workshop 4.2 solution

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telco <- read.csv("WA\_Fn-UseC\_-Telco-Customer-Churn.csv", header=TRUE)

str(telco)

## 'data.frame': 7043 obs. of 21 variables:  
## $ customerID : Factor w/ 7043 levels "0002-ORFBO","0003-MKNFE",..: 5376 3963 2565 5536 6512 6552 1003 4771 5605 4535 ...  
## $ gender : Factor w/ 2 levels "Female","Male": 1 2 2 2 1 1 2 1 1 2 ...  
## $ SeniorCitizen : int 0 0 0 0 0 0 0 0 0 0 ...  
## $ Partner : Factor w/ 2 levels "No","Yes": 2 1 1 1 1 1 1 1 2 1 ...  
## $ Dependents : Factor w/ 2 levels "No","Yes": 1 1 1 1 1 1 2 1 1 2 ...  
## $ tenure : int 1 34 2 45 2 8 22 10 28 62 ...  
## $ PhoneService : Factor w/ 2 levels "No","Yes": 1 2 2 1 2 2 2 1 2 2 ...  
## $ MultipleLines : Factor w/ 3 levels "No","No phone service",..: 2 1 1 2 1 3 3 2 3 1 ...  
## $ InternetService : Factor w/ 3 levels "DSL","Fiber optic",..: 1 1 1 1 2 2 2 1 2 1 ...  
## $ OnlineSecurity : Factor w/ 3 levels "No","No internet service",..: 1 3 3 3 1 1 1 3 1 3 ...  
## $ OnlineBackup : Factor w/ 3 levels "No","No internet service",..: 3 1 3 1 1 1 3 1 1 3 ...  
## $ DeviceProtection: Factor w/ 3 levels "No","No internet service",..: 1 3 1 3 1 3 1 1 3 1 ...  
## $ TechSupport : Factor w/ 3 levels "No","No internet service",..: 1 1 1 3 1 1 1 1 3 1 ...  
## $ StreamingTV : Factor w/ 3 levels "No","No internet service",..: 1 1 1 1 1 3 3 1 3 1 ...  
## $ StreamingMovies : Factor w/ 3 levels "No","No internet service",..: 1 1 1 1 1 3 1 1 3 1 ...  
## $ Contract : Factor w/ 3 levels "Month-to-month",..: 1 2 1 2 1 1 1 1 1 2 ...  
## $ PaperlessBilling: Factor w/ 2 levels "No","Yes": 2 1 2 1 2 2 2 1 2 1 ...  
## $ PaymentMethod : Factor w/ 4 levels "Bank transfer (automatic)",..: 3 4 4 1 3 3 2 4 3 1 ...  
## $ MonthlyCharges : num 29.9 57 53.9 42.3 70.7 ...  
## $ TotalCharges : num 29.9 1889.5 108.2 1840.8 151.7 ...  
## $ Churn : Factor w/ 2 levels "No","Yes": 1 1 2 1 2 2 1 1 2 1 ...

## Convert Data

### Data Sampling

index <- sample(2, nrow(telco), replace=TRUE, prob=c(0.7,0.3) )  
traindata <- telco[index==1,]  
testdata <- telco[index==2,]  
sprintf("Number of Record in Training Dataset is %d" , nrow(traindata))

## [1] "Number of Record in Training Dataset is 4945"

sprintf("Number of Record in Testing Dataset is %d" , nrow(testdata))

## [1] "Number of Record in Testing Dataset is 2098"

### Normalize Data

library(BBmisc)  
print(head(telco[,c("tenure","MonthlyCharges","TotalCharges")]))

## tenure MonthlyCharges TotalCharges  
## 1 1 29.85 29.85  
## 2 34 56.95 1889.50  
## 3 2 53.85 108.15  
## 4 45 42.30 1840.75  
## 5 2 70.70 151.65  
## 6 8 99.65 820.50

normalizedcolumns <- normalize(telco[,c("tenure","MonthlyCharges","TotalCharges")], method="standardize")  
print(head(normalizedcolumns))

## tenure MonthlyCharges TotalCharges  
## 1 -1.27735389 -1.1602405 -0.9941234  
## 2 0.06632271 -0.2596105 -0.1737275  
## 3 -1.23663642 -0.3626346 -0.9595809  
## 4 0.51421491 -0.7464825 -0.1952338  
## 5 -1.23663642 0.1973512 -0.9403906  
## 6 -0.99233158 1.1594634 -0.6453233

### Factor to Number

library(fastDummies)  
telcoconv <- dummy\_cols(telco[,"Churn"])  
head(telcoconv)

## .data .data\_No .data\_Yes  
## 1 No 1 0  
## 2 No 1 0  
## 3 Yes 0 1  
## 4 No 1 0  
## 5 Yes 0 1  
## 6 Yes 0 1

### Numeric to Factor

library(arules)  
x <- telco[,"tenure"]  
discretize(x, breaks = 5)

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## [7041] [6,20) [0,6) [60,72]  
## attr(,"discretized:breaks")  
## [1] 0 6 20 40 60 72  
## attr(,"discretized:method")  
## [1] frequency  
## Levels: [0,6) [6,20) [20,40) [40,60) [60,72]

## PCA

library(e1071)  
library(ggbiplot)  
ir.churn <- telco[, "Churn"]  
telcosmall <- telco[,c("tenure","MonthlyCharges","TotalCharges")]  
telcosmallfix <- impute(telcosmall, what="mean" )  
ir.pca <- prcomp(telcosmallfix, center=TRUE,scale.=TRUE)  
print(ir.pca)

## Standard deviations (1, .., p=3):  
## [1] 1.4761901 0.8716290 0.2472363  
##   
## Rotation (n x k) = (3 x 3):  
## PC1 PC2 PC3  
## tenure 0.5672233 0.60702087 0.5565818  
## MonthlyCharges 0.4860213 -0.79231688 0.3688051  
## TotalCharges 0.6648616 0.06131579 -0.7444457

summary(ir.pca)

## Importance of components:  
## PC1 PC2 PC3  
## Standard deviation 1.4762 0.8716 0.24724  
## Proportion of Variance 0.7264 0.2532 0.02038  
## Cumulative Proportion 0.7264 0.9796 1.00000

### Plot graph PCA

g <- ggbiplot(ir.pca, obs.scale = 1, var.scale = 1,  
 groups = ir.churn, ellipse =TRUE,  
 circle=TRUE)  
g <- g + scale\_color\_discrete(name = '')  
g <- g + theme(legend.direction = 'horizontal',   
 legend.position = 'top')  
print(g)

