DATA 624 - Homework 8

OMER OZEREN

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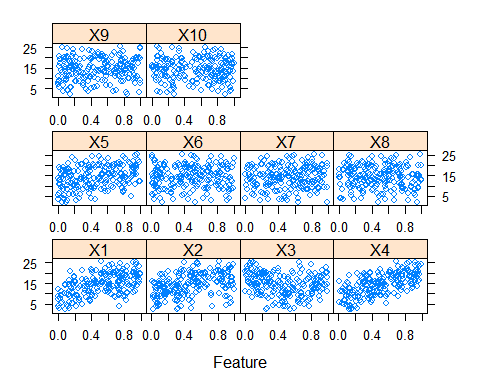
Exercises 7.2 & 7.5

library(mlbench)  
library(caret)  
library(earth)  
library(kernlab)  
library(nnet)  
library(ggplot2)  
library(mice)  
library(AppliedPredictiveModeling)  
library(magrittr)   
library(corrplot)  
library(PerformanceAnalytics)

## 7.2

### Load Data

set.seed(42)  
trainingData <- mlbench.friedman1(200, sd = 1)  
trainingData$x <- data.frame(trainingData$x)  
featurePlot(trainingData$x, trainingData$y)



testData <- mlbench.friedman1(5000, sd = 1)  
testData$x <- data.frame(testData$x)

Let’s tune model parameters by using GridSearch

evaluation = function(method, gridSearch = NULL)  
{  
 Model = train(x = trainingData$x, y = trainingData$y, method = method, tuneGrid = gridSearch, preProcess = c('center', 'scale'), trControl = trainControl(method='cv'))  
 Pred = predict(Model, newdata = testData$x)  
 performance = postResample(Pred, testData$y)  
 print(performance)  
}

### KNN Model Performace

knn\_rst = evaluation('knn')

## RMSE Rsquared MAE   
## 3.0850456 0.6333506 2.4435998

### Neural Net Perforance

nnetGrid = expand.grid(decay = c(0,0.01, .1), size = c(1:10))  
net\_rst = evaluation('nnet', nnetGrid)

## # weights: 13  
## initial value 39407.931493   
## final value 36876.801559   
## converged  
## # weights: 13  
## initial value 40282.461584   
## iter 10 value 36903.200892  
## iter 20 value 36878.402987  
## iter 30 value 36877.603770  
## final value 36877.586809   
## converged  
## # weights: 13  
## initial value 38537.604873   
## iter 10 value 36882.366374  
## final value 36882.220772   
## converged  
## # weights: 25  
## initial value 39844.812321   
## final value 36876.801559   
## converged  
## # weights: 25  
## initial value 39826.023558   
## iter 10 value 36913.594317  
## iter 20 value 36878.542432  
## iter 30 value 36877.461139  
## final value 36877.431878   
## converged  
## # weights: 25  
## initial value 39432.307513   
## iter 10 value 36882.987689  
## final value 36881.256506   
## converged  
## # weights: 37  
## initial value 39987.099238   
## final value 36876.801559   
## converged  
## # weights: 37  
## initial value 39697.086453   
## iter 10 value 36917.332758  
## iter 20 value 36878.168469  
## iter 30 value 36877.381466  
## final value 36877.350390   
## converged  
## # weights: 37  
## initial value 39142.684867   
## iter 10 value 36883.034147  
## iter 20 value 36880.711725  
## iter 20 value 36880.711487  
## iter 20 value 36880.711390  
## final value 36880.711390   
## converged  
## # weights: 49  
## initial value 40531.188746   
## final value 36876.801559   
## converged  
## # weights: 49  
## initial value 39609.807287   
## iter 10 value 36888.518962  
## iter 20 value 36877.676946  
## iter 30 value 36877.312417  
## final value 36877.295016   
## converged  
## # weights: 49  
## initial value 39493.822763   
## iter 10 value 36894.906487  
## iter 20 value 36880.341346  
## iter 20 value 36880.341013  
## iter 20 value 36880.340936  
## final value 36880.340936   
## converged  
## # weights: 61  
## initial value 40462.868228   
## final value 36876.801559   
## converged  
## # weights: 61  
## initial value 39583.317137   
## iter 10 value 36942.764683  
## iter 20 value 36879.422313  
## iter 30 value 36877.438443  
## iter 40 value 36877.260292  
## final value 36877.253740   
## converged  
## # weights: 61  
## initial value 38112.484682   
## iter 10 value 36892.749381  
## iter 20 value 36880.062679  
## iter 20 value 36880.062530  
## iter 20 value 36880.062525  
## final value 36880.062525   
## converged  
## # weights: 73  
## initial value 40042.069963   
## final value 36876.801559   
## converged  
## # weights: 73  
## initial value 39558.675868   
## iter 10 value 36897.525975  
## iter 20 value 36877.728042  
## iter 30 value 36877.265096  
## final value 36877.222928   
## converged  
## # weights: 73  
## initial value 38597.572521   
## iter 10 value 36898.103446  
## iter 20 value 36879.845968  
## final value 36879.840430   
## converged  
## # weights: 85  
## initial value 37935.544248   
## final value 36876.801559   
## converged  
## # weights: 85  
## initial value 38321.658456   
## iter 10 value 36922.726113  
## iter 20 value 36878.675797  
## iter 30 value 36877.230890  
## iter 40 value 36877.197520  
## final value 36877.196127   
## converged  
## # weights: 85  
## initial value 38612.070371   
## iter 10 value 36909.085483  
## iter 20 value 36879.662981  
## final value 36879.655820   
## converged  
## # weights: 97  
## initial value 39726.959354   
## final value 36876.801559   
## converged  
## # weights: 97  
## initial value 40259.552072   
## iter 10 value 36888.587141  
## iter 20 value 36877.266162  
## final value 36877.175374   
## converged  
## # weights: 97  
## initial value 39550.937249   
## iter 10 value 36908.874998  
## iter 20 value 36879.501693  
## final value 36879.498336   
## converged  
## # weights: 109  
## initial value 38417.963583   
## final value 36876.801559   
## converged  
## # weights: 109  
## initial value 38945.519117   
## iter 10 value 36882.105805  
## iter 20 value 36877.200203  
## final value 36877.156529   
## converged  
## # weights: 109  
## initial value 39181.163352   
## iter 10 value 36913.315350  
## iter 20 value 36879.364067  
## final value 36879.361314   
## converged  
## # weights: 121  
## initial value 38436.220719   
## final value 36876.801559   
## converged  
## # weights: 121  
## initial value 40566.377804   
## iter 10 value 36932.762929  
## iter 20 value 36879.233226  
## iter 30 value 36877.264133  
## iter 40 value 36877.142618  
## final value 36877.139429   
## converged  
## # weights: 121  
## initial value 40738.527360   
## iter 10 value 36880.404580  
## final value 36879.240244   
## converged  
## # weights: 13  
## initial value 40612.135988   
## final value 37490.621247   
## converged  
## # weights: 13  
## initial value 40339.440870   
## iter 10 value 37521.590933  
## iter 20 value 37491.796907  
## iter 30 value 37491.413744  
## final value 37491.409036   
## converged  
## # weights: 13  
## initial value 38923.913265   
## iter 10 value 37496.998666  
## final value 37496.051912   
## converged  
## # weights: 25  
## initial value 40355.503139   
## final value 37490.621247   
## converged  
## # weights: 25  
## initial value 39952.087081   
## iter 10 value 37528.282612  
## iter 20 value 37491.850617  
## iter 30 value 37491.277537  
## iter 40 value 37491.252599  
## iter 40 value 37491.252549  
## iter 40 value 37491.252540  
## final value 37491.252540   
## converged  
## # weights: 25  
## initial value 39856.114167   
## iter 10 value 37495.853061  
## final value 37495.085544   
## converged  
## # weights: 37  
## initial value 40128.668636   
## final value 37490.621247   
## converged  
## # weights: 37  
## initial value 39707.913361   
## iter 10 value 37538.749551  
## iter 20 value 37492.561097  
## iter 30 value 37491.250668  
## iter 40 value 37491.170955  
## final value 37491.170002   
## converged  
## # weights: 37  
## initial value 40625.486972   
## iter 10 value 37506.852562  
## iter 20 value 37494.539664  
## iter 20 value 37494.539454  
## iter 20 value 37494.539343  
## final value 37494.539343   
## converged  
## # weights: 49  
## initial value 39769.456998   
## final value 37490.621247   
## converged  
## # weights: 49  
## initial value 38670.173529   
## iter 10 value 37518.983836  
## iter 20 value 37492.473367  
## iter 30 value 37491.187453  
## iter 40 value 37491.116365  
## final value 37491.114780   
## converged  
## # weights: 49  
## initial value 40344.211380   
## iter 10 value 37508.328098  
## final value 37494.168051   
## converged  
## # weights: 61  
## initial value 40256.213778   
## final value 37490.621247   
## converged  
## # weights: 61  
## initial value 40090.511678   
## iter 10 value 37547.181085  
## iter 20 value 37492.188988  
## iter 30 value 37491.100064  
## iter 40 value 37491.075206  
## final value 37491.073624   
## converged  
## # weights: 61  
## initial value 39742.374327   
## iter 10 value 37495.891267  
## iter 20 value 37493.889285  
## iter 20 value 37493.889147  
## iter 20 value 37493.889093  
## final value 37493.889093   
## converged  
## # weights: 73  
## initial value 40012.872081   
## final value 37490.621247   
## converged  
## # weights: 73  
## initial value 39887.232829   
## iter 10 value 37566.638607  
## iter 20 value 37492.908359  
## iter 30 value 37491.237734  
## iter 40 value 37491.049328  
## final value 37491.042970   
## converged  
## # weights: 73  
## initial value 40888.995354   
## iter 10 value 37521.616520  
## iter 20 value 37493.671694  
## final value 37493.666467   
## converged  
## # weights: 85  
## initial value 40526.295074   
## final value 37490.621247   
## converged  
## # weights: 85  
## initial value 38567.874281   
## iter 10 value 37524.149205  
## iter 20 value 37492.603016  
## iter 30 value 37491.063992  
## final value 37491.017195   
## converged  
## # weights: 85  
## initial value 40297.576176   
## iter 10 value 37519.352249  
## iter 20 value 37493.484060  
## final value 37493.481461   
## converged  
## # weights: 97  
## initial value 39678.994136   
## final value 37490.621247   
## converged  
## # weights: 97  
## initial value 40688.591504   
## iter 10 value 37500.696061  
## iter 20 value 37491.099075  
## final value 37490.996189   
## converged  
## # weights: 97  
## initial value 38596.041653   
## iter 10 value 37493.494829  
## final value 37493.323634   
## converged  
## # weights: 109  
## initial value 40164.093187   
## final value 37490.621247   
## converged  
## # weights: 109  
## initial value 40593.582814   
## iter 10 value 37572.296300  
## iter 20 value 37493.185368  
## iter 30 value 37491.167226  
## iter 40 value 37490.984786  
## final value 37490.976401   
## converged  
## # weights: 109  
## initial value 39370.089045   
## iter 10 value 37528.702874  
## iter 20 value 37493.191835  
## final value 37493.186277   
## converged  
## # weights: 121  
## initial value 39406.831931   
## final value 37490.621247   
## converged  
## # weights: 121  
## initial value 41700.906265   
## iter 10 value 37495.359080  
## iter 20 value 37491.020035  
## iter 30 value 37490.960268  
## iter 30 value 37490.960035  
## iter 30 value 37490.959953  
## final value 37490.959953   
## converged  
## # weights: 121  
## initial value 40985.643403   
## iter 10 value 37535.559474  
## iter 20 value 37494.472641  
## iter 30 value 37493.272158  
## iter 40 value 37493.119599  
## final value 37493.065000   
## converged  
## # weights: 13  
## initial value 39252.332968   
## final value 37469.699701   
## converged  
## # weights: 13  
## initial value 39277.399150   
## iter 10 value 37498.567486  
## iter 20 value 37470.941435  
## iter 30 value 37470.513618  
## final value 37470.485980   
## converged  
## # weights: 13  
## initial value 40795.431577   
## iter 10 value 37476.666117  
## final value 37475.132321   
## converged  
## # weights: 25  
## initial value 38652.355783   
## final value 37469.699701   
## converged  
## # weights: 25  
## initial value 40449.212139   
## iter 10 value 37508.770501  
## iter 20 value 37471.281156  
## iter 30 value 37470.386300  
## final value 37470.331271   
## converged  
## # weights: 25  
## initial value 41053.104522   
## iter 10 value 37476.540715  
## final value 37474.165744   
## converged  
## # weights: 37  
## initial value 39674.504019   
## final value 37469.699701   
## converged  
## # weights: 37  
## initial value 38711.382196   
## iter 10 value 37497.059612  
## iter 20 value 37471.026013  
## iter 30 value 37470.291189  
## iter 40 value 37470.248178  
## iter 40 value 37470.248027  
## iter 40 value 37470.247951  
## final value 37470.247951   
## converged  
## # weights: 37  
## initial value 40226.883371   
## iter 10 value 37481.295743  
## iter 20 value 37473.624326  
## final value 37473.619437   
## converged  
## # weights: 49  
## initial value 40798.033194   
## final value 37469.699701   
## converged  
## # weights: 49  
## initial value 39352.289940   
## iter 10 value 37518.601801  
## iter 20 value 37471.341441  
## iter 30 value 37470.283318  
## iter 40 value 37470.193480  
## final value 37470.192650   
## converged  
## # weights: 49  
## initial value 38521.860443   
## iter 10 value 37485.426197  
## iter 20 value 37473.249245  
## final value 37473.248143   
## converged  
## # weights: 61  
## initial value 38574.481275   
## final value 37469.699701   
## converged  
## # weights: 61  
## initial value 40063.172902   
## iter 10 value 37537.387276  
## iter 20 value 37471.824161  
## iter 30 value 37470.340019  
## iter 40 value 37470.158252  
## final value 37470.152642   
## converged  
## # weights: 61  
## initial value 39203.214027   
## iter 10 value 37490.648592  
## iter 20 value 37472.976979  
## final value 37472.969080   
## converged  
## # weights: 73  
## initial value 40999.589428   
## final value 37469.699701   
## converged  
## # weights: 73  
## initial value 39093.197676   
## iter 10 value 37527.333141  
## iter 20 value 37471.674322  
## iter 30 value 37470.202959  
## iter 40 value 37470.123057  
## final value 37470.121557   
## converged  
## # weights: 73  
## initial value 38958.965483   
## iter 10 value 37492.705346  
## iter 20 value 37472.748906  
## final value 37472.746302   
## converged  
## # weights: 85  
## initial value 40050.762589   
## final value 37469.699701   
## converged  
## # weights: 85  
## initial value 40260.246154   
## iter 10 value 37543.162655  
## iter 20 value 37471.757515  
## iter 30 value 37470.291864  
## iter 40 value 37470.103744  
## final value 37470.095726   
## converged  
## # weights: 85  
## initial value 41311.158788   
## iter 10 value 37491.397800  
## iter 20 value 37472.579227  
## final value 37472.561388   
## converged  
## # weights: 97  
## initial value 41492.562298   
## final value 37469.699701   
## converged  
## # weights: 97  
## initial value 40061.569530   
## iter 10 value 37491.813137  
## iter 20 value 37470.213847  
## iter 30 value 37470.078074  
## final value 37470.073901   
## converged  
## # weights: 97  
## initial value 38358.184962   
## iter 10 value 37475.048622  
## iter 20 value 37472.404347  
## final value 37472.403428   
## converged  
## # weights: 109  
## initial value 40040.249408   
## final value 37469.699701   
## converged  
## # weights: 109  
## initial value 41593.324626   
## iter 10 value 37499.829727  
## iter 20 value 37471.799043  
## iter 30 value 37470.161216  
## iter 40 value 37470.059545  
## final value 37470.054516   
## converged  
## # weights: 109  
## initial value 40095.282402   
## iter 10 value 37501.476202  
## iter 20 value 37472.278563  
## final value 37472.266246   
## converged  
## # weights: 121  
## initial value 40047.467554   
## final value 37469.699701   
## converged  
## # weights: 121  
## initial value 39000.484446   
## iter 10 value 37474.578807  
## iter 20 value 37470.065032  
## iter 30 value 37470.038346  
## iter 30 value 37470.038178  
## iter 30 value 37470.038122  
## final value 37470.038122   
## converged  
## # weights: 121  
## initial value 39639.965174   
## iter 10 value 37509.516889  
## iter 20 value 37472.146919  
## final value 37472.144768   
## converged  
## # weights: 13  
## initial value 40286.009846   
## final value 37006.003034   
## converged  
## # weights: 13  
## initial value 39977.330990   
## iter 10 value 37038.057084  
## iter 20 value 37007.322358  
## iter 30 value 37006.813299  
## final value 37006.787853   
## converged  
## # weights: 13  
## initial value 38784.929979   
## iter 10 value 37012.014896  
## final value 37011.421347   
## converged  
## # weights: 25  
## initial value 39278.884992   
## final value 37006.003034   
## converged  
## # weights: 25  
## initial value 40013.677172   
## iter 10 value 37047.536010  
## iter 20 value 37007.791801  
## iter 30 value 37006.687123  
## iter 40 value 37006.634449  
## final value 37006.633617   
## converged  
## # weights: 25  
## initial value 38825.288315   
## iter 10 value 37011.782565  
## final value 37010.456866   
## converged  
## # weights: 37  
## initial value 38954.429502   
## final value 37006.003034   
## converged  
## # weights: 37  
## initial value 39890.234836   
## iter 10 value 37014.653558  
## iter 20 value 37006.933888  
## iter 30 value 37006.587490  
## final value 37006.550842   
## converged  
## # weights: 37  
## initial value 39334.586189   
## iter 10 value 37012.987214  
## final value 37009.911941   
## converged  
## # weights: 49  
## initial value 39624.894617   
## final value 37006.003034   
## converged  
## # weights: 49  
## initial value 40191.505073   
## iter 10 value 37053.346069  
## iter 20 value 37007.666135  
## iter 30 value 37006.550252  
## iter 40 value 37006.495528  
## iter 40 value 37006.495277  
## iter 40 value 37006.495184  
## final value 37006.495184   
## converged  
## # weights: 49  
## initial value 39462.544041   
## iter 10 value 37026.554809  
## iter 20 value 37009.544873  
## final value 37009.541409   
## converged  
## # weights: 61  
## initial value 39208.751675   
## final value 37006.003034   
## converged  
## # weights: 61  
## initial value 38707.314695   
## iter 10 value 37016.792496  
## iter 20 value 37007.136361  
## iter 30 value 37006.538971  
## iter 40 value 37006.466677  
## final value 37006.455403   
## converged  
## # weights: 61  
## initial value 38504.780120   
## iter 10 value 37024.161354  
## iter 20 value 37009.266628  
## final value 37009.263097   
## converged  
## # weights: 73  
## initial value 38036.511940   
## final value 37006.003034   
## converged  
## # weights: 73  
## initial value 38793.625807   
## iter 10 value 37020.081224  
## iter 20 value 37006.581219  
## iter 30 value 37006.429618  
## final value 37006.423252   
## converged  
## # weights: 73  
## initial value 38508.085887   
## iter 10 value 37025.791170  
## iter 20 value 37009.042256  
## final value 37009.040972   
## converged  
## # weights: 85  
## initial value 38214.525822   
## final value 37006.003034   
## converged  
## # weights: 85  
## initial value 39381.879552   
## iter 10 value 37063.601284  
## iter 20 value 37007.786412  
## iter 30 value 37006.427768  
## iter 40 value 37006.399474  
## final value 37006.397496   
## converged  
## # weights: 85  
## initial value 38579.623904   
## iter 10 value 37032.548782  
## iter 20 value 37008.862436  
## final value 37008.856362   
## converged  
## # weights: 97  
## initial value 38787.509001   
## final value 37006.003034   
## converged  
## # weights: 97  
## initial value 38955.715892   
## iter 10 value 37074.108710  
## iter 20 value 37008.367331  
## iter 30 value 37006.558676  
## iter 40 value 37006.383076  
## final value 37006.376064   
## converged  
## # weights: 97  
## initial value 39593.706248   
## iter 10 value 37029.901973  
## iter 20 value 37008.700989  
## final value 37008.699100   
## converged  
## # weights: 109  
## initial value 38952.899553   
## final value 37006.003034   
## converged  
## # weights: 109  
## initial value 39354.575562   
## iter 10 value 37010.929820  
## iter 20 value 37006.369446  
## final value 37006.359197   
## converged  
## # weights: 109  
## initial value 40398.926139   
## iter 10 value 37038.087161  
## iter 20 value 37008.568962  
## final value 37008.561927   
## converged  
## # weights: 121  
## initial value 38826.055127   
## final value 37006.003034   
## converged  
## # weights: 121  
## initial value 38993.864027   
## iter 10 value 37076.817055  
## iter 20 value 37008.593699  
## iter 30 value 37006.424540  
## final value 37006.341978   
## converged  
## # weights: 121  
## initial value 40206.124986   
## iter 10 value 37044.704836  
## iter 20 value 37008.443987  
## final value 37008.441046   
## converged  
## # weights: 13  
## initial value 39765.355154   
## final value 36977.686487   
## converged  
## # weights: 13  
## initial value 40353.960480   
## iter 10 value 37003.271994  
## iter 20 value 36979.082909  
## iter 30 value 36978.530270  
## final value 36978.471573   
## converged  
## # weights: 13  
## initial value 40148.611022   
## iter 10 value 36984.163559  
## final value 36983.107629   
## converged  
## # weights: 25  
## initial value 39297.175841   
## final value 36977.686487   
## converged  
## # weights: 25  
## initial value 40057.750825   
## iter 10 value 37014.581765  
## iter 20 value 36979.102924  
## iter 30 value 36978.382501  
## iter 40 value 36978.319636  
## final value 36978.317265   
## converged  
## # weights: 25  
## initial value 39921.008803   
## iter 10 value 36985.408092  
## iter 20 value 36982.143361  
## final value 36982.142731   
## converged  
## # weights: 37  
## initial value 38878.274158   
## final value 36977.686487   
## converged  
## # weights: 37  
## initial value 38594.437661   
## iter 10 value 37010.736759  
## iter 20 value 36979.147497  
## iter 30 value 36978.253480  
## final value 36978.235307   
## converged  
## # weights: 37  
## initial value 40077.056680   
## iter 10 value 36983.657180  
## final value 36981.597471   
## converged  
## # weights: 49  
## initial value 39161.632938   
## final value 36977.686487   
## converged  
## # weights: 49  
## initial value 39350.280229   
## iter 10 value 37030.891645  
## iter 20 value 36979.123184  
## iter 30 value 36978.254612  
## iter 40 value 36978.181115  
## final value 36978.178732   
## converged  
## # weights: 49  
## initial value 39675.234453   
## iter 10 value 36997.277192  
## iter 20 value 36981.227539  
## final value 36981.226918   
## converged  
## # weights: 61  
## initial value 38923.300678   
## final value 36977.686487   
## converged  
## # weights: 61  
## initial value 38794.102549   
## iter 10 value 37038.115452  
## iter 20 value 36979.934240  
## iter 30 value 36978.336977  
## iter 40 value 36978.150790  
## final value 36978.139062   
## converged  
## # weights: 61  
## initial value 39703.293848   
## iter 10 value 37002.640793  
## iter 20 value 36981.020378  
## final value 36980.948590   
## converged  
## # weights: 73  
## initial value 40028.611696   
## final value 36977.686487   
## converged  
## # weights: 73  
## initial value 38523.583296   
## iter 10 value 37028.710307  
## iter 20 value 36979.627666  
## iter 30 value 36978.182936  
## iter 40 value 36978.111620  
## final value 36978.108505   
## converged  
## # weights: 73  
## initial value 38280.556278   
## iter 10 value 36999.364142  
## iter 20 value 36980.728048  
## final value 36980.726228   
## converged  
## # weights: 85  
## initial value 39189.496951   
## final value 36977.686487   
## converged  
## # weights: 85  
## initial value 39831.786326   
## iter 10 value 36997.185650  
## iter 20 value 36978.228923  
## iter 30 value 36978.084724  
## final value 36978.082473   
## converged  
## # weights: 85  
## initial value 39246.901000   
## iter 10 value 37007.197234  
## iter 20 value 36980.545957  
## final value 36980.541613   
## converged  
## # weights: 97  
## initial value 38055.465653   
## final value 36977.686487   
## converged  
## # weights: 97  
## initial value 40231.208091   
## iter 10 value 37000.417071  
## iter 20 value 36978.738807  
## iter 30 value 36978.065968  
## final value 36978.061288   
## converged  
## # weights: 97  
## initial value 40521.367431   
## iter 10 value 37002.000047  
## iter 20 value 36980.386103  
## final value 36980.384102   
## converged  
## # weights: 109  
## initial value 39158.774790   
## final value 36977.686487   
## converged  
## # weights: 109  
## initial value 40109.118181   
## iter 10 value 37052.390499  
## iter 20 value 36980.338890  
## iter 30 value 36978.139890  
## iter 40 value 36978.045145  
## final value 36978.040668   
## converged  
## # weights: 109  
## initial value 38600.111484   
## iter 10 value 37010.113029  
## iter 20 value 36980.248897  
## final value 36980.247085   
## converged  
## # weights: 121  
## initial value 40022.558413   
## final value 36977.686487   
## converged  
## # weights: 121  
## initial value 38722.777654   
## iter 10 value 37052.108008  
## iter 20 value 36980.268782  
## iter 30 value 36978.192792  
## iter 40 value 36978.028546  
## final value 36978.024116   
## converged  
## # weights: 121  
## initial value 38641.589213   
## iter 10 value 36982.246704  
## iter 20 value 36980.126119  
## iter 20 value 36980.125937  
## iter 20 value 36980.125861  
## final value 36980.125861   
## converged  
## # weights: 13  
## initial value 39813.464072   
## final value 36786.167527   
## converged  
## # weights: 13  
## initial value 38667.574067   
## iter 10 value 36816.420767  
## iter 20 value 36787.556913  
## iter 30 value 36786.972376  
## final value 36786.951986   
## converged  
## # weights: 13  
## initial value 39743.064694   
## iter 10 value 36792.558182  
## final value 36791.582791   
## converged  
## # weights: 25  
## initial value 38682.429772   
## final value 36786.167527   
## converged  
## # weights: 25  
## initial value 39899.230260   
## iter 10 value 36825.224795  
## iter 20 value 36787.721184  
## iter 30 value 36786.886911  
## iter 40 value 36786.800052  
## final value 36786.798801   
## converged  
## # weights: 25  
## initial value 39995.464143   
## iter 10 value 36791.992517  
## iter 20 value 36790.619358  
## iter 20 value 36790.619142  
## iter 20 value 36790.619047  
## final value 36790.619047   
## converged  
## # weights: 37  
## initial value 38361.213839   
## final value 36786.167527   
## converged  
## # weights: 37  
## initial value 38943.707840   
## iter 10 value 36834.856936  
## iter 20 value 36788.205402  
## iter 30 value 36786.814956  
## iter 40 value 36786.715554  
## final value 36786.714497   
## converged  
## # weights: 37  
## initial value 38310.929632   
## iter 10 value 36801.344372  
## iter 20 value 36790.074479  
## iter 20 value 36790.074221  
## iter 20 value 36790.074213  
## final value 36790.074213   
## converged  
## # weights: 49  
## initial value 39674.575747   
## final value 36786.167527   
## converged  
## # weights: 49  
## initial value 39587.197708   
## iter 10 value 36833.739899  
## iter 20 value 36787.732600  
## iter 30 value 36786.689342  
## iter 40 value 36786.659230  
## iter 40 value 36786.659071  
## iter 40 value 36786.659024  
## final value 36786.659024   
## converged  
## # weights: 49  
## initial value 38808.988780   
## iter 10 value 36803.487314  
## iter 20 value 36789.704501  
## final value 36789.703946   
## converged  
## # weights: 61  
## initial value 38651.707324   
## final value 36786.167527   
## converged  
## # weights: 61  
## initial value 39194.065724   
## iter 10 value 36840.648383  
## iter 20 value 36787.938143  
## iter 30 value 36786.676303  
## iter 40 value 36786.621252  
## final value 36786.619126   
## converged  
## # weights: 61  
## initial value 40192.562406   
## iter 10 value 36802.034665  
## iter 20 value 36789.426860  
## final value 36789.425786   
## converged  
## # weights: 73  
## initial value 38951.589204   
## final value 36786.167527   
## converged  
## # weights: 73  
## initial value 39313.075012   
## iter 10 value 36795.028427  
## iter 20 value 36786.652403  
## iter 30 value 36786.590481  
## final value 36786.587139   
## converged  
## # weights: 73  
## initial value 39037.081603   
## iter 10 value 36809.224590  
## iter 20 value 36789.205541  
## final value 36789.203846   
## converged  
## # weights: 85  
## initial value 37800.080072   
## final value 36786.167527   
## converged  
## # weights: 85  
## initial value 38905.123366   
## iter 10 value 36800.066823  
## iter 20 value 36786.706895  
## iter 30 value 36786.563772  
## final value 36786.562848   
## converged  
## # weights: 85  
## initial value 39141.516438   
## iter 10 value 36812.810280  
## iter 20 value 36789.022985  
## final value 36789.019411   
## converged  
## # weights: 97  
## initial value 39965.795123   
## final value 36786.167527   
## converged  
## # weights: 97  
## initial value 39813.386359   
## iter 10 value 36797.958658  
## iter 20 value 36786.643120  
## iter 30 value 36786.543393  
## final value 36786.539771   
## converged  
## # weights: 97  
## initial value 38910.645984   
## iter 10 value 36816.067874  
## iter 20 value 36788.865955  
## final value 36788.861977   
## converged  
## # weights: 109  
## initial value 39730.063941   
## final value 36786.167527   
## converged  
## # weights: 109  
## initial value 39063.628944   
## iter 10 value 36796.865156  
## iter 20 value 36786.640664  
## iter 30 value 36786.529416  
## final value 36786.523050   
## converged  
## # weights: 109  
## initial value 39339.128035   
## iter 10 value 36819.928149  
## iter 20 value 36788.729370  
## final value 36788.725166   
## converged  
## # weights: 121  
## initial value 38276.309668   
## final value 36786.167527   
## converged  
## # weights: 121  
## initial value 40586.493190   
## iter 10 value 36835.893008  
## iter 20 value 36788.654335  
## iter 30 value 36786.615387  
## iter 40 value 36786.509287  
## final value 36786.505235   
## converged  
## # weights: 121  
## initial value 40211.189058   
## iter 10 value 36830.465169  
## iter 20 value 36789.222929  
## final value 36788.604070   
## converged  
## # weights: 13  
## initial value 40126.233458   
## final value 37167.265962   
## converged  
## # weights: 13  
## initial value 38591.017144   
## iter 10 value 37190.842149  
## iter 20 value 37168.670883  
## iter 30 value 37168.058677  
## final value 37168.052173   
## converged  
## # weights: 13  
## initial value 40387.208549   
## iter 10 value 37173.332637  
## final value 37172.689159   
## converged  
## # weights: 25  
## initial value 39067.815065   
## final value 37167.265962   
## converged  
## # weights: 25  
## initial value 39876.191784   
## iter 10 value 37208.200872  
## iter 20 value 37168.921111  
## iter 30 value 37168.007367  
## iter 40 value 37167.897369  
## final value 37167.896545   
## converged  
## # weights: 25  
## initial value 40437.341424   
## iter 10 value 37174.548596  
## iter 20 value 37171.738181  
## final value 37171.723862   
## converged  
## # weights: 37  
## initial value 39460.646674   
## final value 37167.265962   
## converged  
## # weights: 37  
## initial value 40123.378986   
## iter 10 value 37208.034377  
## iter 20 value 37168.735802  
## iter 30 value 37167.867305  
## iter 40 value 37167.814224  
## final value 37167.813600   
## converged  
## # weights: 37  
## initial value 39266.322216   
## iter 10 value 37172.343493  
## final value 37171.178414   
## converged  
## # weights: 49  
## initial value 39813.241372   
## final value 37167.265962   
## converged  
## # weights: 49  
## initial value 40614.512605   
## iter 10 value 37207.521021  
## iter 20 value 37168.980386  
## iter 30 value 37167.844706  
## iter 40 value 37167.760805  
## final value 37167.758573   
## converged  
## # weights: 49  
## initial value 39320.072710   
## iter 10 value 37172.775239  
## final value 37170.807741   
## converged  
## # weights: 61  
## initial value 39774.653980   
## final value 37167.265962   
## converged  
## # weights: 61  
## initial value 40004.236505   
## iter 10 value 37226.551805  
## iter 20 value 37168.986896  
## iter 30 value 37167.773025  
## iter 40 value 37167.720167  
## final value 37167.718677   
## converged  
## # weights: 61  
## initial value 39533.348381   
## iter 10 value 37188.302447  
## iter 20 value 37170.529690  
## iter 20 value 37170.529328  
## iter 20 value 37170.529304  
## final value 37170.529304   
## converged  
## # weights: 73  
## initial value 39694.485255   
## final value 37167.265962   
## converged  
## # weights: 73  
## initial value 38766.309633   
## iter 10 value 37219.343587  
## iter 20 value 37168.922341  
## iter 30 value 37167.750773  
## iter 40 value 37167.688091  
## final value 37167.686834   
## converged  
## # weights: 73  
## initial value 39517.402727   
## iter 10 value 37192.370951  
## iter 20 value 37170.313895  
## final value 37170.306906   
## converged  
## # weights: 85  
## initial value 40382.174054   
## final value 37167.265962   
## converged  
## # weights: 85  
## initial value 38280.350698   
## iter 10 value 37176.245343  
## iter 20 value 37167.830066  
## iter 30 value 37167.664565  
## final value 37167.661358   
## converged  
## # weights: 85  
## initial value 40090.229297   
## iter 10 value 37199.993222  
## iter 20 value 37170.132083  
## final value 37170.122007   
## converged  
## # weights: 97  
## initial value 39626.286069   
## final value 37167.265962   
## converged  
## # weights: 97  
## initial value 40730.891553   
## iter 10 value 37220.245256  
## iter 20 value 37169.793537  
## iter 30 value 37167.727727  
## iter 40 value 37167.640879  
## final value 37167.639529   
## converged  
## # weights: 97  
## initial value 38607.436851   
## iter 10 value 37196.396360  
## iter 20 value 37169.968607  
## final value 37169.964481   
## converged  
## # weights: 109  
## initial value 38917.897506   
## final value 37167.265962   
## converged  
## # weights: 109  
## initial value 39334.301789   
## iter 10 value 37252.093451  
## iter 20 value 37169.543016  
## iter 30 value 37167.794098  
## iter 40 value 37167.624303  
## final value 37167.620447   
## converged  
## # weights: 109  
## initial value 38576.121036   
## iter 10 value 37198.979991  
## iter 20 value 37169.830768  
## final value 37169.827427   
## converged  
## # weights: 121  
## initial value 39593.290251   
## final value 37167.265962   
## converged  
## # weights: 121  
## initial value 40118.128790   
## iter 10 value 37246.225690  
## iter 20 value 37169.976027  
## iter 30 value 37167.785826  
## iter 40 value 37167.610397  
## final value 37167.604028   
## converged  
## # weights: 121  
## initial value 38489.352535   
## iter 10 value 37197.971742  
## iter 20 value 37170.012897  
## final value 37169.706096   
## converged  
## # weights: 13  
## initial value 39401.094402   
## final value 36970.828793   
## converged  
## # weights: 13  
## initial value 40393.179677   
## iter 10 value 36993.810159  
## iter 20 value 36972.230660  
## iter 30 value 36971.625829  
## final value 36971.614102   
## converged  
## # weights: 13  
## initial value 38817.590933   
## iter 10 value 36976.732808  
## final value 36976.250082   
## converged  
## # weights: 25  
## initial value 38241.514952   
## final value 36970.828793   
## converged  
## # weights: 25  
## initial value 39260.573702   
## iter 10 value 37011.934238  
## iter 20 value 36972.285547  
## iter 30 value 36971.498426  
## final value 36971.460685   
## converged  
## # weights: 25  
## initial value 39040.276856   
## iter 10 value 36981.209966  
## iter 20 value 36975.294818  
## final value 36975.285283   
## converged  
## # weights: 37  
## initial value 39659.301581   
## final value 36970.828793   
## converged  
## # weights: 37  
## initial value 40115.342362   
## iter 10 value 37014.072196  
## iter 20 value 36972.469744  
## iter 30 value 36971.428115  
## iter 40 value 36971.377161  
## iter 40 value 36971.376866  
## iter 40 value 36971.376775  
## final value 36971.376775   
## converged  
## # weights: 37  
## initial value 39113.040742   
## iter 10 value 36977.602101  
## final value 36974.739942   
## converged  
## # weights: 49  
## initial value 39642.170546   
## final value 36970.828793   
## converged  
## # weights: 49  
## initial value 39588.841570   
## iter 10 value 36985.994520  
## iter 20 value 36974.306195  
## iter 30 value 36971.500539  
## iter 40 value 36971.330414  
## final value 36971.320993   
## converged  
## # weights: 49  
## initial value 39894.559569   
## iter 10 value 36981.951464  
## iter 20 value 36974.369959  
## iter 20 value 36974.369602  
## iter 20 value 36974.369511  
## final value 36974.369511   
## converged  
## # weights: 61  
## initial value 39523.363236   
## final value 36970.828793   
## converged  
## # weights: 61  
## initial value 39465.873022   
## iter 10 value 36986.411335  
## iter 20 value 36971.639664  
## iter 30 value 36971.285819  
## final value 36971.280675   
## converged  
## # weights: 61  
## initial value 38713.716270   
## iter 10 value 36991.147760  
## iter 20 value 36974.092410  
## final value 36974.091003   
## converged  
## # weights: 73  
## initial value 39078.910362   
## final value 36970.828793   
## converged  
## # weights: 73  
## initial value 40527.688495   
## iter 10 value 37012.903135  
## iter 20 value 36972.525824  
## iter 30 value 36971.315337  
## iter 40 value 36971.253005  
## final value 36971.249657   
## converged  
## # weights: 73  
## initial value 39868.634859   
## iter 10 value 36994.006123  
## iter 20 value 36973.873532  
## final value 36973.868635   
## converged  
## # weights: 85  
## initial value 40220.745048   
## final value 36970.828793   
## converged  
## # weights: 85  
## initial value 38812.114473   
## iter 10 value 37028.855278  
## iter 20 value 36972.771370  
## iter 30 value 36971.295545  
## iter 40 value 36971.226680  
## final value 36971.223610   
## converged  
## # weights: 85  
## initial value 39201.443230   
## iter 10 value 36997.092314  
## iter 20 value 36973.684453  
## iter 20 value 36973.684207  
## iter 20 value 36973.684136  
## final value 36973.684136   
## converged  
## # weights: 97  
## initial value 38840.935092   
## final value 36970.828793   
## converged  
## # weights: 97  
## initial value 38263.693360   
## iter 10 value 37015.477562  
## iter 20 value 36972.523786  
## iter 30 value 36971.244076  
## iter 40 value 36971.202620  
## iter 40 value 36971.202273  
## iter 40 value 36971.202194  
## final value 36971.202194   
## converged  
## # weights: 97  
## initial value 40195.125006   
## iter 10 value 37001.308571  
## iter 20 value 36973.528823  
## final value 36973.526500   
## converged  
## # weights: 109  
## initial value 38687.316326   
## final value 36970.828793   
## converged  
## # weights: 109  
## initial value 39498.366722   
## iter 10 value 36988.449683  
## iter 20 value 36971.320082  
## iter 30 value 36971.185952  
## final value 36971.183453   
## converged  
## # weights: 109  
## initial value 41175.719965   
## iter 10 value 36976.447626  
## iter 20 value 36973.389647  
## iter 20 value 36973.389449  
## iter 20 value 36973.389428  
## final value 36973.389428   
## converged  
## # weights: 121  
## initial value 39188.708676   
## final value 36970.828793   
## converged  
## # weights: 121  
## initial value 40538.543984   
## iter 10 value 36981.203810  
## iter 20 value 36971.969725  
## iter 30 value 36971.196056  
## final value 36971.167187   
## converged  
## # weights: 121  
## initial value 40312.372582   
## iter 10 value 37005.609781  
## iter 20 value 36973.274540  
## final value 36973.268342   
## converged  
## # weights: 13  
## initial value 40172.551267   
## final value 37293.818567   
## converged  
## # weights: 13  
## initial value 39255.283390   
## iter 10 value 37328.567121  
## iter 20 value 37295.483435  
## iter 30 value 37294.724040  
## iter 40 value 37294.605464  
## final value 37294.603890   
## converged  
## # weights: 13  
## initial value 39985.851189   
## iter 10 value 37299.763875  
## final value 37299.243489   
## converged  
## # weights: 25  
## initial value 40043.102247   
## final value 37293.818567   
## converged  
## # weights: 25  
## initial value 40030.813246   
## iter 10 value 37340.488048  
## iter 20 value 37295.559212  
## iter 30 value 37294.529643  
## final value 37294.449739   
## converged  
## # weights: 25  
## initial value 39715.207368   
## iter 10 value 37304.828266  
## iter 20 value 37298.278776  
## final value 37298.277889   
## converged  
## # weights: 37  
## initial value 40458.427972   
## final value 37293.818567   
## converged  
## # weights: 37  
## initial value 39643.504991   
## iter 10 value 37341.641415  
## iter 20 value 37295.484634  
## iter 30 value 37294.443199  
## iter 40 value 37294.368866  
## final value 37294.366383   
## converged  
## # weights: 37  
## initial value 38912.297747   
## iter 10 value 37302.068150  
## iter 20 value 37297.733035  
## final value 37297.732294   
## converged  
## # weights: 49  
## initial value 40930.777986   
## final value 37293.818567   
## converged  
## # weights: 49  
## initial value 40149.270264   
## iter 10 value 37340.916377  
## iter 20 value 37295.596889  
## iter 30 value 37294.382297  
## iter 40 value 37294.315900  
## final value 37294.311585   
## converged  
## # weights: 49  
## initial value 40043.719037   
## iter 10 value 37312.663281  
## iter 20 value 37297.361717  
## iter 20 value 37297.361522  
## iter 20 value 37297.361446  
## final value 37297.361446   
## converged  
## # weights: 61  
## initial value 40521.464504   
## final value 37293.818567   
## converged  
## # weights: 61  
## initial value 40653.129136   
## iter 10 value 37301.406890  
## iter 20 value 37294.506412  
## iter 30 value 37294.294118  
## final value 37294.272074   
## converged  
## # weights: 61  
## initial value 38908.030037   
## iter 10 value 37311.570534  
## iter 20 value 37297.082922  
## iter 20 value 37297.082736  
## iter 20 value 37297.082723  
## final value 37297.082723   
## converged  
## # weights: 73  
## initial value 38724.904371   
## final value 37293.818567   
## converged  
## # weights: 73  
## initial value 38561.420038   
## iter 10 value 37332.507581  
## iter 20 value 37295.535452  
## iter 30 value 37294.297972  
## final value 37294.241019   
## converged  
## # weights: 73  
## initial value 40518.093795   
## iter 10 value 37315.830590  
## iter 20 value 37296.867628  
## final value 37296.860276   
## converged  
## # weights: 85  
## initial value 40655.901018   
## final value 37293.818567   
## converged  
## # weights: 85  
## initial value 40189.408662   
## iter 10 value 37359.610112  
## iter 20 value 37296.198199  
## iter 30 value 37294.382175  
## iter 40 value 37294.216536  
## final value 37294.213922   
## converged  
## # weights: 85  
## initial value 39291.760386   
## iter 10 value 37322.459002  
## iter 20 value 37296.681334  
## final value 37296.675694   
## converged  
## # weights: 97  
## initial value 39916.902053   
## final value 37293.818567   
## converged  
## # weights: 97  
## initial value 40895.577071   
## iter 10 value 37311.300435  
## iter 20 value 37294.503219  
## iter 30 value 37294.200656  
## final value 37294.192656   
## converged  
## # weights: 97  
## initial value 39849.947745   
## iter 10 value 37324.095685  
## iter 20 value 37296.520221  
## final value 37296.517915   
## converged  
## # weights: 109  
## initial value 40582.712632   
## final value 37293.818567   
## converged  
## # weights: 109  
## initial value 39808.647958   
## iter 10 value 37315.292013  
## iter 20 value 37295.244420  
## iter 30 value 37294.269635  
## iter 40 value 37294.176465  
## final value 37294.172766   
## converged  
## # weights: 109  
## initial value 40589.422374   
## iter 10 value 37332.272954  
## iter 20 value 37296.385915  
## final value 37296.380721   
## converged  
## # weights: 121  
## initial value 40274.516296   
## final value 37293.818567   
## converged  
## # weights: 121  
## initial value 38028.224220   
## iter 10 value 37321.402616  
## iter 20 value 37296.110888  
## iter 30 value 37294.205951  
## final value 37294.156670   
## converged  
## # weights: 121  
## initial value 41303.274128   
## iter 10 value 37297.536995  
## final value 37296.259606   
## converged  
## # weights: 13  
## initial value 40505.092099   
## final value 37021.959838   
## converged  
## # weights: 13  
## initial value 39992.245509   
## iter 10 value 37056.056818  
## iter 20 value 37023.465973  
## iter 30 value 37022.799154  
## final value 37022.745388   
## converged  
## # weights: 13  
## initial value 38745.855277   
## iter 10 value 37027.551512  
## final value 37027.384399   
## converged  
## # weights: 25  
## initial value 38715.061567   
## final value 37021.959838   
## converged  
## # weights: 25  
## initial value 40212.917482   
## iter 10 value 37054.943928  
## iter 20 value 37023.395486  
## iter 30 value 37022.640069  
## final value 37022.591035   
## converged  
## # weights: 25  
## initial value 39959.260897   
## iter 10 value 37026.619478  
## final value 37026.419572   
## converged  
## # weights: 37  
## initial value 38969.947546   
## final value 37021.959838   
## converged  
## # weights: 37  
## initial value 38423.304769   
## iter 10 value 37051.502061  
## iter 20 value 37023.430073  
## iter 30 value 37022.546643  
## iter 40 value 37022.507852  
## iter 40 value 37022.507642  
## iter 40 value 37022.507568  
## final value 37022.507568   
## converged  
## # weights: 37  
## initial value 39222.502808   
## iter 10 value 37027.368102  
## final value 37025.873904   
## converged  
## # weights: 49  
## initial value 40629.086131   
## final value 37021.959838   
## converged  
## # weights: 49  
## initial value 40151.588697   
## iter 10 value 37031.477657  
## iter 20 value 37022.862843  
## iter 30 value 37022.478066  
## final value 37022.452146   
## converged  
## # weights: 49  
## initial value 40289.858225   
## iter 10 value 37028.216532  
## final value 37025.503244   
## converged  
## # weights: 61  
## initial value 40669.835637   
## final value 37021.959838   
## converged  
## # weights: 61  
## initial value 40438.630104   
## iter 10 value 37064.823308  
## iter 20 value 37023.812838  
## iter 30 value 37022.487538  
## iter 40 value 37022.414483  
## final value 37022.412990   
## converged  
## # weights: 61  
## initial value 40635.273300   
## iter 10 value 37040.337249  
## iter 20 value 37025.235037  
## final value 37025.224511   
## converged  
## # weights: 73  
## initial value 39373.304348   
## final value 37021.959838   
## converged  
## # weights: 73  
## initial value 38737.628255   
## iter 10 value 37077.807319  
## iter 20 value 37024.412736  
## iter 30 value 37022.565869  
## iter 40 value 37022.388951  
## final value 37022.381372   
## converged  
## # weights: 73  
## initial value 38687.923926   
## iter 10 value 37047.283009  
## iter 20 value 37025.006945  
## final value 37025.002043   
## converged  
## # weights: 85  
## initial value 38683.154326   
## final value 37021.959838   
## converged  
## # weights: 85  
## initial value 39641.859087   
## iter 10 value 37094.049397  
## iter 20 value 37024.055572  
## iter 30 value 37022.433912  
## iter 40 value 37022.359383  
## final value 37022.355137   
## converged  
## # weights: 85  
## initial value 38469.045089   
## iter 10 value 37026.559177  
## iter 20 value 37024.817427  
## iter 20 value 37024.817303  
## iter 20 value 37024.817276  
## final value 37024.817276   
## converged  
## # weights: 97  
## initial value 40983.472396   
## final value 37021.959838   
## converged  
## # weights: 97  
## initial value 39227.305909   
## iter 10 value 37031.308767  
## iter 20 value 37022.389410  
## final value 37022.333582   
## converged  
## # weights: 97  
## initial value 39996.384621   
## iter 10 value 37053.697872  
## iter 20 value 37024.682821  
## final value 37024.659667   
## converged  
## # weights: 109  
## initial value 39614.271775   
## final value 37021.959838   
## converged  
## # weights: 109  
## initial value 39141.835138   
## iter 10 value 37031.053635  
## iter 20 value 37022.407148  
## iter 30 value 37022.315982  
## final value 37022.314669   
## converged  
## # weights: 109  
## initial value 38899.252578   
## iter 10 value 37055.718966  
## iter 20 value 37024.525133  
## final value 37024.522494   
## converged  
## # weights: 121  
## initial value 37837.847621   
## final value 37021.959838   
## converged  
## # weights: 121  
## initial value 40414.329938   
## iter 10 value 37042.812500  
## iter 20 value 37022.505146  
## iter 30 value 37022.299327  
## final value 37022.298061   
## converged  
## # weights: 121  
## initial value 39516.676869   
## iter 10 value 37065.227876  
## iter 20 value 37024.403656  
## final value 37024.401344   
## converged

## Warning in nominalTrainWorkflow(x = x, y = y, wts = weights, info = trainInfo, :  
## There were missing values in resampled performance measures.

## # weights: 13  
## initial value 43292.015220   
## final value 41228.983635   
## converged  
## RMSE Rsquared MAE   
## 14.31734 NA 13.40039

### SVM Performace

library(mlbench)  
svm\_rst = evaluation('svmRadial')

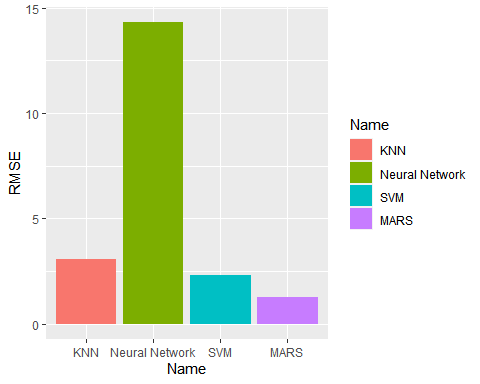
## RMSE Rsquared MAE   
## 2.3206365 0.7888815 1.7814575

### MARS Performance

marsGrid = expand.grid(degree = 1:2, nprune = 2:15)  
mars\_rst = evaluation('earth', marsGrid)

## RMSE Rsquared MAE   
## 1.2730567 0.9365257 1.0126842

df\_performance = rbind(data.frame(Name = 'KNN', RMSE = knn\_rst[1]), data.frame(Name= 'Neural Network', RMSE = net\_rst[1]) , data.frame(Name = 'SVM', RMSE =svm\_rst[1]), data.frame(Name = 'MARS', RMSE = mars\_rst[1]))  
ggplot() +  
 geom\_bar(data = df\_performance, aes(x = Name, y = RMSE, fill=Name), stat="identity")



### Which models appear to give the best performance?

**As we can see from above graph, The MARS model outpreform among all the other models.The model performance metric RMSE gives minimum result for MARS model.**

### Does MARS select informative predictors (those named X1-X5)

marsGrid = expand.grid(degree = 1:2, nprune = 2:15)  
MARSModel = train(x = trainingData$x, y = trainingData$y, method = 'earth', tuneGrid = marsGrid, preProcess = c('center', 'scale'), trControl = trainControl(method='cv'))  
varImp(MARSModel)

## earth variable importance  
##   
## Overall  
## X4 100.00  
## X1 63.04  
## X2 40.92  
## X5 18.90  
## X3 0.00

**The graph at above shows ranking /feature importance results for variables X1- X5.As we can review X4 (100) is highest ranked feaure,next X1 (63.04), X2 (40.92), X5 (18.90) nad X3 (0.00)**

## 7.5

Exercise 6.3 describes data for a chemical manufacturing process. Use the same data imputation, data splitting, and pre-processing steps as before and train several nonlinear regression models.

### Prepare Data

set.seed(42)   
data(ChemicalManufacturingProcess)  
chem\_data <- ChemicalManufacturingProcess  
chem\_imputed <- preProcess(chem\_data[,2:ncol(chem\_data)], method=c('knnImpute')) # KNN imputation for NaN values  
chem\_data <- cbind(chem\_data$Yield,predict(chem\_imputed, chem\_data[,2:ncol(chem\_data)]))  
colnames(chem\_data)[1] <- "Yield"  
#split train and test data into 70/30  
n <- floor(0.70 \* nrow(chem\_data))  
idx <- sample(seq\_len(nrow(chem\_data)), size = n)  
train <- chem\_data[idx, ]  
test <- chem\_data[-idx, ]

### Model Evaluation Function

evaluation = function(method, gridSearch = NULL)  
{  
 Model = train(x = train[,-1], y = train$Yield, method = method, tuneGrid = gridSearch, preProcess = c('center', 'scale'), trControl = trainControl(method='cv'))  
 Pred = predict(Model, newdata = test[,-1])  
 performance = postResample(Pred, test$Yield)  
 print(performance)  
}

### KNN Model Performace

knn\_rst = evaluation('knn')

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07  
  
## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07  
  
## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07  
  
## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07  
  
## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07  
  
## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07  
  
## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07  
  
## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07  
  
## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07  
  
## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07  
  
## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07  
  
## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07  
  
## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07  
  
## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07  
  
## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07  
  
## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07  
  
## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07  
  
## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07  
  
## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07  
  
## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07  
  
## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## RMSE Rsquared MAE   
## 1.2758531 0.5315532 1.0397736

### Neural Net Perforance

nnetGrid = expand.grid(decay = c(0,0.01, .1), size = c(1:10))  
net\_rst = evaluation('nnet', nnetGrid)

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 60  
## initial value 173118.109867   
## final value 168757.744700   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 60  
## initial value 172189.589199   
## iter 10 value 168855.153030  
## iter 20 value 168759.909577  
## iter 30 value 168758.873373  
## iter 40 value 168758.678876  
## iter 50 value 168758.604262  
## iter 50 value 168758.603571  
## iter 50 value 168758.603149  
## final value 168758.603149   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 60  
## initial value 174121.816489   
## iter 10 value 168766.931172  
## iter 20 value 168763.768631  
## final value 168763.761623   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 119  
## initial value 171857.485722   
## final value 168757.744700   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 119  
## initial value 172855.878908   
## iter 10 value 168899.789614  
## iter 20 value 168761.719301  
## iter 30 value 168758.882932  
## iter 40 value 168758.438574  
## final value 168758.431709   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 119  
## initial value 173188.131277   
## iter 10 value 168801.185678  
## iter 20 value 168763.289577  
## final value 168762.668826   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 178  
## initial value 172294.107455   
## final value 168757.744700   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 178  
## initial value 174757.021748   
## iter 10 value 168772.567242  
## iter 20 value 168760.238218  
## iter 30 value 168758.576582  
## iter 40 value 168758.351782  
## final value 168758.339513   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 178  
## initial value 172457.442836   
## iter 10 value 168811.388259  
## iter 20 value 168762.615862  
## final value 168762.057168   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 237  
## initial value 172669.020385   
## final value 168757.744700   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 237  
## initial value 172876.974877   
## iter 10 value 168781.035495  
## iter 20 value 168758.517660  
## iter 30 value 168758.303060  
## final value 168758.278613   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 237  
## initial value 173248.247390   
## iter 10 value 168833.095976  
## iter 20 value 168762.347011  
## iter 30 value 168761.650266  
## iter 30 value 168761.649282  
## iter 30 value 168761.649282  
## final value 168761.649282   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 296  
## initial value 175183.095710   
## final value 168757.744700   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 296  
## initial value 171107.258886   
## iter 10 value 168758.739951  
## iter 20 value 168758.246948  
## final value 168758.238414   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 296  
## initial value 173248.933989   
## iter 10 value 168845.426869  
## iter 20 value 168761.795275  
## final value 168761.337711   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 355  
## initial value 172721.863771   
## final value 168757.744700   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 355  
## initial value 171695.926521   
## iter 10 value 168758.447730  
## iter 20 value 168758.211935  
## final value 168758.207666   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 355  
## initial value 171553.038308   
## iter 10 value 168765.220983  
## iter 20 value 168761.106493  
## final value 168761.089453   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 414  
## initial value 172075.459248   
## final value 168757.744700   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 414  
## initial value 172142.101899   
## iter 10 value 168758.375438  
## final value 168758.180176   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 414  
## initial value 171185.953724   
## iter 10 value 168763.701453  
## iter 20 value 168760.891291  
## final value 168760.885985   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 473  
## initial value 171298.946071   
## final value 168757.744700   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 473  
## initial value 172016.392931   
## iter 10 value 168758.401317  
## iter 20 value 168758.154685  
## iter 20 value 168758.153425  
## iter 20 value 168758.152935  
## final value 168758.152935   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 473  
## initial value 172026.609408   
## iter 10 value 168763.215748  
## iter 20 value 168760.738114  
## final value 168760.712698   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 532  
## initial value 173154.148571   
## final value 168757.744700   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 532  
## initial value 174924.565950   
## iter 10 value 168781.833398  
## iter 20 value 168758.497285  
## iter 30 value 168758.139306  
## final value 168758.132212   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 532  
## initial value 175221.752435   
## iter 10 value 168809.698253  
## iter 20 value 168760.755980  
## final value 168760.579984   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 591  
## initial value 173984.763847   
## final value 168757.744700   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 591  
## initial value 170219.516154   
## iter 10 value 168759.304899  
## iter 20 value 168758.118713  
## final value 168758.113767   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 591  
## initial value 175537.906038   
## iter 10 value 168812.029793  
## iter 20 value 168760.467638  
## final value 168760.429790   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 60  
## initial value 174329.319363   
## final value 169443.878000   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 60  
## initial value 174125.089621   
## iter 10 value 169543.510683  
## iter 20 value 169445.957600  
## iter 30 value 169444.912816  
## final value 169444.739845   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 60  
## initial value 172979.665233   
## iter 10 value 169469.525660  
## iter 20 value 169449.944458  
## final value 169449.897525   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 119  
## initial value 175527.304915   
## final value 169443.878000   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 119  
## initial value 175003.704976   
## iter 10 value 169558.814771  
## iter 20 value 169447.140660  
## iter 30 value 169444.966345  
## iter 40 value 169444.676620  
## final value 169444.566255   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 119  
## initial value 173514.093690   
## iter 10 value 169483.795585  
## iter 20 value 169448.863639  
## final value 169448.803246   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 178  
## initial value 173413.983466   
## final value 169443.878000   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 178  
## initial value 175161.112267   
## iter 10 value 169481.965806  
## iter 20 value 169447.330101  
## iter 30 value 169444.856908  
## iter 40 value 169444.556911  
## iter 50 value 169444.481985  
## final value 169444.476963   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 178  
## initial value 173815.987160   
## iter 10 value 169502.993450  
## iter 20 value 169449.264719  
## iter 30 value 169448.225464  
## final value 169448.190950   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 237  
## initial value 172985.863786   
## final value 169443.878000   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 237  
## initial value 173843.842813   
## iter 10 value 169491.105987  
## iter 20 value 169444.709189  
## iter 30 value 169444.509232  
## iter 40 value 169444.429168  
## final value 169444.416289   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 237  
## initial value 171920.776888   
## iter 10 value 169449.477712  
## iter 20 value 169447.796027  
## final value 169447.777631   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 296  
## initial value 175360.209807   
## final value 169443.878000   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 296  
## initial value 171236.225695   
## iter 10 value 169459.663120  
## iter 20 value 169444.614859  
## iter 30 value 169444.384693  
## final value 169444.373305   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 296  
## initial value 174484.229341   
## iter 10 value 169455.229376  
## iter 20 value 169447.915404  
## iter 30 value 169447.470014  
## iter 30 value 169447.469242  
## iter 30 value 169447.469073  
## final value 169447.469073   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 355  
## initial value 171596.375782   
## final value 169443.878000   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 355  
## initial value 175793.524736   
## iter 10 value 169461.615731  
## iter 20 value 169444.547457  
## iter 30 value 169444.344012  
## iter 30 value 169444.342351  
## iter 30 value 169444.341212  
## final value 169444.341212   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 355  
## initial value 173449.683523   
## iter 10 value 169606.738902  
## iter 20 value 169450.882830  
## iter 30 value 169447.536689  
## iter 40 value 169447.270447  
## iter 40 value 169447.269092  
## final value 169447.226576   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 414  
## initial value 173416.029518   
## final value 169443.878000   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 414  
## initial value 172016.153564   
## iter 10 value 169450.700579  
## iter 20 value 169444.328649  
## final value 169444.309935   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 414  
## initial value 175382.690980   
## iter 10 value 169450.216603  
## iter 20 value 169447.038644  
## final value 169447.020206   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 473  
## initial value 171576.794154   
## final value 169443.878000   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 473  
## initial value 176839.323951   
## iter 10 value 169444.963383  
## iter 20 value 169444.433673  
## iter 30 value 169444.288398  
## iter 30 value 169444.286827  
## iter 30 value 169444.286293  
## final value 169444.286293   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 473  
## initial value 172780.702579   
## iter 10 value 169449.217022  
## iter 20 value 169446.851330  
## final value 169446.847338   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 532  
## initial value 172518.093276   
## final value 169443.878000   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 532  
## initial value 174698.359578   
## iter 10 value 169449.557797  
## iter 20 value 169444.309643  
## final value 169444.267423   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 532  
## initial value 173884.833366   
## iter 10 value 169448.842690  
## iter 20 value 169446.710621  
## final value 169446.697130   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 591  
## initial value 173539.002434   
## final value 169443.878000   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 591  
## initial value 175002.614532   
## iter 10 value 169452.940849  
## iter 20 value 169444.274298  
## final value 169444.247249   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 591  
## initial value 174105.569087   
## iter 10 value 169465.571921  
## iter 20 value 169446.851185  
## iter 30 value 169446.615642  
## iter 40 value 169446.564580  
## iter 40 value 169446.563410  
## iter 40 value 169446.563179  
## final value 169446.563179   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 60  
## initial value 175423.702508   
## final value 170252.579600   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 60  
## initial value 174723.808033   
## iter 10 value 170365.746642  
## iter 20 value 170254.963028  
## iter 30 value 170253.757024  
## final value 170253.515741   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 60  
## initial value 173864.448012   
## iter 10 value 170262.054397  
## iter 20 value 170258.667142  
## final value 170258.606161   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 119  
## initial value 176193.066646   
## final value 170252.579600   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 119  
## initial value 174178.142791   
## iter 10 value 170374.816433  
## iter 20 value 170255.685651  
## iter 30 value 170253.593177  
## iter 40 value 170253.316111  
## final value 170253.280049   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 119  
## initial value 175111.952889   
## iter 10 value 170289.698803  
## iter 20 value 170257.929899  
## final value 170257.510987   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 178  
## initial value 174881.600351   
## final value 170252.579600   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 178  
## initial value 175160.073789   
## iter 10 value 170297.764784  
## iter 20 value 170255.917111  
## iter 30 value 170253.399170  
## iter 40 value 170253.201393  
## final value 170253.175733   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 178  
## initial value 173586.764587   
## iter 10 value 170311.522920  
## iter 20 value 170257.325371  
## final value 170256.898633   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 237  
## initial value 172682.546632   
## final value 170252.579600   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 237  
## initial value 175620.168286   
## iter 10 value 170278.721606  
## iter 20 value 170254.814096  
## iter 30 value 170253.317089  
## iter 40 value 170253.144816  
## final value 170253.118869   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 237  
## initial value 175549.939829   
## iter 10 value 170325.920492  
## iter 20 value 170257.349511  
## iter 30 value 170256.486468  
## final value 170256.483604   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 296  
## initial value 174571.580521   
## final value 170252.579600   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 296  
## initial value 174073.928397   
## iter 10 value 170254.807230  
## iter 20 value 170253.424488  
## iter 30 value 170253.137379  
## final value 170253.074307   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 296  
## initial value 174295.780758   
## iter 10 value 170347.049279  
## iter 20 value 170257.307582  
## iter 30 value 170256.181990  
## final value 170256.176035   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 355  
## initial value 176775.293871   
## final value 170252.579600   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 355  
## initial value 172760.494180   
## iter 10 value 170253.476102  
## iter 20 value 170253.050084  
## final value 170253.041437   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 355  
## initial value 173052.467517   
## iter 10 value 170259.323286  
## iter 20 value 170255.967880  
## final value 170255.930907   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 414  
## initial value 174104.163990   
## final value 170252.579600   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 414  
## initial value 174642.197640   
## iter 10 value 170253.580354  
## iter 20 value 170253.017166  
## final value 170253.012980   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 414  
## initial value 175450.805289   
## iter 10 value 170263.432546  
## iter 20 value 170255.750234  
## final value 170255.725386   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 473  
## initial value 176289.013363   
## final value 170252.579600   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 473  
## initial value 175593.366098   
## iter 10 value 170268.124467  
## iter 20 value 170253.277778  
## iter 30 value 170252.994570  
## final value 170252.988370   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 473  
## initial value 176255.946325   
## iter 10 value 170257.294966  
## iter 20 value 170255.559656  
## final value 170255.551421   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 532  
## initial value 174013.512971   
## final value 170252.579600   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 532  
## initial value 175384.535293   
## iter 10 value 170254.038870  
## iter 20 value 170252.973217  
## final value 170252.967249   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 532  
## initial value 174923.692442   
## iter 10 value 170262.288843  
## iter 20 value 170255.687663  
## iter 30 value 170255.404865  
## final value 170255.401480   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 591  
## initial value 173021.401469   
## final value 170252.579600   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 591  
## initial value 174480.990849   
## iter 10 value 170253.071045  
## final value 170252.950787   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 591  
## initial value 173752.477762   
## iter 10 value 170257.108019  
## iter 20 value 170255.285527  
## final value 170255.268700   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 60  
## initial value 175952.545905   
## final value 170461.187900   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 60  
## initial value 173375.124241   
## iter 10 value 170549.582324  
## iter 20 value 170463.339906  
## iter 30 value 170462.330039  
## final value 170462.047486   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 60  
## initial value 174356.424913   
## iter 10 value 170470.826936  
## iter 20 value 170467.221164  
## final value 170467.214489   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 119  
## initial value 176729.727536   
## final value 170461.187900   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 119  
## initial value 174643.490896   
## iter 10 value 170481.098736  
## iter 20 value 170462.750253  
## iter 30 value 170462.259833  
## iter 40 value 170461.925131  
## final value 170461.878725   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 119  
## initial value 173889.490371   
## iter 10 value 170496.863825  
## iter 20 value 170466.391205  
## final value 170466.121097   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 178  
## initial value 175085.740059   
## final value 170461.187900   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 178  
## initial value 173469.153537   
## iter 10 value 170479.534191  
## iter 20 value 170462.117333  
## iter 30 value 170461.829938  
## final value 170461.784413   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 178  
## initial value 175308.323324   
## iter 10 value 170515.279755  
## iter 20 value 170465.982597  
## final value 170465.506558   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 237  
## initial value 173872.878632   
## final value 170461.187900   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 237  
## initial value 175013.120283   
## iter 10 value 170488.312628  
## iter 20 value 170462.084804  
## iter 30 value 170461.766494  
## final value 170461.725145   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 237  
## initial value 175041.758036   
## iter 10 value 170530.696178  
## iter 20 value 170467.058645  
## iter 30 value 170465.093949  
## iter 30 value 170465.092432  
## iter 30 value 170465.092432  
## final value 170465.092432   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 296  
## initial value 174682.753699   
## final value 170461.187900   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 296  
## initial value 174429.143245   
## iter 10 value 170461.888890  
## iter 20 value 170461.693071  
## final value 170461.679107   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 296  
## initial value 176874.566106   
## iter 10 value 170466.349527  
## iter 20 value 170464.784832  
## iter 20 value 170464.783485  
## iter 20 value 170464.783469  
## final value 170464.783469   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 355  
## initial value 175342.271912   
## final value 170461.187900   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 355  
## initial value 173305.464609   
## iter 10 value 170462.184585  
## iter 20 value 170461.676082  
## final value 170461.647121   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 355  
## initial value 175494.795642   
## iter 10 value 170467.767371  
## iter 20 value 170464.554795  
## final value 170464.537254   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 414  
## initial value 176291.929183   
## final value 170461.187900   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 414  
## initial value 175679.351112   
## iter 10 value 170502.366303  
## iter 20 value 170461.865344  
## iter 30 value 170461.623186  
## iter 30 value 170461.621839  
## iter 30 value 170461.621119  
## final value 170461.621119   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 414  
## initial value 174240.054682   
## iter 10 value 170469.259156  
## iter 20 value 170464.432891  
## final value 170464.333616   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 473  
## initial value 174916.485239   
## final value 170461.187900   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 473  
## initial value 175234.019912   
## iter 10 value 170461.731955  
## final value 170461.596305   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 473  
## initial value 176657.696698   
## iter 10 value 170471.897516  
## iter 20 value 170464.170824  
## final value 170464.161371   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 532  
## initial value 173796.682766   
## final value 170461.187900   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 532  
## initial value 175218.527415   
## iter 10 value 170462.186176  
## iter 20 value 170461.581489  
## final value 170461.575820   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 532  
## initial value 176871.102314   
## iter 10 value 170512.222652  
## iter 20 value 170464.087658  
## final value 170464.009661   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 591  
## initial value 177132.194439   
## final value 170461.187900   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 591  
## initial value 173492.984417   
## iter 10 value 170461.990393  
## iter 20 value 170461.563356  
## final value 170461.559207   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 591  
## initial value 174602.259056   
## iter 10 value 170516.738286  
## iter 20 value 170464.408225  
## iter 30 value 170464.120239  
## iter 40 value 170463.968000  
## final value 170463.876448   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 60  
## initial value 175055.959323   
## final value 170696.381100   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 60  
## initial value 176118.357071   
## iter 10 value 170793.092978  
## iter 20 value 170698.738031  
## iter 30 value 170697.518264  
## iter 40 value 170697.264705  
## final value 170697.240257   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 60  
## initial value 175330.260799   
## iter 10 value 170706.830686  
## iter 20 value 170702.411481  
## final value 170702.408507   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 119  
## initial value 176373.089828   
## final value 170696.381100   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 119  
## initial value 173787.520219   
## iter 10 value 170717.965458  
## iter 20 value 170697.825156  
## iter 30 value 170697.210264  
## iter 40 value 170697.092325  
## final value 170697.071936   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 119  
## initial value 174183.848287   
## iter 10 value 170738.028579  
## iter 20 value 170701.660097  
## final value 170701.312694   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 178  
## initial value 172984.751503   
## final value 170696.381100   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 178  
## initial value 173737.449100   
## iter 10 value 170712.989526  
## iter 20 value 170697.576389  
## iter 30 value 170697.093255  
## iter 40 value 170696.986911  
## final value 170696.982420   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 178  
## initial value 176386.543280   
## iter 10 value 170753.758564  
## iter 20 value 170701.411428  
## iter 30 value 170700.744070  
## final value 170700.714357   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 237  
## initial value 174934.959025   
## final value 170696.381100   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 237  
## initial value 173384.541726   
## iter 10 value 170697.140122  
## iter 20 value 170696.940638  
## final value 170696.918349   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 237  
## initial value 175590.486384   
## iter 10 value 170801.501059  
## iter 20 value 170701.842421  
## iter 30 value 170700.294828  
## final value 170700.288377   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 296  
## initial value 174883.655317   
## final value 170696.381100   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 296  
## initial value 173772.125259   
## iter 10 value 170697.037548  
## iter 20 value 170696.880534  
## final value 170696.874368   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 296  
## initial value 176023.534456   
## iter 10 value 170909.338314  
## iter 20 value 170707.339999  
## iter 30 value 170700.033664  
## final value 170699.976687   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 355  
## initial value 173184.743947   
## final value 170696.381100   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 355  
## initial value 175213.703716   
## iter 10 value 170697.068794  
## final value 170696.850462   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 355  
## initial value 174105.724654   
## iter 10 value 170876.765861  
## iter 20 value 170701.251946  
## iter 30 value 170699.762354  
## final value 170699.730500   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 414  
## initial value 174335.060940   
## final value 170696.381100   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 414  
## initial value 176097.685587   
## iter 10 value 170725.449333  
## iter 20 value 170697.533844  
## iter 30 value 170696.819800  
## final value 170696.813409   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 414  
## initial value 175897.728795   
## iter 10 value 170706.766140  
## iter 20 value 170699.538863  
## final value 170699.527438   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 473  
## initial value 176288.414675   
## final value 170696.381100   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 473  
## initial value 176718.252609   
## iter 10 value 170718.571688  
## iter 20 value 170697.199442  
## iter 30 value 170696.817049  
## final value 170696.790619   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 473  
## initial value 176933.547547   
## iter 10 value 170700.798282  
## iter 20 value 170699.364417  
## final value 170699.353491   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 532  
## initial value 174408.766728   
## final value 170696.381100   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 532  
## initial value 173558.787812   
## iter 10 value 170705.473760  
## iter 20 value 170696.814126  
## final value 170696.770026   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 532  
## initial value 174749.115891   
## iter 10 value 170704.808671  
## iter 20 value 170699.244040  
## final value 170699.206056   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 591  
## initial value 175581.117360   
## final value 170696.381100   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 591  
## initial value 174896.895049   
## iter 10 value 170697.446680  
## iter 20 value 170696.760615  
## final value 170696.750775   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 591  
## initial value 177269.095364   
## iter 10 value 170758.167557  
## iter 20 value 170699.865921  
## iter 30 value 170699.098310  
## final value 170699.071828   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 60  
## initial value 173288.471425   
## final value 169366.958600   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 60  
## initial value 173514.358728   
## iter 10 value 169474.461411  
## iter 20 value 169369.849961  
## iter 30 value 169368.087103  
## iter 40 value 169367.818110  
## iter 40 value 169367.817287  
## iter 40 value 169367.816979  
## final value 169367.816979   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 60  
## initial value 173699.894674   
## iter 10 value 169394.398233  
## iter 20 value 169373.031219  
## final value 169372.978367   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 119  
## initial value 172658.166908   
## final value 169366.958600   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 119  
## initial value 173276.368437   
## iter 10 value 169482.958129  
## iter 20 value 169370.123202  
## iter 30 value 169368.010623  
## iter 40 value 169367.723738  
## iter 50 value 169367.649797  
## iter 50 value 169367.648219  
## iter 50 value 169367.647353  
## final value 169367.647353   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 119  
## initial value 174662.638906   
## iter 10 value 169408.366491  
## iter 20 value 169372.030895  
## final value 169371.890585   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 178  
## initial value 173076.161887   
## final value 169366.958600   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 178  
## initial value 172177.165428   
## iter 10 value 169487.323779  
## iter 20 value 169371.241323  
## iter 30 value 169368.161565  
## iter 40 value 169367.671688  
## iter 50 value 169367.559825  
## final value 169367.555237   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 178  
## initial value 173938.507338   
## iter 10 value 169423.054912  
## iter 20 value 169371.950074  
## final value 169371.283081   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 237  
## initial value 172581.453788   
## final value 169366.958600   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 237  
## initial value 172968.905399   
## iter 10 value 169396.097713  
## iter 20 value 169368.264981  
## iter 30 value 169367.557596  
## final value 169367.502020   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 237  
## initial value 173905.445875   
## iter 10 value 169437.526501  
## iter 20 value 169371.491363  
## final value 169370.858516   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 296  
## initial value 174113.921725   
## final value 169366.958600   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 296  
## initial value 172929.823926   
## iter 10 value 169367.665485  
## iter 20 value 169367.458899  
## final value 169367.449810   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 296  
## initial value 174362.190138   
## iter 10 value 169375.404040  
## iter 20 value 169370.601265  
## final value 169370.549788   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 355  
## initial value 174472.494248   
## final value 169366.958600   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 355  
## initial value 175859.675964   
## iter 10 value 169397.542873  
## iter 20 value 169370.375937  
## iter 30 value 169367.591363  
## iter 40 value 169367.440500  
## final value 169367.421405   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 355  
## initial value 174290.100715   
## iter 10 value 169376.777970  
## iter 20 value 169370.446645  
## final value 169370.303968   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 414  
## initial value 172376.221628   
## final value 169366.958600   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 414  
## initial value 174390.402860   
## iter 10 value 169396.004858  
## iter 20 value 169367.718792  
## final value 169367.395025   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 414  
## initial value 172585.240773   
## iter 10 value 169371.723627  
## iter 20 value 169370.102045  
## iter 20 value 169370.100957  
## iter 20 value 169370.100957  
## final value 169370.100957   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 473  
## initial value 172233.658805   
## final value 169366.958600   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 473  
## initial value 171689.747828   
## iter 10 value 169373.760369  
## iter 20 value 169367.664272  
## iter 30 value 169367.435331  
## iter 40 value 169367.367943  
## iter 40 value 169367.366503  
## iter 40 value 169367.366052  
## final value 169367.366052   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 473  
## initial value 174110.286086   
## iter 10 value 169379.852853  
## iter 20 value 169369.965681  
## final value 169369.928084   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 532  
## initial value 175486.422673   
## final value 169366.958600   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 532  
## initial value 171430.808757   
## iter 10 value 169367.743559  
## iter 20 value 169367.359449  
## final value 169367.345109   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 532  
## initial value 173411.814577   
## iter 10 value 169373.216584  
## iter 20 value 169369.794327  
## final value 169369.776703   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 591  
## initial value 173310.529325   
## final value 169366.958600   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 591  
## initial value 171459.013055   
## iter 10 value 169368.103066  
## iter 20 value 169367.348854  
## final value 169367.332200   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 591  
## initial value 173788.594589   
## iter 10 value 169371.443953  
## iter 20 value 169369.647187  
## final value 169369.643698   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 60  
## initial value 176384.125937   
## final value 170667.369000   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 60  
## initial value 175475.577419   
## iter 10 value 170778.721038  
## iter 20 value 170669.863288  
## iter 30 value 170668.474850  
## final value 170668.392174   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 60  
## initial value 174576.452238   
## iter 10 value 170682.497144  
## iter 20 value 170673.418467  
## final value 170673.396323   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 119  
## initial value 176039.206138   
## final value 170667.369000   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 119  
## initial value 173499.378179   
## iter 10 value 170758.847373  
## iter 20 value 170670.391582  
## iter 30 value 170668.337888  
## iter 40 value 170668.076085  
## final value 170668.057890   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 119  
## initial value 175842.132948   
## iter 10 value 170706.979951  
## iter 20 value 170672.740424  
## final value 170672.314390   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 178  
## initial value 174206.231393   
## final value 170667.369000   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 178  
## initial value 175866.220885   
## iter 10 value 170691.453780  
## iter 20 value 170668.203681  
## iter 30 value 170667.975386  
## final value 170667.964551   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 178  
## initial value 175468.662757   
## iter 10 value 170721.940896  
## iter 20 value 170672.319432  
## iter 30 value 170671.688833  
## iter 30 value 170671.687325  
## iter 30 value 170671.687267  
## final value 170671.687267   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 237  
## initial value 176452.235088   
## final value 170667.369000   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 237  
## initial value 175765.249819   
## iter 10 value 170700.723355  
## iter 20 value 170668.250533  
## iter 30 value 170667.944898  
## final value 170667.907221   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 237  
## initial value 174348.147617   
## iter 10 value 170677.591641  
## iter 20 value 170671.410572  
## final value 170671.274137   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 296  
## initial value 173287.848771   
## final value 170667.369000   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 296  
## initial value 176892.205584   
## iter 10 value 170703.056962  
## iter 20 value 170669.239004  
## iter 30 value 170667.915397  
## final value 170667.862738   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 296  
## initial value 177437.743232   
## iter 10 value 170687.932425  
## iter 20 value 170671.470326  
## iter 30 value 170670.980734  
## final value 170670.968882   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 355  
## initial value 174802.124472   
## final value 170667.369000   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 355  
## initial value 177303.514999   
## iter 10 value 170685.020567  
## iter 20 value 170667.981987  
## final value 170667.829885   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 355  
## initial value 174982.511463   
## iter 10 value 170676.571585  
## iter 20 value 170670.823667  
## final value 170670.719349   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 414  
## initial value 175340.618055   
## final value 170667.369000   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 414  
## initial value 178515.613041   
## iter 10 value 170676.002350  
## iter 20 value 170668.066102  
## iter 30 value 170667.827440  
## final value 170667.801631   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 414  
## initial value 175481.802690   
## iter 10 value 170672.516743  
## iter 20 value 170670.522969  
## final value 170670.514890   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 473  
## initial value 176596.929991   
## final value 170667.369000   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 473  
## initial value 174530.024693   
## iter 10 value 170668.078859  
## iter 20 value 170667.782195  
## iter 20 value 170667.780607  
## iter 20 value 170667.780044  
## final value 170667.780044   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 473  
## initial value 173442.965999   
## iter 10 value 170673.291487  
## iter 20 value 170670.399444  
## final value 170670.341934   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 532  
## initial value 175104.674987   
## final value 170667.369000   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 532  
## initial value 176716.078005   
## iter 10 value 170679.229204  
## iter 20 value 170668.114536  
## iter 30 value 170667.786162  
## final value 170667.754471   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 532  
## initial value 176467.609555   
## iter 10 value 170671.721807  
## iter 20 value 170670.207911  
## final value 170670.190987   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 591  
## initial value 173564.846420   
## final value 170667.369000   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 591  
## initial value 177266.869965   
## iter 10 value 170681.043833  
## iter 20 value 170667.931649  
## iter 30 value 170667.739040  
## iter 30 value 170667.737407  
## iter 30 value 170667.737163  
## final value 170667.737163   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 591  
## initial value 174747.224205   
## iter 10 value 170673.773176  
## iter 20 value 170670.069974  
## final value 170670.057475   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 60  
## initial value 175310.401316   
## final value 170954.957500   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 60  
## initial value 175510.578927   
## iter 10 value 171069.011696  
## iter 20 value 170957.433345  
## iter 30 value 170956.120789  
## final value 170955.893814   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 60  
## initial value 174514.207908   
## iter 10 value 170969.445472  
## iter 20 value 170961.014247  
## final value 170960.991999   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 119  
## initial value 176125.463021   
## final value 170954.957500   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 119  
## initial value 174078.262084   
## iter 10 value 171064.891919  
## iter 20 value 170958.133245  
## iter 30 value 170955.991087  
## iter 40 value 170955.690975  
## final value 170955.658670   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 119  
## initial value 175112.573880   
## iter 10 value 170992.509690  
## iter 20 value 170960.282150  
## iter 30 value 170959.895424  
## final value 170959.889530   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 178  
## initial value 176110.161338   
## final value 170954.957500   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 178  
## initial value 174460.348046   
## iter 10 value 170977.814667  
## iter 20 value 170957.931643  
## iter 30 value 170955.914065  
## iter 40 value 170955.622295  
## iter 50 value 170955.565029  
## final value 170955.553736   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 178  
## initial value 176740.922558   
## iter 10 value 171011.520250  
## iter 20 value 170959.752822  
## final value 170959.276523   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 237  
## initial value 174871.527282   
## final value 170954.957500   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 237  
## initial value 174356.287166   
## iter 10 value 170957.139222  
## iter 20 value 170955.800349  
## iter 30 value 170955.544331  
## final value 170955.494054   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 237  
## initial value 176341.845359   
## iter 10 value 171027.986947  
## iter 20 value 170959.375567  
## iter 30 value 170958.864895  
## iter 30 value 170958.864069  
## iter 30 value 170958.863652  
## final value 170958.863652   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 296  
## initial value 176802.990522   
## final value 170954.957500   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 296  
## initial value 174635.246090   
## iter 10 value 170955.889507  
## iter 20 value 170955.496077  
## final value 170955.451284   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 296  
## initial value 175313.556740   
## iter 10 value 170969.297025  
## iter 20 value 170958.627258  
## final value 170958.557050   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 355  
## initial value 174567.406946   
## final value 170954.957500   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 355  
## initial value 175261.910508   
## iter 10 value 170955.769766  
## iter 20 value 170955.428306  
## final value 170955.416896   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 355  
## initial value 175651.527638   
## iter 10 value 170961.178065  
## iter 20 value 170958.362094  
## final value 170958.308782   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 414  
## initial value 176912.989370   
## final value 170954.957500   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 414  
## initial value 176780.634922   
## iter 10 value 170981.199573  
## iter 20 value 170955.595796  
## iter 30 value 170955.407330  
## final value 170955.388133   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 414  
## initial value 174305.641055   
## iter 10 value 170960.337381  
## iter 20 value 170958.113340  
## final value 170958.105489   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 473  
## initial value 175266.517512   
## final value 170954.957500   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 473  
## initial value 173518.813289   
## iter 10 value 170962.792437  
## iter 20 value 170955.392400  
## final value 170955.367132   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 473  
## initial value 174783.354882   
## iter 10 value 170958.576485  
## final value 170957.930235   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 532  
## initial value 175379.677126   
## final value 170954.957500   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 532  
## initial value 176396.110859   
## iter 10 value 170955.845700  
## iter 20 value 170955.349558  
## iter 20 value 170955.347931  
## iter 20 value 170955.347342  
## final value 170955.347342   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 532  
## initial value 175392.941365   
## iter 10 value 170960.940152  
## iter 20 value 170957.802919  
## final value 170957.780234   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 591  
## initial value 175558.636612   
## final value 170954.957500   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 591  
## initial value 173237.589238   
## iter 10 value 170956.152279  
## iter 20 value 170955.338558  
## final value 170955.327003   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 591  
## initial value 176805.497412   
## iter 10 value 170958.608859  
## iter 20 value 170957.648259  
## final value 170957.645914   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 60  
## initial value 174620.138771   
## final value 170499.808000   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 60  
## initial value 175931.436761   
## iter 10 value 170593.396597  
## iter 20 value 170502.173303  
## iter 30 value 170500.832871  
## final value 170500.744131   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 60  
## initial value 174801.056018   
## iter 10 value 170524.317347  
## iter 20 value 170506.148066  
## final value 170505.834892   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 119  
## initial value 175247.560678   
## final value 170499.808000   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 119  
## initial value 175495.166425   
## iter 10 value 170622.617748  
## iter 20 value 170502.809148  
## iter 30 value 170500.859836  
## iter 40 value 170500.533713  
## final value 170500.498746   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 119  
## initial value 174646.317530   
## iter 10 value 170543.834969  
## iter 20 value 170504.810815  
## final value 170504.740903   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 178  
## initial value 174408.845650   
## final value 170499.808000   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 178  
## initial value 173628.984269   
## iter 10 value 170521.952907  
## iter 20 value 170500.647637  
## iter 30 value 170500.422479  
## final value 170500.403152   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 178  
## initial value 175904.712504   
## iter 10 value 170557.021937  
## iter 20 value 170504.688009  
## final value 170504.126640   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 237  
## initial value 175023.904479   
## final value 170499.808000   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 237  
## initial value 174993.843095   
## iter 10 value 170526.102315  
## iter 20 value 170500.621619  
## iter 30 value 170500.362362  
## final value 170500.342745   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 237  
## initial value 175105.908048   
## iter 10 value 170578.082193  
## iter 20 value 170504.191563  
## final value 170503.719026   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 296  
## initial value 176941.696617   
## final value 170499.808000   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 296  
## initial value 174778.012284   
## iter 10 value 170543.055386  
## iter 20 value 170501.291025  
## iter 30 value 170500.357603  
## final value 170500.303433   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 296  
## initial value 175047.560378   
## iter 10 value 170620.048168  
## iter 20 value 170522.881427  
## iter 30 value 170503.800642  
## iter 40 value 170503.479446  
## iter 40 value 170503.479399  
## iter 40 value 170503.479399  
## final value 170503.479399   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 355  
## initial value 174880.444073   
## final value 170499.808000   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 355  
## initial value 176812.809446   
## iter 10 value 170514.577001  
## iter 20 value 170501.471817  
## iter 30 value 170500.771949  
## iter 40 value 170500.357872  
## iter 50 value 170500.276753  
## final value 170500.271877   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 355  
## initial value 173382.023470   
## iter 10 value 170507.343338  
## iter 20 value 170503.208034  
## final value 170503.157760   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 414  
## initial value 172239.883233   
## final value 170499.808000   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 414  
## initial value 175012.201947   
## iter 10 value 170500.468956  
## iter 20 value 170500.256027  
## final value 170500.238709   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 414  
## initial value 173642.896335   
## iter 10 value 170518.137198  
## iter 20 value 170503.027609  
## final value 170502.954643   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 473  
## initial value 173966.774037   
## final value 170499.808000   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 473  
## initial value 173786.369517   
## iter 10 value 170507.736956  
## iter 20 value 170500.263287  
## final value 170500.218592   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 473  
## initial value 176282.120296   
## iter 10 value 170505.386417  
## iter 20 value 170502.786885  
## final value 170502.780478   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 532  
## initial value 175486.022402   
## final value 170499.808000   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 532  
## initial value 172067.324133   
## iter 10 value 170500.697047  
## iter 20 value 170500.215666  
## final value 170500.196714   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 532  
## initial value 175004.237933   
## iter 10 value 170535.160283  
## iter 20 value 170502.705952  
## final value 170502.629549   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 591  
## initial value 173249.308079   
## final value 170499.808000   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 591  
## initial value 175402.162267   
## iter 10 value 170509.847584  
## iter 20 value 170500.213442  
## final value 170500.181779   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 591  
## initial value 176667.103987   
## iter 10 value 170560.013534  
## iter 20 value 170502.938101  
## iter 30 value 170502.507692  
## iter 30 value 170502.506119  
## final value 170502.496661   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 60  
## initial value 174865.192230   
## final value 170853.437100   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 60  
## initial value 174404.908843   
## iter 10 value 170947.396331  
## iter 20 value 170855.806054  
## iter 30 value 170854.562556  
## iter 40 value 170854.308257  
## final value 170854.297986   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 60  
## initial value 176913.480196   
## iter 10 value 170864.159810  
## iter 20 value 170859.797527  
## iter 30 value 170859.468056  
## final value 170859.465250   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 119  
## initial value 174403.984729   
## final value 170853.437100   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 119  
## initial value 175201.522918   
## iter 10 value 170970.501688  
## iter 20 value 170856.680571  
## iter 30 value 170854.501335  
## iter 40 value 170854.183355  
## final value 170854.137044   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 119  
## initial value 175050.852974   
## iter 10 value 170891.973799  
## iter 20 value 170859.301233  
## iter 30 value 170858.626239  
## final value 170858.369810   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 178  
## initial value 174957.207581   
## final value 170853.437100   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 178  
## initial value 174758.462939   
## iter 10 value 170878.527765  
## iter 20 value 170854.316536  
## iter 30 value 170854.067624  
## final value 170854.036389   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 178  
## initial value 176568.843605   
## iter 10 value 170908.460957  
## iter 20 value 170859.196998  
## iter 30 value 170857.786473  
## final value 170857.755436   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 237  
## initial value 174744.484611   
## final value 170853.437100   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 237  
## initial value 176098.581828   
## iter 10 value 170886.778712  
## iter 20 value 170854.464101  
## iter 30 value 170853.997608  
## final value 170853.972513   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 237  
## initial value 173483.021547   
## iter 10 value 170860.534682  
## iter 20 value 170857.379928  
## final value 170857.341651   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 296  
## initial value 175091.938687   
## final value 170853.437100   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 296  
## initial value 175805.414535   
## iter 10 value 170875.808190  
## iter 20 value 170854.370125  
## iter 30 value 170853.982368  
## final value 170853.928153   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 296  
## initial value 175559.544837   
## iter 10 value 170862.219581  
## iter 20 value 170857.143400  
## final value 170857.033734   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 355  
## initial value 174937.003363   
## final value 170853.437100   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 355  
## initial value 174929.859362   
## iter 10 value 170854.570435  
## iter 20 value 170853.920681  
## final value 170853.897502   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 355  
## initial value 175381.291414   
## iter 10 value 170911.236562  
## iter 20 value 170856.966031  
## iter 30 value 170856.801801  
## final value 170856.789369   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 414  
## initial value 175375.862862   
## final value 170853.437100   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 414  
## initial value 172044.244120   
## iter 10 value 170864.516920  
## iter 20 value 170854.870547  
## iter 30 value 170854.061552  
## iter 40 value 170853.889620  
## final value 170853.874833   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 414  
## initial value 176891.000644   
## iter 10 value 170861.555004  
## iter 20 value 170856.612481  
## final value 170856.583634   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 473  
## initial value 177011.417883   
## final value 170853.437100   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 473  
## initial value 176705.994789   
## iter 10 value 170879.709583  
## iter 20 value 170854.063843  
## final value 170853.847606   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 473  
## initial value 175684.417367   
## iter 10 value 170859.007527  
## iter 20 value 170856.415666  
## final value 170856.409786   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 532  
## initial value 177459.368867   
## final value 170853.437100   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 532  
## initial value 175227.927629   
## iter 10 value 170854.266360  
## iter 20 value 170853.828339  
## final value 170853.824627   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 532  
## initial value 177323.551264   
## iter 10 value 170903.796517  
## iter 20 value 170856.264708  
## final value 170856.258612   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 591  
## initial value 174285.273691   
## final value 170853.437100   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 591  
## initial value 176228.274274   
## iter 10 value 170862.728173  
## iter 20 value 170853.815633  
## final value 170853.807743   
## converged

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 591  
## initial value 176500.942655   
## iter 10 value 170864.925395  
## iter 20 value 170856.264932  
## iter 30 value 170856.169435  
## iter 40 value 170856.127460  
## iter 40 value 170856.126058  
## iter 40 value 170856.125963  
## final value 170856.125963   
## converged

## Warning in nominalTrainWorkflow(x = x, y = y, wts = weights, info = trainInfo, :  
## There were missing values in resampled performance measures.

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## # weights: 60  
## initial value 193533.341261   
## final value 189106.033500   
## converged  
## RMSE Rsquared MAE   
## 39.24164 NA 39.20038

### SVM Performace

library(mlbench)  
svm\_rst = evaluation('svmRadial')

## Warning in preProcess.default(method = c("center", "scale"), x =  
## structure(list(: These variables have zero variances: BiologicalMaterial07

## Warning in .local(x, ...): Variable(s) `' constant. Cannot scale data.

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## Warning in .local(x, ...): Variable(s) `' constant. Cannot scale data.

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## Warning in .local(x, ...): Variable(s) `' constant. Cannot scale data.

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## Warning in .local(x, ...): Variable(s) `' constant. Cannot scale data.

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## Warning in .local(x, ...): Variable(s) `' constant. Cannot scale data.

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## Warning in .local(x, ...): Variable(s) `' constant. Cannot scale data.

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## Warning in .local(x, ...): Variable(s) `' constant. Cannot scale data.

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## Warning in .local(x, ...): Variable(s) `' constant. Cannot scale data.

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## Warning in .local(x, ...): Variable(s) `' constant. Cannot scale data.

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## Warning in .local(x, ...): Variable(s) `' constant. Cannot scale data.

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## Warning in .local(x, ...): Variable(s) `' constant. Cannot scale data.

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## Warning in .local(x, ...): Variable(s) `' constant. Cannot scale data.

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## Warning in .local(x, ...): Variable(s) `' constant. Cannot scale data.

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## Warning in .local(x, ...): Variable(s) `' constant. Cannot scale data.

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## Warning in .local(x, ...): Variable(s) `' constant. Cannot scale data.

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## Warning in .local(x, ...): Variable(s) `' constant. Cannot scale data.

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## Warning in .local(x, ...): Variable(s) `' constant. Cannot scale data.

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## Warning in .local(x, ...): Variable(s) `' constant. Cannot scale data.

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## Warning in .local(x, ...): Variable(s) `' constant. Cannot scale data.

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## Warning in .local(x, ...): Variable(s) `' constant. Cannot scale data.

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## Warning in .local(x, ...): Variable(s) `' constant. Cannot scale data.

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## Warning in .local(x, ...): Variable(s) `' constant. Cannot scale data.

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## Warning in .local(x, ...): Variable(s) `' constant. Cannot scale data.

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## Warning in .local(x, ...): Variable(s) `' constant. Cannot scale data.

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## Warning in .local(x, ...): Variable(s) `' constant. Cannot scale data.

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## Warning in .local(x, ...): Variable(s) `' constant. Cannot scale data.

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## Warning in .local(x, ...): Variable(s) `' constant. Cannot scale data.

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## Warning in .local(x, ...): Variable(s) `' constant. Cannot scale data.

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## Warning in .local(x, ...): Variable(s) `' constant. Cannot scale data.

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## Warning in .local(x, ...): Variable(s) `' constant. Cannot scale data.

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## Warning in .local(x, ...): Variable(s) `' constant. Cannot scale data.

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## Warning in .local(x, ...): Variable(s) `' constant. Cannot scale data.

## RMSE Rsquared MAE   
## 1.1463921 0.6880977 0.9427456

### MARS Performance

marsGrid = expand.grid(degree = 1:2, nprune = 2:15)  
mars\_rst = evaluation('earth', marsGrid)

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07  
  
## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07  
  
## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07  
  
## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07  
  
## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07  
  
## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07  
  
## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07  
  
## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
## 10, : These variables have zero variances: BiologicalMaterial07

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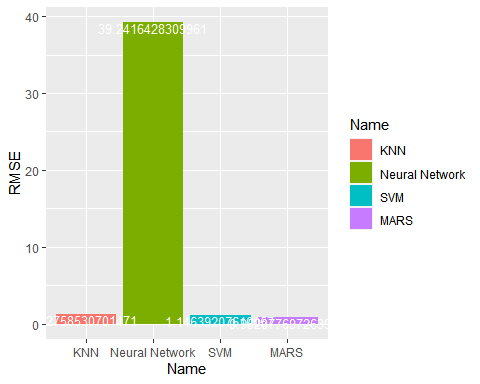
## Warning in preProcess.default(thresh = 0.95, k = 5, freqCut = 19, uniqueCut =  
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## RMSE Rsquared MAE   
## 0.9520777 0.7362918 0.8203221

df\_performance= rbind(data.frame(Name = 'KNN', RMSE = knn\_rst[1]), data.frame(Name= 'Neural Network', RMSE = net\_rst[1]) , data.frame(Name = 'SVM', RMSE = svm\_rst[1]), data.frame(Name = 'MARS', RMSE = mars\_rst[1]))  
ggplot(data =df\_performance, aes(x = Name, y = RMSE, fill=Name)) +  
 geom\_bar(stat="identity", position=position\_dodge()) +  
 geom\_text(aes(label=RMSE), vjust=1, color="white",  
 position = position\_dodge(0.9), size=3.5)



### A

Which nonlinear regression model gives the optimal resampling and test set performance?

#### ANSWER :

As we can see from above graph, The MARS model outperform among all the other models.The model performance metric RMSE gives minimum result for MARS model.

### B

Which predictors are most important in the optimal nonlinear regression model? Do either the biological or process variables dominate the list? How do the top ten important predictors compare to the top ten predictors from the optimal linear model?

marsGrid = expand.grid(degree = 1:2, nprune = 2:38)  
MARSModel = train(x = train[,-1], y = train$Yield, method = 'earth', tuneGrid = marsGrid, preProcess = c('center', 'scale'), trControl = trainControl(method='cv'))

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varImp(MARSModel)

## earth variable importance  
##   
## Overall  
## ManufacturingProcess32 100.00  
## ManufacturingProcess09 32.62  
## ManufacturingProcess13 0.00

#### ANS:

The graph on above shows aus Neural Network model’s top best features.

The Neural Network models (Which performs the best among the other models) gives us most important features as ranked above graph. The Neural Network models says that the most important feaute is ManufacturingProcess32 (100), and next ManufacturingProcess09 (32.62) ,ManufacturingProcess13 (0.00).

summary(MARSModel)

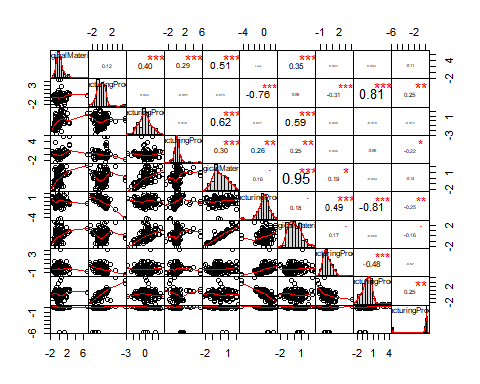
## Call: earth(x=data.frame[123,57], y=c(38.66,38.67,3...), keepxy=TRUE, degree=1,  
## nprune=4)  
##   
## coefficients  
## (Intercept) 38.781735  
## h(-1.02888-ManufacturingProcess09) -1.354290  
## h(-1.27561-ManufacturingProcess13) 3.705496  
## h(ManufacturingProcess32- -1.10694) 1.147357  
##   
## Selected 4 of 21 terms, and 3 of 57 predictors (nprune=4)  
## Termination condition: RSq changed by less than 0.001 at 21 terms  
## Importance: ManufacturingProcess32, ManufacturingProcess09, ...  
## Number of terms at each degree of interaction: 1 3 (additive model)  
## GCV 1.711083 RSS 187.1897 GRSq 0.5122766 RSq 0.5590697

### C

Explore the relationships between the top predictors and the response for the predictors that are unique to the optimal nonlinear regression model. Do these plots reveal intuition about the biological or process predictors and their relationship with yield?

#### ANS:

I’m going to plot correlation plot to see relationships



The graph above shows top 10 important features correlation with target varianle “Yield”. As we can in graph above, there are variables that have non-linear realtionship with target variable “Yield”.In addition to that, there are also variables that have linear correlationship with “Yield” target variable.