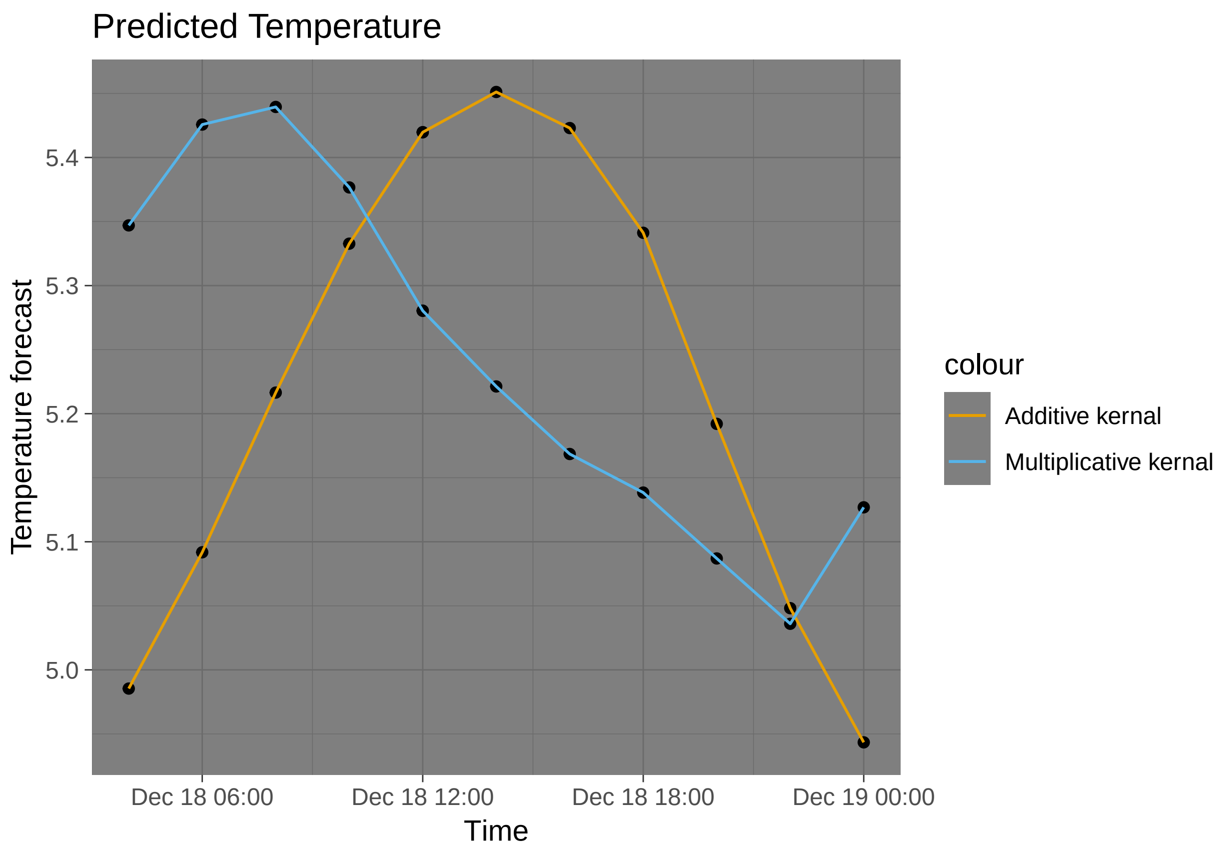
Assignment 1.

Kernal methods:



A distance of 25Kms is chosen, Since Sweden is close to the arctic circle the temperature fluctuations remain uniform over large distances.

The width of the distance for days is taken as 7 as people generally talk about the weeks weather. It is noticebly uniform in any given week.

The width of the distance for the hours is taken as 12 as the temperature during any given day is defined by night and day which is 2 groups out of 24.

Assignment 2

Support vector machines

```
##              Predicted svm
## Actual Test nonspam spam
```

```
##     nonspam    1346   56
##     spam        155  744
```

```
## [1] "The misclassificaiton rate is 0.0916992611907866"
```

```
##            Predicted svm
## Actual Test nonspam spam
##     nonspam    1340   62
##     spam        131  768
```

```
## [1] "The misclassificaiton rate is 0.0838765754019991"
```

```
##            Predicted svm
## Actual Test nonspam spam
##     nonspam    1336   66
##     spam        125  774
```

```
## [1] "The misclassificaiton rate is 0.0830073880921338"
```

The Misclassication error rates of the models are 0.0916,0.0838 and 0.0830 for the models with width of 0.05 as the hyperparameter for the kernal of type Radial Basis. C is the cost of contraint violation. This is the 'C' Constant of the regularisation term in the Lagrange formulation. The purpose of this is to behave as a penalty term for violation of the rules of the classification so as to not overfit the model.

Apendix

```
knitr::opts_chunk$set(echo = TRUE)
library(geosphere)
library(kernlab)
library(ggplot2)
library(lubridate)
set.seed(1234567890)
stations <- read.csv("stations.csv")
temps <- read.csv("temps50k.csv")
st <- merge(stations,temps,by="station_number")
rm(stations,temps)
st$time <- as.POSIXct(st$time,format="%H:%M:%S")
a <- 58.4166
b <- 15.6333
hdist<-250000
hdate<-7
htime<-12
date <- "2001-11-04"
timeseq <- c("04:00:00", "06:00:00", "08:00:00","10:00:00","12:00:00","12:00:00","14:00:00","16:00:00",
timeseq <- as.POSIXct(timeseq,format="%H:%M:%S")

coords<-cbind(st$longitude, st$latitude)
ykernalsum<-c()
ykernalprod<-c()
final<-c()
```

```
for (i in 1:length(timeseq)){
  h_distance<-(distHaversine(coords,c(b,a))/hdist)
  k_distance<-exp(-(h_distance)^2)
  h_date <- abs(as.numeric(as.Date(st$date) - as.Date(date)))
  h_date[h_date > 182] <- 365 - h_date[h_date > 182]
  h_date <- h_date /hdate
  k_date <- exp(-(h_date)^2)
  h_time <- as.numeric(difftime(time1 = st$time ,time2= timeseq[i], units = "hours"))
  h_time <- abs(h_time)
  h_time[h_time > 12] = 24 - h_time[h_time > 12]
  h_time <- h_time / htime
  k_time <- exp(-(h_time)^2)
  ksum <- k_distance + k_date + k_time
  ykernalsum[i] <- sum(ksum*st$air_temperature) / sum(ksum)
  kprod <- k_distance * k_date * k_time
  ykernalprod[i] <- sum(kprod*st$air_temperature) / sum(kprod)
  df <- data.frame(Time = timeseq[i], ykernalsum = ykernalsum[i], ykernalprod = ykernalprod[i])
  final <- rbind(final, df)
}

p1 <- ggplot(final, aes(Time)) +
  geom_point(aes(y = ykernalsum)) +
  geom_point(aes(y = ykernalprod)) +
  geom_line(aes(y = ykernalsum, color = "Additive kernal")) +
  geom_line(aes(y = ykernalprod, color = "Multiplicative kernal")) +
  scale_color_manual(values=c("#E69F00", "#56B4E9")) +
  ylab("Temperature forecast") +
  theme_dark()+ggtitle("Predicted Temperature")
p1
set.seed(1234567890)
data(spam)
n<-dim(spam)[1]
id<-sample(1:n,floor(n*0.5))
train<-spam[id,]
test<-spam[-id,]
xtrain<-as.matrix(train[,-58])
ytrain<-as.matrix(train[,58])
xtest<-as.matrix(test[,-58])
ytest<-as.matrix(test[,58])
xtrain2<-train[,-58]
svmmodel0.5<- ksvm(xtrain, ytrain, kernel="rbfdot",kpar=list(sigma=0.05),C=0.5)
svmmodel1<- ksvm(xtrain, ytrain, kernel="rbfdot",kpar=list(sigma=0.05),C=1)
svmmodel5<- ksvm(xtrain, ytrain, kernel="rbfdot",kpar=list(sigma=0.05),C=5)

svmpredict0.5<-predict(svmmodel0.5, xtest, type="response")
svmpredict1<- predict(svmmodel1, xtest, type="response")
svmpredict5<- predict(svmmodel5, xtest, type="response")

consvm0.5<- table(ytest, svmpredict0.5)
names(dimnames(consvm0.5)) <- c("Actual Test", "Predicted svm")
consvmres0.5<-caret::confusionMatrix(consvm0.5)
consvm0.5
mse3.1<-(1-(sum(diag(consvm0.5))/sum(consvm0.5)))
```

```
paste("The misclassificaiton rate is",mse3.1)

consvm1<- table(ytest, svmpredict1)
names(dimnames(consvm1)) <- c("Actual Test", "Predicted svm")
consvmres1<-caret::confusionMatrix(consvm1)
consvm1
mse3.2<-(1-(sum(diag(consvm1))/sum(consvm1)))
paste("The misclassificaiton rate is",mse3.2)

consvm5<- table(ytest, svmpredict5)
names(dimnames(consvm5)) <- c("Actual Test", "Predicted svm")
consvmres5<-caret::confusionMatrix(consvm5)
consvm5
mse3.3<-(1-(sum(diag(consvm5))/sum(consvm5)))
paste("The misclassificaiton rate is",mse3.3)
```