Tournament of doom solution

2023-04-24

knitr::opts\_chunk$set(echo = TRUE)

## R Markdown

library(readxl)
TD <- read\_excel("D:/Google Drive/SCRANTON/Other/Data contest/Tournament of doom/Tournament of Doom.xlsx")

#################################
#data prep
TD$sex=factor(TD$sex)
library(dplyr)

##
## Attaching package: 'dplyr'

## The following objects are masked from 'package:stats':
##
## filter, lag

## The following objects are masked from 'package:base':
##
## intersect, setdiff, setequal, union

TD$sex=recode(TD$sex, "1"= "Males", "0"= "Females")

TD$mohawk=factor(TD$mohawk)
TD$weapon=factor(TD$weapon)
##########################
#data exploration
library(GGally)

## Loading required package: ggplot2

## Registered S3 method overwritten by 'GGally':
## method from
## +.gg ggplot2

ggpairs(TD, columns = 2:11)

## `stat\_bin()` using `bins = 30`. Pick better value with `binwidth`.

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#############################
#sex differences

cor.test(as.numeric(TD$sex), TD$height) #yes association

##
## Pearson's product-moment correlation
##
## data: as.numeric(TD$sex) and TD$height
## t = 13.482, df = 998, p-value < 2.2e-16
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
## 0.3387639 0.4437100
## sample estimates:
## cor
## 0.3925138

cor.test(as.numeric(TD$sex), TD$dangerousness) #yes association

##
## Pearson's product-moment correlation
##
## data: as.numeric(TD$sex) and TD$dangerousness
## t = 15.571, df = 998, p-value < 2.2e-16
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
## 0.3908243 0.4906514
## sample estimates:
## cor
## 0.4421059

cor.test(as.numeric(TD$sex), TD$beefiness) #yes association

##
## Pearson's product-moment correlation
##
## data: as.numeric(TD$sex) and TD$beefiness
## t = 18.645, df = 998, p-value < 2.2e-16
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
## 0.4607913 0.5528390
## sample estimates:
## cor
## 0.5082653

cor.test(as.numeric(TD$sex), TD$meanness) #yes association

##
## Pearson's product-moment correlation
##
## data: as.numeric(TD$sex) and TD$meanness
## t = 7.9826, df = 998, p-value = 3.92e-15
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
## 0.1858140 0.3023857
## sample estimates:
## cor
## 0.2449851

cor.test(as.numeric(TD$sex), as.numeric(TD$mohawk)) #no association

##
## Pearson's product-moment correlation
##
## data: as.numeric(TD$sex) and as.numeric(TD$mohawk)
## t = 0.86548, df = 998, p-value = 0.387
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
## -0.03466592 0.08922762
## sample estimates:
## cor
## 0.02738602

cor.test(as.numeric(TD$sex), TD$bs) #yes association

##
## Pearson's product-moment correlation
##
## data: as.numeric(TD$sex) and TD$bs
## t = 7.8566, df = 998, p-value = 1.017e-14
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
## 0.1820751 0.2988655
## sample estimates:
## cor
## 0.241344

cor.test(as.numeric(TD$sex), TD$sf) #no association

##
## Pearson's product-moment correlation
##
## data: as.numeric(TD$sex) and TD$sf
## t = 0.87879, df = 998, p-value = 0.3797
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
## -0.03424525 0.08964542
## sample estimates:
## cor
## 0.02780687

cor.test(as.numeric(TD$sex), TD$agility) #yes association

##
## Pearson's product-moment correlation
##
## data: as.numeric(TD$sex) and TD$agility
## t = -13.469, df = 998, p-value < 2.2e-16
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
## -0.4433968 -0.3384186
## sample estimates:
## cor
## -0.3921838

#########################

mod.bf=lm(beefiness~ meanness, data = TD)
summary(mod.bf)

##
## Call:
## lm(formula = beefiness ~ meanness, data = TD)
##
## Residuals:
## Min 1Q Median 3Q Max
## -50.549 -15.665 0.176 15.685 53.197
##
## Coefficients:
## Estimate Std. Error t value Pr(>|t|)
## (Intercept) 4.41512 2.93749 1.503 0.133
## meanness 0.80861 0.05706 14.171 <2e-16 \*\*\*
## ---
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 19.77 on 998 degrees of freedom
## Multiple R-squared: 0.1675, Adjusted R-squared: 0.1667
## F-statistic: 200.8 on 1 and 998 DF, p-value: < 2.2e-16

mod.s=lm(beefiness~sex + meanness, data = TD)
summary(mod.s)

##
## Call:
## lm(formula = beefiness ~ sex + meanness, data = TD)
##
## Residuals:
## Min 1Q Median 3Q Max
## -58.088 -11.584 0.204 11.978 50.701
##
## Coefficients:
## Estimate Std. Error t value Pr(>|t|)
## (Intercept) 6.15361 2.60985 2.358 0.0186 \*
## sexMales 18.82490 1.14694 16.413 <2e-16 \*\*\*
## meanness 0.59854 0.05225 11.456 <2e-16 \*\*\*
## ---
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 17.55 on 997 degrees of freedom
## Multiple R-squared: 0.3446, Adjusted R-squared: 0.3433
## F-statistic: 262.1 on 2 and 997 DF, p-value: < 2.2e-16

#causal model
library(dagitty)
dag1 <- dagitty("dag {
Sex -> Beefiness
Sex->Meanness
Meanness->Beefiness
}")

plot(graphLayout(dag1))



adjustmentSets(dag1, exposure = "Meanness", outcome = "Beefiness") #must control for sex

## { Sex }

################################################################

#figuring out which variables to include in the dangerousness model
#here some possible interactions are included

mod.exp = lm(dangerousness~sex \* height + weapon \* beefiness + bs \* sf + meanness + agility, data = TD)

library(MASS)

##
## Attaching package: 'MASS'

## The following object is masked from 'package:dplyr':
##
## select

step=stepAIC(mod.exp, direction = c("both"),
 trace = 0, steps = 1000, k = 4)
step$anova

## Stepwise Model Path
## Analysis of Deviance Table
##
## Initial Model:
## dangerousness ~ sex \* height + weapon \* beefiness + bs \* sf +
## meanness + agility
##
## Final Model:
## dangerousness ~ sex + height + beefiness + bs + sf + agility +
## bs:sf
##
##
## Step Df Deviance Resid. Df Resid. Dev AIC
## 1 978 10352.21 2425.200
## 2 - weapon:beefiness 6 26.2748900 984 10378.48 2403.735
## 3 - weapon 6 71.6240291 990 10450.11 2386.612
## 4 - meanness 1 0.6224504 991 10450.73 2382.672
## 5 - sex:height 1 1.2477498 992 10451.98 2378.791

step$coefficients

## (Intercept) sexMales height beefiness bs sf
## 6.31555797 5.14886681 2.02312957 1.99089014 0.59875150 -0.46610983
## agility bs:sf
## 1.99887368 0.07766062

plot(step)



mod1=lm(dangerousness~sex + height + beefiness + bs + agility, data=TD)
library(jtools)
summ(mod1,vifs = TRUE)

## MODEL INFO:
## Observations: 1000
## Dependent Variable: dangerousness
## Type: OLS linear regression
##
## MODEL FIT:
## F(5,994) = 28737.81, p = 0.00
## R² = 0.99
## Adj. R² = 0.99
##
## Standard errors: OLS
## ------------------------------------------------------
## Est. S.E. t val. p VIF
## ----------------- ------ ------ -------- ------ ------
## (Intercept) 3.83 2.19 1.75 0.08
## sexMales 5.12 0.24 21.16 0.00 1.37
## height 2.03 0.03 63.62 0.00 2.13
## beefiness 1.99 0.01 244.64 0.00 2.92
## bs 0.98 0.07 14.65 0.00 1.12
## agility 2.00 0.01 205.09 0.00 1.85
## ------------------------------------------------------

library(ggpubr)

## Registered S3 methods overwritten by 'broom':
## method from
## tidy.glht jtools
## tidy.summary.glht jtools

ggscatter(data=TD, x = "beefiness", y = "dangerousness", add = "reg.line", conf.int = TRUE,
 size = "height", color = "agility", facet.by = "sex", alpha = 0.5,
 xlab = "Beefiness",
 ylab = "Dangerousness")

## `geom\_smooth()` using formula = 'y ~ x'

## Warning: The following aesthetics were dropped during statistical transformation:
## colour, fill
## ℹ This can happen when ggplot fails to infer the correct grouping structure in
## the data.
## ℹ Did you forget to specify a `group` aesthetic or to convert a numerical
## variable into a factor?
## The following aesthetics were dropped during statistical transformation:
## colour, fill
## ℹ This can happen when ggplot fails to infer the correct grouping structure in
## the data.
## ℹ Did you forget to specify a `group` aesthetic or to convert a numerical
## variable into a factor?



#########################################
#machine learning stuff
#first using some decision trees via rpart
library(caret)

## Loading required package: lattice

set.seed(12345)
treeexp= train(dangerousness~sex + height + weapon + beefiness + bs + sf + meanness + agility,
 data=TD,
 method= "rpart",
 metric="RMSE",
 trControl= trainControl(method="cv", number=5,
 returnResamp = "all",
 savePredictions = "all"),
 tuneLength=20)

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

summary(treeexp)

## Call:
## (function (formula, data, weights, subset, na.action = na.rpart,
## method, model = FALSE, x = FALSE, y = TRUE, parms, control,
## cost, ...)
## {
## Call <- match.call()
## if (is.data.frame(model)) {
## m <- model
## model <- FALSE
## }
## else {
## indx <- match(c("formula", "data", "weights", "subset"),
## names(Call), nomatch = 0)
## if (indx[1] == 0)
## stop("a 'formula' argument is required")
## temp <- Call[c(1, indx)]
## temp$na.action <- na.action
## temp[[1]] <- quote(stats::model.frame)
## m <- eval.parent(temp)
## }
## Terms <- attr(m, "terms")
## if (any(attr(Terms, "order") > 1))
## stop("Trees cannot handle interaction terms")
## Y <- model.response(m)
## wt <- model.weights(m)
## if (any(wt < 0))
## stop("negative weights not allowed")
## if (!length(wt))
## wt <- rep(1, nrow(m))
## offset <- model.offset(m)
## X <- rpart.matrix(m)
## nobs <- nrow(X)
## nvar <- ncol(X)
## if (missing(method)) {
## method <- if (is.factor(Y) || is.character(Y))
## "class"
## else if (inherits(Y, "Surv"))
## "exp"
## else if (is.matrix(Y))
## "poisson"
## else "anova"
## }
## if (is.list(method)) {
## mlist <- method
## method <- "user"
## init <- if (missing(parms))
## mlist$init(Y, offset, wt = wt)
## else mlist$init(Y, offset, parms, wt)
## keep <- rpartcallback(mlist, nobs, init)
## method.int <- 4
## parms <- init$parms
## }
## else {
## method.int <- pmatch(method, c("anova", "poisson", "class",
## "exp"))
## if (is.na(method.int))
## stop("Invalid method")
## method <- c("anova", "poisson", "class", "exp")[method.int]
## if (method.int == 4)
## method.int <- 2
## init <- if (missing(parms))
## get(paste("rpart", method, sep = "."), envir = environment())(Y,
## offset, , wt)
## else get(paste("rpart", method, sep = "."), envir = environment())(Y,
## offset, parms, wt)
## ns <- asNamespace("rpart")
## if (!is.null(init$print))
## environment(init$print) <- ns
## if (!is.null(init$summary))
## environment(init$summary) <- ns
## if (!is.null(init$text))
## environment(init$text) <- ns
## }
## Y <- init$y
## xlevels <- .getXlevels(Terms, m)
## cats <- rep(0, ncol(X))
## if (!is.null(xlevels)) {
## xlevels <- xlevels[names(xlevels) %in% colnames(X)]
## cats[match(names(xlevels), colnames(X))] <- unlist(lapply(xlevels,
## length))
## }
## extraArgs <- list(...)
## if (length(extraArgs)) {
## controlargs <- names(formals(rpart.control))
## indx <- match(names(extraArgs), controlargs, nomatch = 0)
## if (any(indx == 0))
## stop(gettextf("Argument %s not matched", names(extraArgs)[indx ==
## 0]), domain = NA)
## }
## controls <- rpart.control(...)
## if (!missing(control))
## controls[names(control)] <- control
## xval <- controls$xval
## if (is.null(xval) || (length(xval) == 1 && xval == 0) ||
## method == "user") {
## xgroups <- 0
## xval <- 0
## }
## else if (length(xval) == 1) {
## xgroups <- sample(rep(1:xval, length.out = nobs), nobs,
## replace = FALSE)
## }
## else if (length(xval) == nobs) {
## xgroups <- xval
## xval <- length(unique(xgroups))
## }
## else {
## if (!is.null(attr(m, "na.action"))) {
## temp <- as.integer(attr(m, "na.action"))
## xval <- xval[-temp]
## if (length(xval) == nobs) {
## xgroups <- xval
## xval <- length(unique(xgroups))
## }
## else stop("Wrong length for 'xval'")
## }
## else stop("Wrong length for 'xval'")
## }
## if (missing(cost))
## cost <- rep(1, nvar)
## else {
## if (length(cost) != nvar)
## stop("Cost vector is the wrong length")
## if (any(cost <= 0))
## stop("Cost vector must be positive")
## }
## tfun <- function(x) if (is.matrix(x))
## rep(is.ordered(x), ncol(x))
## else is.ordered(x)
## labs <- sub("^`(.\*)`$", "\\1", attr(Terms, "term.labels"))
## isord <- unlist(lapply(m[labs], tfun))
## storage.mode(X) <- "double"
## storage.mode(wt) <- "double"
## temp <- as.double(unlist(init$parms))
## if (!length(temp))
## temp <- 0
## rpfit <- .Call(C\_rpart, ncat = as.integer(cats \* !isord),
## method = as.integer(method.int), as.double(unlist(controls)),
## temp, as.integer(xval), as.integer(xgroups), as.double(t(init$y)),
## X, wt, as.integer(init$numy), as.double(cost))
## nsplit <- nrow(rpfit$isplit)
## ncat <- if (!is.null(rpfit$csplit))
## nrow(rpfit$csplit)
## else 0
## if (nsplit == 0)
## xval <- 0
## numcp <- ncol(rpfit$cptable)
## temp <- if (nrow(rpfit$cptable) == 3)
## c("CP", "nsplit", "rel error")
## else c("CP", "nsplit", "rel error", "xerror", "xstd")
## dimnames(rpfit$cptable) <- list(temp, 1:numcp)
## tname <- c("<leaf>", colnames(X))
## splits <- matrix(c(rpfit$isplit[, 2:3], rpfit$dsplit), ncol = 5,
## dimnames = list(tname[rpfit$isplit[, 1] + 1], c("count",
## "ncat", "improve", "index", "adj")))
## index <- rpfit$inode[, 2]
## nadd <- sum(isord[rpfit$isplit[, 1]])
## if (nadd > 0) {
## newc <- matrix(0, nadd, max(cats))
## cvar <- rpfit$isplit[, 1]
## indx <- isord[cvar]
## cdir <- splits[indx, 2]
## ccut <- floor(splits[indx, 4])
## splits[indx, 2] <- cats[cvar[indx]]
## splits[indx, 4] <- ncat + 1:nadd
## for (i in 1:nadd) {
## newc[i, 1:(cats[(cvar[indx])[i]])] <- -as.integer(cdir[i])
## newc[i, 1:ccut[i]] <- as.integer(cdir[i])
## }
## catmat <- if (ncat == 0)
## newc
## else {
## cs <- rpfit$csplit
## ncs <- ncol(cs)
## ncc <- ncol(newc)
## if (ncs < ncc)
## cs <- cbind(cs, matrix(0, nrow(cs), ncc - ncs))
## rbind(cs, newc)
## }
## ncat <- ncat + nadd
## }
## else catmat <- rpfit$csplit
## if (nsplit == 0) {
## frame <- data.frame(row.names = 1, var = "<leaf>", n = rpfit$inode[,
## 5], wt = rpfit$dnode[, 3], dev = rpfit$dnode[, 1],
## yval = rpfit$dnode[, 4], complexity = rpfit$dnode[,
## 2], ncompete = 0, nsurrogate = 0)
## }
## else {
## temp <- ifelse(index == 0, 1, index)
## svar <- ifelse(index == 0, 0, rpfit$isplit[temp, 1])
## frame <- data.frame(row.names = rpfit$inode[, 1], var = tname[svar +
## 1], n = rpfit$inode[, 5], wt = rpfit$dnode[, 3],
## dev = rpfit$dnode[, 1], yval = rpfit$dnode[, 4],
## complexity = rpfit$dnode[, 2], ncompete = pmax(0,
## rpfit$inode[, 3] - 1), nsurrogate = rpfit$inode[,
## 4])
## }
## if (method.int == 3) {
## numclass <- init$numresp - 2
## nodeprob <- rpfit$dnode[, numclass + 5]/sum(wt)
## temp <- pmax(1, init$counts)
## temp <- rpfit$dnode[, 4 + (1:numclass)] %\*% diag(init$parms$prior/temp)
## yprob <- temp/rowSums(temp)
## yval2 <- matrix(rpfit$dnode[, 4 + (0:numclass)], ncol = numclass +
## 1)
## frame$yval2 <- cbind(yval2, yprob, nodeprob)
## }
## else if (init$numresp > 1)
## frame$yval2 <- rpfit$dnode[, -(1:3), drop = FALSE]
## if (is.null(init$summary))
## stop("Initialization routine is missing the 'summary' function")
## functions <- if (is.null(init$print))
## list(summary = init$summary)
## else list(summary = init$summary, print = init$print)
## if (!is.null(init$text))
## functions <- c(functions, list(text = init$text))
## if (method == "user")
## functions <- c(functions, mlist)
## where <- rpfit$which
## names(where) <- row.names(m)
## ans <- list(frame = frame, where = where, call = Call, terms = Terms,
## cptable = t(rpfit$cptable), method = method, parms = init$parms,
## control = controls, functions = functions, numresp = init$numresp)
## if (nsplit)
## ans$splits = splits
## if (ncat > 0)
## ans$csplit <- catmat + 2
## if (nsplit)
## ans$variable.importance <- importance(ans)
## if (model) {
## ans$model <- m
## if (missing(y))
## y <- FALSE
## }
## if (y)
## ans$y <- Y
## if (x) {
## ans$x <- X
## ans$wt <- wt
## }
## ans$ordered <- isord
## if (!is.null(attr(m, "na.action")))
## ans$na.action <- attr(m, "na.action")
## if (!is.null(xlevels))
## attr(ans, "xlevels") <- xlevels
## if (method == "class")
## attr(ans, "ylevels") <- init$ylevels
## class(ans) <- "rpart"
## ans
## })(formula = .outcome ~ ., data = list(c(0, 1, 0, 1, 0, 1, 0,
## 1, 0, 0, 0, 0, 0, 1, 1, 1, 0, 1, 0, 1, 0, 1, 0, 1, 0, 1, 0, 1,
## 0, 0, 0, 1, 0, 1, 0, 1, 0, 1, 0, 1, 1, 1, 0, 1, 1, 1, 0, 0, 0,
## 1, 1, 0, 0, 1, 1, 1, 0, 1, 0, 1, 1, 0, 0, 0, 1, 0, 0, 1, 1, 0,
## 0, 1, 0, 0, 0, 1, 1, 0, 0, 1, 0, 1, 0, 1, 1, 1, 1, 1, 0, 1, 0,
## 1, 0, 0, 0, 1, 1, 1, 0, 1, 0, 1, 1, 1, 0, 1, 0, 0, 0, 0, 0, 1,
## 0, 1, 1, 1, 0, 1, 1, 0, 1, 1, 1, 1, 0, 1, 0, 1, 0, 1, 0, 1, 0,
## 1, 0, 0, 0, 1, 0, 0, 0, 1, 1, 1, 0, 1, 0, 1, 1, 0, 0, 0, 0, 1,
## 0, 1, 0, 0, 0, 1, 0, 1, 0, 0, 0, 0, 0, 1, 0, 1, 0, 0, 0, 1, 0,
## 1, 1, 1, 0, 1, 0, 1, 0, 1, 0, 0, 1, 0, 1, 1, 1, 1, 0, 1, 0, 1,
## 0, 0, 1, 0, 0, 0, 0, 1, 1, 0, 1, 1, 0, 1, 0, 1, 0, 1, 0, 1, 0,
## 1, 0, 1, 0, 0, 0, 1, 0, 1, 0, 1, 0, 1, 0, 0, 0, 1, 1, 1, 0, 0,
## 0, 1, 0, 1, 0, 1, 0, 1, 0, 1, 0, 1, 0, 1, 0, 1, 0, 1, 0, 0, 1,
## 1, 0, 1, 0, 1, 1, 1, 0, 0, 0, 1, 1, 1, 1, 0, 1, 1, 0, 1, 0, 1,
## 0, 1, 0, 1, 0, 1, 0, 1, 0, 1, 0, 1, 1, 1, 0, 1, 0, 1, 0, 0, 0,
## 1, 0, 1, 0, 0, 1, 1, 0, 1, 0, 1, 1, 1, 0, 0, 0, 1, 0, 1, 0, 1,
## 0, 1, 0, 1, 0, 1, 0, 1, 1, 0, 0, 1, 1, 1, 0, 0, 0, 1, 0, 1, 0,
## 1, 0, 1, 0, 0, 1, 0, 1, 0, 1, 1, 0, 1, 0, 0, 0, 1, 0, 0, 0, 1,
## 0, 0, 1, 0, 0, 1, 0, 1, 0, 1, 0, 1, 0, 1, 0, 1, 1, 0, 0, 1, 1,
## 0, 0, 1, 1, 1, 0, 1, 0, 1, 0, 1, 0, 1, 0, 0, 0, 0, 1, 1, 0, 0,
## 0, 1, 0, 1, 0, 1, 0, 0, 0, 1, 0, 1, 0, 1, 0, 1, 0, 1, 0, 1, 0,
## 1, 0, 0, 0, 1, 0, 1, 0, 0, 0, 1, 0, 1, 0, 0, 0, 1, 0, 0, 1, 1,
## 0, 1, 0, 1, 0, 1, 0, 1, 0, 0, 0, 1, 0, 0, 1, 1, 0, 1, 0, 1, 0,
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## 380.331600314729, 303.925764311292, 395.351768148252, 314.632426335216,
## 372.223540200729, 344.90336787318, 374.548318770096, 335.91698467563,
## 378.073966127015, 349.245450493307, 330.797427875447, 312.117216380948,
## 367.421170572603, 282.758047858728, 353.871903726598, 340.498233720337,
## 346.17580620797, 393.02577621046, 355.844614426238, 294.709479584892,
## 354.633339999487, 283.876840603777, 369.910335392707, 325.635133261383,
## 362.364576543165, 303.242833618839, 332.380037379615, 309.773098067921,
## 358.215346374501, 249.343209996545, 387.293672731143, 281.947230500488,
## 383.476689771278, 298.697384991739, 398.617143084444, 334.429347720762,
## 378.505702822696, 294.005267546643, 334.254724738774, 278.60252534297,
## 378.583890022482, 265.775001741251, 386.93179445417, 321.804838188222,
## 383.339261721203, 312.728149823288, 413.136826691682, 323.993397562812,
## 323.549279494047, 287.028608898062, 344.337028439083, 305.137163395388,
## 380.649623218008, 353.932914478748, 372.904865478005, 328.21441624019,
## 367.021709998644, 288.40773591973, 362.721868715215, 327.091001963404,
## 385.721178075821, 315.557021470273, 327.314753460173, 302.442976709919,
## 374.138573411768, 298.603215520268, 358.936718173886, 231.297219323215,
## 331.918784428721, 344.66900006348, 368.964400833752, 276.935817953964,
## 380.017709786033, 275.946701909748, 353.282352241467, 311.433679774684,
## 374.858774400884, 304.004737418726, 356.46038817929, 349.90417201474,
## 348.356601405371, 261.765993132935, 386.216121415623, 314.768236381972,
## 370.952647627352, 312.883516802867, 360.74304527128, 299.254555474886,
## 348.931518982483, 311.13316269924, 397.283804325134, 323.256409679697,
## 341.828004117475, 319.642622245754, 361.437888686427, 329.812442873482,
## 392.454277882892, 292.601776355383, 379.971705255085, 299.983056649022,
## 401.760584401083, 294.882581633999, 322.782858437698, 312.40038157497,
## 400.375174492027, 268.747314005542, 390.693705126578, 308.985885354712,
## 353.321163607819, 323.686486347501, 421.937514174167, 341.410854999964,
## 332.062526125125, 313.259514502898, 317.901990288482, 346.850630204549,
## 379.424788583668, 300.561837475781, 360.740817843179, 293.042354649302,
## 359.220978232075, 300.680993860413, 364.613976457984, 308.022973251028,
## 390.210441150594, 294.519510122608, 325.351581299192, 270.380901544298,
## 360.915813003058, 261.100333178257, 424.643042078335, 330.92805700626,
## 373.921059248821, 288.911138526264, 370.474986333084, 280.810532719615,
## 370.343457212806, 274.742378022311, 360.465287417535, 314.421359149754,
## 393.465868569005, 313.688530488299, 383.386916462534, 356.146333898757,
## 366.501252590278, 352.664146337554, 419.720703456415, 358.833837741334,
## 382.079996537837, 345.901396033843, 323.664010120116, 306.683277279786,
## 347.482018465197, 280.927502487592, 335.079613776035, 260.160142340634,
## 341.92607800614, 350.15708903105, 349.840226096597, 340.97883236729,
## 388.616904999703, 313.1160606591, 344.115447586837, 356.87702146137,
## 397.269605812991, 341.716022606956, 382.459416815152, 311.749208340654,
## 399.419912942694, 275.390756452701, 358.52672779139, 314.396017385589,
## 385.718401357268, 330.154846411769, 369.638923091473, 338.553652565278,
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## 370.410627061913, 330.451984938311, 366.816654210839, 294.395917612678,
## 396.638017135997, 310.004926301894, 397.780515569427, 311.171178246781,
## 372.777996872361, 307.677784762444, 396.707149338641, 275.092328529462,
## 383.450482961051, 291.324830829142, 360.839880429028, 365.678759052426,
## 373.423012451016, 271.929159773569, 373.462292360911, 341.245059713168,
## 370.733116061689, 265.150721823401, 355.603485070711, 293.086847756959,
## 364.898722769051, 318.566799757103, 345.715678142684, 301.614456041429,
## 368.975654656431, 271.422797347051, 346.460513952718, 319.740506475826,
## 353.391546259687, 339.951461008621, 383.660400808954, 328.043020303497,
## 346.580511693668, 279.390190650279, 383.969337250307, 316.713039130692,
## 354.862085307228, 308.357796781784, 379.161203854676, 271.992798358625,
## 366.74251020116, 311.914678188906, 385.121407281731, 328.349764805722,
## 384.557240770328, 305.21733261627, 386.195144847756, 341.977134283095,
## 355.160833319491, 310.110007653816, 379.762267700322, 323.889594178377,
## 371.213837557787, 322.904469945388, 392.270729825224, 315.312641046307,
## 375.9323145498, 261.114300289385, 393.462896917185, 302.045527678253,
## 361.183393558281, 296.863159045578, 376.544855568543, 323.855424324509,
## 382.280007569588, 296.47550418585, 356.930664367643, 323.409585672338,
## 353.12970074227, 330.159408849761, 360.791232642166, 307.645640388032,
## 401.362212454831, 278.431142969055, 350.351398607444, 306.411751572058,
## 352.017176591937, 341.051815230422, 417.019758896519, 291.109287688349,
## 374.679919046325, 372.346208289428, 366.232818167893, 309.516207231234,
## 386.763768858198, 281.222688687261, 327.176125402836, 295.768526506207,
## 386.918393900295, 272.916239637457, 352.007662784664, 267.417610178932,
## 358.622827595983, 266.797099727362, 358.973273825432, 280.309188064259,
## 386.539592803161, 309.653173758375, 380.53935175793, 315.537103070442,
## 346.320025104402, 353.03722526624, 341.914223540526, 294.400832925914,
## 325.737895309685)), control = list(20, 7, 0, 4, 5, 2, 0,
## 30, 0))
## n= 1000
##
## CP nsplit rel error
## 1 0.570141366 0 1.00000000
## 2 0.074759045 1 0.42985863
## 3 0.065812698 2 0.35509959
## 4 0.041384669 3 0.28928689
## 5 0.031704598 4 0.24790222
## 6 0.019341661 5 0.21619762
## 7 0.015162838 6 0.19685596
## 8 0.012696902 7 0.18169313
## 9 0.012257707 8 0.16899622
## 10 0.009623840 9 0.15673852
## 11 0.007235981 10 0.14711468
## 12 0.007135546 11 0.13987869
## 13 0.006024534 12 0.13274315
## 14 0.005859969 13 0.12671861
## 15 0.005502363 14 0.12085865
## 16 0.004449289 15 0.11535628
## 17 0.004058350 16 0.11090699
## 18 0.003856963 17 0.10684864
## 19 0.003732429 18 0.10299168
## 20 0.003705843 19 0.09925925
##
## Variable importance
## beefiness agility height sexMales meanness bs
## 29 25 19 12 9 6
##
## Node number 1: 1000 observations, complexity param=0.5701414
## mean=339.0632, MSE=1534.819
## left son=2 (522 obs) right son=3 (478 obs)
## Primary splits:
## beefiness < 52.5 to the left, improve=0.57014140, (0 missing)
## height < 69.20857 to the left, improve=0.40837800, (0 missing)
## sexMales < 0.5 to the left, improve=0.19545760, (0 missing)
## meanness < 49.5 to the left, improve=0.08332828, (0 missing)
## agility < 48.5 to the right, improve=0.07543923, (0 missing)
## Surrogate splits:
## height < 68.21148 to the left, agree=0.874, adj=0.736, (0 split)
## agility < 49.5 to the right, agree=0.825, adj=0.634, (0 split)
## sexMales < 0.5 to the left, agree=0.759, adj=0.496, (0 split)
## meanness < 49.5 to the left, agree=0.697, adj=0.366, (0 split)
## bs < 5.5 to the left, agree=0.633, adj=0.232, (0 split)
##
## Node number 2: 522 observations, complexity param=0.07475905
## mean=310.7558, MSE=748.7839
## left son=4 (268 obs) right son=5 (254 obs)
## Primary splits:
## agility < 59.5 to the left, improve=0.293558100, (0 missing)
## beefiness < 27.5 to the left, improve=0.288827400, (0 missing)
## height < 66.87118 to the left, improve=0.061712930, (0 missing)
## weapon7 < 0.5 to the left, improve=0.012863900, (0 missing)
## meanness < 29.5 to the right, improve=0.009399561, (0 missing)
## Surrogate splits:
## height < 62.47712 to the right, agree=0.557, adj=0.091, (0 split)
## beefiness < 15.5 to the right, agree=0.534, adj=0.043, (0 split)
## meanness < 34.5 to the right, agree=0.534, adj=0.043, (0 split)
## bs < 5.5 to the right, agree=0.533, adj=0.039, (0 split)
## weapon7 < 0.5 to the left, agree=0.529, adj=0.031, (0 split)
##
## Node number 3: 478 observations, complexity param=0.0658127
## mean=369.9762, MSE=562.5317
## left son=6 (266 obs) right son=7 (212 obs)
## Primary splits:
## agility < 41.5 to the left, improve=0.37565750, (0 missing)
## beefiness < 65.5 to the left, improve=0.14259100, (0 missing)
## height < 69.13403 to the left, improve=0.03505555, (0 missing)
## meanness < 45.5 to the right, improve=0.01504556, (0 missing)
## sexMales < 0.5 to the left, improve=0.01435128, (0 missing)
## Surrogate splits:
## sf < 8.5 to the left, agree=0.569, adj=0.028, (0 split)
## height < 64.89065 to the right, agree=0.565, adj=0.019, (0 split)
## beefiness < 55.5 to the right, agree=0.563, adj=0.014, (0 split)
## bs < 4.5 to the right, agree=0.563, adj=0.014, (0 split)
## weapon3 < 0.5 to the left, agree=0.561, adj=0.009, (0 split)
##
## Node number 4: 268 observations, complexity param=0.04138467
## mean=296.3222, MSE=564.3884
## left son=8 (148 obs) right son=9 (120 obs)
## Primary splits:
## beefiness < 26.5 to the left, improve=0.41993680, (0 missing)
## height < 68.81371 to the left, improve=0.16662110, (0 missing)
## agility < 52.5 to the left, improve=0.11409870, (0 missing)
## sexMales < 0.5 to the left, improve=0.04300230, (0 missing)
## meanness < 60.5 to the left, improve=0.02463975, (0 missing)
## Surrogate splits:
## height < 68.81371 to the left, agree=0.612, adj=0.133, (0 split)
## agility < 38.5 to the right, agree=0.601, adj=0.108, (0 split)
## weapon4 < 0.5 to the left, agree=0.597, adj=0.100, (0 split)
## weapon6 < 0.5 to the left, agree=0.571, adj=0.042, (0 split)
## meanness < 56.5 to the left, agree=0.571, adj=0.042, (0 split)
##
## Node number 5: 254 observations, complexity param=0.0317046
## mean=325.985, MSE=491.6042
## left son=10 (99 obs) right son=11 (155 obs)
## Primary splits:
## beefiness < 22.5 to the left, improve=0.38969980, (0 missing)
## agility < 74.5 to the left, improve=0.25981710, (0 missing)
## height < 64.28261 to the left, improve=0.09268484, (0 missing)
## meanness < 42.5 to the right, improve=0.02405100, (0 missing)
## sf < 9.5 to the left, improve=0.02077405, (0 missing)
## Surrogate splits:
## meanness < 61.5 to the right, agree=0.630, adj=0.051, (0 split)
## sf < 1.5 to the left, agree=0.618, adj=0.020, (0 split)
##
## Node number 6: 266 observations, complexity param=0.01934166
## mean=356.9985, MSE=381.3323
## left son=12 (26 obs) right son=13 (240 obs)
## Primary splits:
## agility < 22.5 to the left, improve=0.29266170, (0 missing)
## beefiness < 67.5 to the left, improve=0.28872910, (0 missing)
## height < 69.13403 to the left, improve=0.05372561, (0 missing)
## bs < 4.5 to the left, improve=0.04627648, (0 missing)
## sexMales < 0.5 to the left, improve=0.03938987, (0 missing)
##
## Node number 7: 212 observations, complexity param=0.01225771
## mean=386.2595, MSE=313.4207
## left son=14 (108 obs) right son=15 (104 obs)
## Primary splits:
## beefiness < 65.5 to the left, improve=0.28314120, (0 missing)
## agility < 54.5 to the left, improve=0.21929970, (0 missing)
## height < 69.00662 to the left, improve=0.10703950, (0 missing)
## meanness < 45.5 to the right, improve=0.01740099, (0 missing)
## sexMales < 0.5 to the left, improve=0.01342430, (0 missing)
## Surrogate splits:
## agility < 44.5 to the right, agree=0.585, adj=0.154, (0 split)
## meanness < 60.5 to the left, agree=0.561, adj=0.106, (0 split)
## height < 74.30353 to the right, agree=0.552, adj=0.087, (0 split)
## weapon2 < 0.5 to the left, agree=0.538, adj=0.058, (0 split)
## weapon5 < 0.5 to the left, agree=0.538, adj=0.058, (0 split)
##
## Node number 8: 148 observations, complexity param=0.00962384
## mean=282.4598, MSE=296.6786
## left son=16 (68 obs) right son=17 (80 obs)
## Primary splits:
## agility < 51.5 to the left, improve=0.33640140, (0 missing)
## beefiness < 22.5 to the left, improve=0.21898680, (0 missing)
## height < 68.35152 to the left, improve=0.13259250, (0 missing)
## bs < 2.5 to the left, improve=0.01957344, (0 missing)
## weapon7 < 0.5 to the left, improve=0.01778132, (0 missing)
## Surrogate splits:
## height < 66.72647 to the right, agree=0.588, adj=0.103, (0 split)
## meanness < 51.5 to the right, agree=0.581, adj=0.088, (0 split)
## bs < 7.5 to the right, agree=0.568, adj=0.059, (0 split)
## beefiness < 4.5 to the left, agree=0.554, adj=0.029, (0 split)
## sf < 5.5 to the left, agree=0.554, adj=0.029, (0 split)
##
## Node number 9: 120 observations, complexity param=0.007235981
## mean=313.4193, MSE=365.2472
## left son=18 (64 obs) right son=19 (56 obs)
## Primary splits:
## beefiness < 33.5 to the left, improve=0.25338830, (0 missing)
## height < 66.85377 to the left, improve=0.24037970, (0 missing)
## meanness < 53.5 to the left, improve=0.10396520, (0 missing)
## agility < 45.5 to the left, improve=0.08619279, (0 missing)
## sexMales < 0.5 to the left, improve=0.07157241, (0 missing)
## Surrogate splits:
## agility < 48.5 to the right, agree=0.700, adj=0.357, (0 split)
## height < 66.92355 to the left, agree=0.683, adj=0.321, (0 split)
## meanness < 57.5 to the left, agree=0.625, adj=0.196, (0 split)
## sexMales < 0.5 to the left, agree=0.608, adj=0.161, (0 split)
## weapon7 < 0.5 to the left, agree=0.575, adj=0.089, (0 split)
##
## Node number 10: 99 observations, complexity param=0.007135546
## mean=308.6661, MSE=252.1102
## left son=20 (57 obs) right son=21 (42 obs)
## Primary splits:
## agility < 67.5 to the left, improve=0.43879220, (0 missing)
## beefiness < 9.5 to the left, improve=0.35318750, (0 missing)
## height < 61.96929 to the left, improve=0.16252110, (0 missing)
## sf < 2.5 to the left, improve=0.04557510, (0 missing)
## bs < 4.5 to the left, improve=0.02769302, (0 missing)
## Surrogate splits:
## bs < 5.5 to the left, agree=0.596, adj=0.048, (0 split)
## weapon5 < 0.5 to the left, agree=0.586, adj=0.024, (0 split)
## beefiness < 18.5 to the left, agree=0.586, adj=0.024, (0 split)
##
## Node number 11: 155 observations, complexity param=0.0126969
## mean=337.0468, MSE=330.6305
## left son=22 (104 obs) right son=23 (51 obs)
## Primary splits:
## agility < 69.5 to the left, improve=0.38025980, (0 missing)
## beefiness < 30.5 to the left, improve=0.22854580, (0 missing)
## height < 66.53981 to the left, improve=0.13675170, (0 missing)
## meanness < 28.5 to the right, improve=0.03548843, (0 missing)
## bs < 5.5 to the left, improve=0.01492765, (0 missing)
## Surrogate splits:
## height < 69.87397 to the left, agree=0.690, adj=0.059, (0 split)
## meanness < 25 to the right, agree=0.690, adj=0.059, (0 split)
## sf < 9.5 to the left, agree=0.684, adj=0.039, (0 split)
##
## Node number 12: 26 observations
## mean=324.9023, MSE=270.4448
##
## Node number 13: 240 observations, complexity param=0.01516284
## mean=360.4756, MSE=269.6536
## left son=26 (127 obs) right son=27 (113 obs)
## Primary splits:
## beefiness < 67.5 to the left, improve=0.35960050, (0 missing)
## agility < 31.5 to the left, improve=0.09713194, (0 missing)
## height < 69.13403 to the left, improve=0.05960727, (0 missing)
## sexMales < 0.5 to the left, improve=0.03998747, (0 missing)
## meanness < 71.5 to the right, improve=0.02500460, (0 missing)
## Surrogate splits:
## meanness < 49.5 to the right, agree=0.588, adj=0.124, (0 split)
## agility < 29.5 to the right, agree=0.583, adj=0.115, (0 split)
## weapon6 < 0.5 to the left, agree=0.562, adj=0.071, (0 split)
## height < 67.74965 to the right, agree=0.550, adj=0.044, (0 split)
## bs < 3.5 to the right, agree=0.550, adj=0.044, (0 split)
##
## Node number 14: 108 observations, complexity param=0.005859969
## mean=377.0152, MSE=220.2765
## left son=28 (71 obs) right son=29 (37 obs)
## Primary splits:
## agility < 51.5 to the left, improve=0.37805990, (0 missing)
## beefiness < 56.5 to the left, improve=0.19194310, (0 missing)
## height < 69.00662 to the left, improve=0.16649750, (0 missing)
## weapon6 < 0.5 to the right, improve=0.03961269, (0 missing)
## sf < 5.5 to the right, improve=0.03476957, (0 missing)
## Surrogate splits:
## height < 64.8813 to the right, agree=0.667, adj=0.027, (0 split)
##
## Node number 15: 104 observations, complexity param=0.006024534
## mean=395.8592, MSE=229.2496
## left son=30 (61 obs) right son=31 (43 obs)
## Primary splits:
## agility < 47.5 to the left, improve=0.38782770, (0 missing)
## beefiness < 73.5 to the left, improve=0.18987040, (0 missing)
## height < 73.65981 to the left, improve=0.14643160, (0 missing)
## meanness < 45.5 to the right, improve=0.05620619, (0 missing)
## bs < 7.5 to the left, improve=0.02350625, (0 missing)
## Surrogate splits:
## height < 76.02629 to the left, agree=0.615, adj=0.070, (0 split)
## weapon7 < 0.5 to the left, agree=0.615, adj=0.070, (0 split)
## weapon6 < 0.5 to the left, agree=0.606, adj=0.047, (0 split)
## beefiness < 78.5 to the left, agree=0.606, adj=0.047, (0 split)
## bs < 7.5 to the left, agree=0.606, adj=0.047, (0 split)
##
## Node number 16: 68 observations, complexity param=0.003856963
## mean=271.6239, MSE=224.0976
## left son=32 (59 obs) right son=33 (9 obs)
## Primary splits:
## height < 68.35152 to the left, improve=0.38846920, (0 missing)
## beefiness < 19.5 to the left, improve=0.30565590, (0 missing)
## agility < 44.5 to the left, improve=0.24655420, (0 missing)
## sexMales < 0.5 to the left, improve=0.05796940, (0 missing)
## meanness < 34.5 to the right, improve=0.04779093, (0 missing)
##
## Node number 17: 80 observations
## mean=291.6702, MSE=173.7366
##
## Node number 18: 64 observations, complexity param=0.005502363
## mean=304.4204, MSE=217.6183
## left son=36 (20 obs) right son=37 (44 obs)
## Primary splits:
## agility < 50.5 to the left, improve=0.60636080, (0 missing)
## height < 64.55971 to the left, improve=0.15714170, (0 missing)
## beefiness < 31.5 to the left, improve=0.07891925, (0 missing)
## sf < 6.5 to the left, improve=0.05508372, (0 missing)
## bs < 3.5 to the right, improve=0.03722982, (0 missing)
## Surrogate splits:
## height < 58.83705 to the left, agree=0.719, adj=0.10, (0 split)
## meanness < 32 to the left, agree=0.703, adj=0.05, (0 split)
##
## Node number 19: 56 observations
## mean=323.7038, MSE=335.646
##
## Node number 20: 57 observations
## mean=299.6376, MSE=162.335
##
## Node number 21: 42 observations
## mean=320.9189, MSE=113.1915
##
## Node number 22: 104 observations, complexity param=0.00405835
## mean=329.1948, MSE=167.5436
## left son=44 (67 obs) right son=45 (37 obs)
## Primary splits:
## beefiness < 31.5 to the left, improve=0.35747500, (0 missing)
## height < 65.35768 to the left, improve=0.19190420, (0 missing)
## agility < 64.5 to the left, improve=0.13082970, (0 missing)
## weapon4 < 0.5 to the left, improve=0.03931846, (0 missing)
## sf < 5.5 to the right, improve=0.03553541, (0 missing)
## Surrogate splits:
## weapon4 < 0.5 to the left, agree=0.673, adj=0.081, (0 split)
## sf < 7.5 to the left, agree=0.654, adj=0.027, (0 split)
##
## Node number 23: 51 observations
## mean=353.0587, MSE=281.0931
##
## Node number 26: 127 observations, complexity param=0.004449289
## mean=351.187, MSE=163.0093
## left son=52 (56 obs) right son=53 (71 obs)
## Primary splits:
## agility < 34.5 to the left, improve=0.32986160, (0 missing)
## beefiness < 55.5 to the left, improve=0.18775280, (0 missing)
## height < 74.97564 to the left, improve=0.08192664, (0 missing)
## meanness < 63.5 to the left, improve=0.05539262, (0 missing)
## sf < 6.5 to the right, improve=0.02119588, (0 missing)
## Surrogate splits:
## beefiness < 64.5 to the right, agree=0.630, adj=0.161, (0 split)
## weapon5 < 0.5 to the right, agree=0.598, adj=0.089, (0 split)
## height < 73.61339 to the right, agree=0.583, adj=0.054, (0 split)
## sf < 5.5 to the right, agree=0.583, adj=0.054, (0 split)
## meanness < 70.5 to the right, agree=0.575, adj=0.036, (0 split)
##
## Node number 27: 113 observations, complexity param=0.003732429
## mean=370.915, MSE=183.5616
## left son=54 (99 obs) right son=55 (14 obs)
## Primary splits:
## beefiness < 78.5 to the left, improve=0.27617760, (0 missing)
## agility < 34.5 to the left, improve=0.18815820, (0 missing)
## height < 68.48662 to the left, improve=0.14352030, (0 missing)
## bs < 5.5 to the left, improve=0.07317698, (0 missing)
## sexMales < 0.5 to the left, improve=0.05943628, (0 missing)
##
## Node number 28: 71 observations
## mean=370.4275, MSE=120.5688
##
## Node number 29: 37 observations
## mean=389.6566, MSE=168.5266
##
## Node number 30: 61 observations
## mean=387.9425, MSE=108.6696
##
## Node number 31: 43 observations
## mean=407.0899, MSE=185.2684
##
## Node number 32: 59 observations
## mean=267.9798, MSE=139.934
##
## Node number 33: 9 observations
## mean=295.5131, MSE=118.0881
##
## Node number 36: 20 observations
## mean=287.3821, MSE=90.36992
##
## Node number 37: 44 observations
## mean=312.165, MSE=83.52365
##
## Node number 44: 67 observations
## mean=323.4437, MSE=105.8311
##
## Node number 45: 37 observations
## mean=339.6089, MSE=110.9463
##
## Node number 52: 56 observations
## mean=342.9303, MSE=113.1901
##
## Node number 53: 71 observations
## mean=357.6993, MSE=106.1223
##
## Node number 54: 99 observations
## mean=368.2375, MSE=135.868
##
## Node number 55: 14 observations
## mean=389.8488, MSE=111.6374

###########################
library(rpart)
tree1 <- rpart(
 dangerousness~sex + height + weapon + beefiness + bs + sf + meanness + agility,
 data=TD,
 method = "anova",
 cp =0.003,
 maxdepth= 10,
 minbucket = 30
)

tree1

## n= 1000
##
## node), split, n, deviance, yval
## \* denotes terminal node
##
## 1) root 1000 1534819.000 339.0632
## 2) beefiness< 52.5 522 390865.200 310.7558
## 4) agility< 59.5 268 151256.100 296.3222
## 8) beefiness< 26.5 148 43908.430 282.4598
## 16) agility< 51.5 68 15238.640 271.6239 \*
## 17) agility>=51.5 80 13898.930 291.6702 \*
## 9) beefiness>=26.5 120 43829.670 313.4193
## 18) beefiness< 33.5 64 13927.570 304.4204 \*
## 19) beefiness>=33.5 56 18796.170 323.7038 \*
## 5) agility>=59.5 254 124867.500 325.9850
## 10) beefiness< 22.5 99 24958.910 308.6661
## 20) agility< 67.5 57 9253.092 299.6376 \*
## 21) agility>=67.5 42 4754.042 320.9189 \*
## 11) beefiness>=22.5 155 51247.730 337.0468
## 22) agility< 69.5 104 17424.530 329.1948
## 44) beefiness< 31.5 67 7090.685 323.4437 \*
## 45) beefiness>=31.5 37 4105.012 339.6089 \*
## 23) agility>=69.5 51 14335.750 353.0587 \*
## 3) beefiness>=52.5 478 268890.200 369.9762
## 6) agility< 41.5 266 101434.400 356.9985
## 12) beefiness< 67.5 144 39535.170 347.3403
## 24) agility< 30.5 44 9152.935 330.5548 \*
## 25) agility>=30.5 100 12530.300 354.7259 \*
## 13) beefiness>=67.5 122 32612.160 368.3983
## 26) beefiness< 73.5 88 20475.290 363.6660 \*
## 27) beefiness>=73.5 34 5065.218 380.6468 \*
## 7) agility>=41.5 212 66445.190 386.2595
## 14) beefiness< 65.5 108 23789.860 377.0152
## 28) agility< 51.5 71 8560.387 370.4275 \*
## 29) agility>=51.5 37 6235.483 389.6566 \*
## 15) beefiness>=65.5 104 23841.960 395.8592
## 30) agility< 47.5 61 6628.843 387.9425 \*
## 31) agility>=47.5 43 7966.541 407.0899 \*

summary(tree1)

## Call:
## rpart(formula = dangerousness ~ sex + height + weapon + beefiness +
## bs + sf + meanness + agility, data = TD, method = "anova",
## cp = 0.003, maxdepth = 10, minbucket = 30)
## n= 1000
##
## CP nsplit rel error xerror xstd
## 1 0.570141366 0 1.0000000 1.0010791 0.035983545
## 2 0.074759045 1 0.4298586 0.4465726 0.020316879
## 3 0.065812698 2 0.3550996 0.3921790 0.017853201
## 4 0.041384669 3 0.2892869 0.3130273 0.015504425
## 5 0.031704598 4 0.2479022 0.2795601 0.013993685
## 6 0.019081762 5 0.2161976 0.2420638 0.011067485
## 7 0.012696902 6 0.1971159 0.2150485 0.010271330
## 8 0.012257707 7 0.1844190 0.2000141 0.009860478
## 9 0.011631296 8 0.1721613 0.1868071 0.009353031
## 10 0.009623840 9 0.1605300 0.1834317 0.009295611
## 11 0.007235981 10 0.1509061 0.1765091 0.008926905
## 12 0.007135546 11 0.1436701 0.1765097 0.008888624
## 13 0.006024534 12 0.1365346 0.1646282 0.008220888
## 14 0.005859969 13 0.1305101 0.1622763 0.008235415
## 15 0.004607480 14 0.1246501 0.1551555 0.007965232
## 16 0.004058350 15 0.1200426 0.1535923 0.007879906
## 17 0.003000000 16 0.1159843 0.1513030 0.007815932
##
## Variable importance
## beefiness agility height sex meanness bs weapon
## 29 24 19 12 9 6 1
##
## Node number 1: 1000 observations, complexity param=0.5701414
## mean=339.0632, MSE=1534.819
## left son=2 (522 obs) right son=3 (478 obs)
## Primary splits:
## beefiness < 52.5 to the left, improve=0.57014140, (0 missing)
## height < 69.20857 to the left, improve=0.40837800, (0 missing)
## sex splits as LR, improve=0.19545760, (0 missing)
## meanness < 49.5 to the left, improve=0.08332828, (0 missing)
## agility < 48.5 to the right, improve=0.07543923, (0 missing)
## Surrogate splits:
## height < 68.21148 to the left, agree=0.874, adj=0.736, (0 split)
## agility < 49.5 to the right, agree=0.825, adj=0.634, (0 split)
## sex splits as LR, agree=0.759, adj=0.496, (0 split)
## meanness < 49.5 to the left, agree=0.697, adj=0.366, (0 split)
## bs < 5.5 to the left, agree=0.633, adj=0.232, (0 split)
##
## Node number 2: 522 observations, complexity param=0.07475905
## mean=310.7558, MSE=748.7839
## left son=4 (268 obs) right son=5 (254 obs)
## Primary splits:
## agility < 59.5 to the left, improve=0.293558100, (0 missing)
## beefiness < 27.5 to the left, improve=0.288827400, (0 missing)
## height < 66.87118 to the left, improve=0.061712930, (0 missing)
## weapon splits as LLLLLLR, improve=0.012863900, (0 missing)
## meanness < 30.5 to the right, improve=0.008839797, (0 missing)
## Surrogate splits:
## height < 62.47712 to the right, agree=0.557, adj=0.091, (0 split)
## weapon splits as RLLLLRR, agree=0.540, adj=0.055, (0 split)
## beefiness < 15.5 to the right, agree=0.534, adj=0.043, (0 split)
## meanness < 34.5 to the right, agree=0.534, adj=0.043, (0 split)
## bs < 5.5 to the right, agree=0.533, adj=0.039, (0 split)
##
## Node number 3: 478 observations, complexity param=0.0658127
## mean=369.9762, MSE=562.5317
## left son=6 (266 obs) right son=7 (212 obs)
## Primary splits:
## agility < 41.5 to the left, improve=0.37565750, (0 missing)
## beefiness < 65.5 to the left, improve=0.14259100, (0 missing)
## height < 69.13403 to the left, improve=0.03505555, (0 missing)
## meanness < 45.5 to the right, improve=0.01504556, (0 missing)
## sex splits as LR, improve=0.01435128, (0 missing)
## Surrogate splits:
## sf < 8.5 to the left, agree=0.569, adj=0.028, (0 split)
## height < 64.89065 to the right, agree=0.565, adj=0.019, (0 split)
## weapon splits as LLRLLLR, agree=0.563, adj=0.014, (0 split)
## beefiness < 55.5 to the right, agree=0.563, adj=0.014, (0 split)
## bs < 4.5 to the right, agree=0.563, adj=0.014, (0 split)
##
## Node number 4: 268 observations, complexity param=0.04138467
## mean=296.3222, MSE=564.3884
## left son=8 (148 obs) right son=9 (120 obs)
## Primary splits:
## beefiness < 26.5 to the left, improve=0.41993680, (0 missing)
## height < 68.81371 to the left, improve=0.16662110, (0 missing)
## agility < 52.5 to the left, improve=0.11409870, (0 missing)
## sex splits as LR, improve=0.04300230, (0 missing)
## weapon splits as LLLRRRR, improve=0.02683148, (0 missing)
## Surrogate splits:
## weapon splits as LLLRLRL, agree=0.616, adj=0.142, (0 split)
## height < 68.81371 to the left, agree=0.612, adj=0.133, (0 split)
## agility < 38.5 to the right, agree=0.601, adj=0.108, (0 split)
## meanness < 56.5 to the left, agree=0.571, adj=0.042, (0 split)
## sf < 2.5 to the right, agree=0.567, adj=0.033, (0 split)
##
## Node number 5: 254 observations, complexity param=0.0317046
## mean=325.985, MSE=491.6042
## left son=10 (99 obs) right son=11 (155 obs)
## Primary splits:
## beefiness < 22.5 to the left, improve=0.38969980, (0 missing)
## agility < 74.5 to the left, improve=0.25981710, (0 missing)
## height < 64.28261 to the left, improve=0.09268484, (0 missing)
## meanness < 42.5 to the right, improve=0.02405100, (0 missing)
## bs < 5.5 to the left, improve=0.01850370, (0 missing)
## Surrogate splits:
## weapon splits as LRRRRRR, agree=0.630, adj=0.051, (0 split)
## meanness < 61.5 to the right, agree=0.630, adj=0.051, (0 split)
## sf < 1.5 to the left, agree=0.618, adj=0.020, (0 split)
##
## Node number 6: 266 observations, complexity param=0.01908176
## mean=356.9985, MSE=381.3323
## left son=12 (144 obs) right son=13 (122 obs)
## Primary splits:
## beefiness < 67.5 to the left, improve=0.28872910, (0 missing)
## agility < 24.5 to the left, improve=0.24308000, (0 missing)
## height < 69.13403 to the left, improve=0.05372561, (0 missing)
## bs < 4.5 to the left, improve=0.04627648, (0 missing)
## sex splits as LR, improve=0.03938987, (0 missing)
## Surrogate splits:
## meanness < 47.5 to the right, agree=0.579, adj=0.082, (0 split)
## weapon splits as RLRLLRL, agree=0.571, adj=0.066, (0 split)
## height < 67.74965 to the right, agree=0.564, adj=0.049, (0 split)
## bs < 3.5 to the right, agree=0.560, adj=0.041, (0 split)
## agility < 29.5 to the right, agree=0.560, adj=0.041, (0 split)
##
## Node number 7: 212 observations, complexity param=0.01225771
## mean=386.2595, MSE=313.4207
## left son=14 (108 obs) right son=15 (104 obs)
## Primary splits:
## beefiness < 65.5 to the left, improve=0.28314120, (0 missing)
## agility < 54.5 to the left, improve=0.21929970, (0 missing)
## height < 69.00662 to the left, improve=0.10703950, (0 missing)
## weapon splits as RRLLRLR, improve=0.02245809, (0 missing)
## meanness < 45.5 to the right, improve=0.01740099, (0 missing)
## Surrogate splits:
## agility < 44.5 to the right, agree=0.585, adj=0.154, (0 split)
## weapon splits as RRLLRLR, agree=0.575, adj=0.135, (0 split)
## meanness < 60.5 to the left, agree=0.561, adj=0.106, (0 split)
## height < 74.30353 to the right, agree=0.552, adj=0.087, (0 split)
## sf < 5.5 to the left, agree=0.538, adj=0.058, (0 split)
##
## Node number 8: 148 observations, complexity param=0.00962384
## mean=282.4598, MSE=296.6786
## left son=16 (68 obs) right son=17 (80 obs)
## Primary splits:
## agility < 51.5 to the left, improve=0.33640140, (0 missing)
## beefiness < 22.5 to the left, improve=0.21898680, (0 missing)
## height < 62.76089 to the left, improve=0.05893440, (0 missing)
## sex splits as LR, improve=0.01730027, (0 missing)
## meanness < 40.5 to the right, improve=0.01564390, (0 missing)
## Surrogate splits:
## height < 66.72647 to the right, agree=0.588, adj=0.103, (0 split)
## meanness < 51.5 to the right, agree=0.581, adj=0.088, (0 split)
## weapon splits as LRRRRRR, agree=0.574, adj=0.074, (0 split)
## bs < 7.5 to the right, agree=0.568, adj=0.059, (0 split)
## beefiness < 4.5 to the left, agree=0.554, adj=0.029, (0 split)
##
## Node number 9: 120 observations, complexity param=0.007235981
## mean=313.4193, MSE=365.2472
## left son=18 (64 obs) right son=19 (56 obs)
## Primary splits:
## beefiness < 33.5 to the left, improve=0.25338830, (0 missing)
## height < 66.85377 to the left, improve=0.24037970, (0 missing)
## meanness < 53.5 to the left, improve=0.10396520, (0 missing)
## agility < 51.5 to the left, improve=0.08306477, (0 missing)
## sex splits as LR, improve=0.07157241, (0 missing)
## Surrogate splits:
## agility < 48.5 to the right, agree=0.700, adj=0.357, (0 split)
## height < 66.92355 to the left, agree=0.683, adj=0.321, (0 split)
## meanness < 57.5 to the left, agree=0.625, adj=0.196, (0 split)
## sex splits as LR, agree=0.608, adj=0.161, (0 split)
## weapon splits as LLLLLLR, agree=0.575, adj=0.089, (0 split)
##
## Node number 10: 99 observations, complexity param=0.007135546
## mean=308.6661, MSE=252.1102
## left son=20 (57 obs) right son=21 (42 obs)
## Primary splits:
## agility < 67.5 to the left, improve=0.43879220, (0 missing)
## beefiness < 18.5 to the left, improve=0.22829410, (0 missing)
## height < 63.64828 to the left, improve=0.13430650, (0 missing)
## weapon splits as LRLRLRR, improve=0.05924231, (0 missing)
## bs < 4.5 to the left, improve=0.02769302, (0 missing)
## Surrogate splits:
## bs < 5.5 to the left, agree=0.596, adj=0.048, (0 split)
## weapon splits as LLLLRLL, agree=0.586, adj=0.024, (0 split)
## beefiness < 18.5 to the left, agree=0.586, adj=0.024, (0 split)
##
## Node number 11: 155 observations, complexity param=0.0126969
## mean=337.0468, MSE=330.6305
## left son=22 (104 obs) right son=23 (51 obs)
## Primary splits:
## agility < 69.5 to the left, improve=0.38025980, (0 missing)
## beefiness < 30.5 to the left, improve=0.22854580, (0 missing)
## height < 66.53981 to the left, improve=0.13675170, (0 missing)
## meanness < 38.5 to the right, improve=0.01790089, (0 missing)
## bs < 5.5 to the left, improve=0.01492765, (0 missing)
## Surrogate splits:
## height < 69.87397 to the left, agree=0.690, adj=0.059, (0 split)
## meanness < 25 to the right, agree=0.690, adj=0.059, (0 split)
## sf < 9.5 to the left, agree=0.684, adj=0.039, (0 split)
##
## Node number 12: 144 observations, complexity param=0.0116313
## mean=347.3403, MSE=274.5498
## left son=24 (44 obs) right son=25 (100 obs)
## Primary splits:
## agility < 30.5 to the left, improve=0.45154580, (0 missing)
## beefiness < 60.5 to the left, improve=0.09333379, (0 missing)
## height < 71.67107 to the left, improve=0.04605728, (0 missing)
## weapon splits as LRLRLRR, improve=0.03477631, (0 missing)
## meanness < 51.5 to the left, improve=0.03013695, (0 missing)
## Surrogate splits:
## beefiness < 54.5 to the left, agree=0.736, adj=0.136, (0 split)
## bs < 3.5 to the left, agree=0.715, adj=0.068, (0 split)
## meanness < 70.5 to the right, agree=0.701, adj=0.023, (0 split)
##
## Node number 13: 122 observations, complexity param=0.00460748
## mean=368.3983, MSE=267.3128
## left son=26 (88 obs) right son=27 (34 obs)
## Primary splits:
## beefiness < 73.5 to the left, improve=0.21684090, (0 missing)
## agility < 34.5 to the left, improve=0.20745010, (0 missing)
## height < 70.35828 to the left, improve=0.11480960, (0 missing)
## bs < 5.5 to the left, improve=0.06085127, (0 missing)
## weapon splits as LRLLRRL, improve=0.01568398, (0 missing)
##
## Node number 14: 108 observations, complexity param=0.005859969
## mean=377.0152, MSE=220.2765
## left son=28 (71 obs) right son=29 (37 obs)
## Primary splits:
## agility < 51.5 to the left, improve=0.37805990, (0 missing)
## beefiness < 58.5 to the left, improve=0.16290920, (0 missing)
## height < 70.71032 to the left, improve=0.06727173, (0 missing)
## sf < 5.5 to the right, improve=0.03476957, (0 missing)
## meanness < 56.5 to the right, improve=0.03126181, (0 missing)
## Surrogate splits:
## height < 64.8813 to the right, agree=0.667, adj=0.027, (0 split)
##
## Node number 15: 104 observations, complexity param=0.006024534
## mean=395.8592, MSE=229.2496
## left son=30 (61 obs) right son=31 (43 obs)
## Primary splits:
## agility < 47.5 to the left, improve=0.38782770, (0 missing)
## beefiness < 72.5 to the left, improve=0.18946280, (0 missing)
## height < 73.65357 to the left, improve=0.13451210, (0 missing)
## meanness < 53.5 to the right, improve=0.02369911, (0 missing)
## weapon splits as RRLLLRR, improve=0.01325784, (0 missing)
## Surrogate splits:
## weapon splits as RLLLLRR, agree=0.654, adj=0.163, (0 split)
## height < 76.02629 to the left, agree=0.615, adj=0.070, (0 split)
## beefiness < 78.5 to the left, agree=0.606, adj=0.047, (0 split)
## bs < 7.5 to the left, agree=0.606, adj=0.047, (0 split)
## sf < 9.5 to the left, agree=0.596, adj=0.023, (0 split)
##
## Node number 16: 68 observations
## mean=271.6239, MSE=224.0976
##
## Node number 17: 80 observations
## mean=291.6702, MSE=173.7366
##
## Node number 18: 64 observations
## mean=304.4204, MSE=217.6183
##
## Node number 19: 56 observations
## mean=323.7038, MSE=335.646
##
## Node number 20: 57 observations
## mean=299.6376, MSE=162.335
##
## Node number 21: 42 observations
## mean=320.9189, MSE=113.1915
##
## Node number 22: 104 observations, complexity param=0.00405835
## mean=329.1948, MSE=167.5436
## left son=44 (67 obs) right son=45 (37 obs)
## Primary splits:
## beefiness < 31.5 to the left, improve=0.35747500, (0 missing)
## height < 65.35768 to the left, improve=0.19190420, (0 missing)
## agility < 64.5 to the left, improve=0.13082970, (0 missing)
## weapon splits as LLRRRRL, improve=0.04784078, (0 missing)
## sf < 5.5 to the right, improve=0.03553541, (0 missing)
## Surrogate splits:
## weapon splits as LLLRLLL, agree=0.673, adj=0.081, (0 split)
## sf < 7.5 to the left, agree=0.654, adj=0.027, (0 split)
##
## Node number 23: 51 observations
## mean=353.0587, MSE=281.0931
##
## Node number 24: 44 observations
## mean=330.5548, MSE=208.0212
##
## Node number 25: 100 observations
## mean=354.7259, MSE=125.303
##
## Node number 26: 88 observations
## mean=363.666, MSE=232.6737
##
## Node number 27: 34 observations
## mean=380.6468, MSE=148.977
##
## Node number 28: 71 observations
## mean=370.4275, MSE=120.5688
##
## Node number 29: 37 observations
## mean=389.6566, MSE=168.5266
##
## Node number 30: 61 observations
## mean=387.9425, MSE=108.6696
##
## Node number 31: 43 observations
## mean=407.0899, MSE=185.2684
##
## Node number 44: 67 observations
## mean=323.4437, MSE=105.8311
##
## Node number 45: 37 observations
## mean=339.6089, MSE=110.9463

library(rpart.plot)
rpart.plot(tree1)



library(partykit)

## Loading required package: grid

## Loading required package: libcoin

## Loading required package: mvtnorm

tree1.pk <- as.party(tree1)
plot(tree1.pk , ep\_args = list(digits = 0)) #the branching symbols are getting messed up for some reason.



###################
#random forest model
library(caret)
set.seed(12345)
rf1= train(dangerousness~sex + height + weapon + beefiness + bs + sf + meanness + agility, data=TD, method= "rf", trControl= trainControl(method="cv", number=5))

rf1

## Random Forest
##
## 1000 samples
## 8 predictor
##
## No pre-processing
## Resampling: Cross-Validated (5 fold)
## Summary of sample sizes: 800, 800, 800, 800, 800
## Resampling results across tuning parameters:
##
## mtry RMSE Rsquared MAE
## 2 16.871188 0.8594504 13.013865
## 7 7.795428 0.9662975 5.735455
## 13 6.953772 0.9702981 5.287937
##
## RMSE was used to select the optimal model using the smallest value.
## The final value used for the model was mtry = 13.

summary(rf1)

## Length Class Mode
## call 4 -none- call
## type 1 -none- character
## predicted 1000 -none- numeric
## mse 500 -none- numeric
## rsq 500 -none- numeric
## oob.times 1000 -none- numeric
## importance 13 -none- numeric
## importanceSD 0 -none- NULL
## localImportance 0 -none- NULL
## proximity 0 -none- NULL
## ntree 1 -none- numeric
## mtry 1 -none- numeric
## forest 11 -none- list
## coefs 0 -none- NULL
## y 1000 -none- numeric
## test 0 -none- NULL
## inbag 0 -none- NULL
## xNames 13 -none- character
## problemType 1 -none- character
## tuneValue 1 data.frame list
## obsLevels 1 -none- logical
## param 0 -none- list

plot(rf1$finalModel)



###################
#Code that was used to generate the data
set.seed(1908)
id=1:1000

weapon= round(runif(n=1000, min = 1, max = 7))
sex=rbinom(n=1000, 1, prob= c(.2, .7))
height =rnorm(n = 1000, mean = c(65, 72), sd = 3)
beefiness= round(rnorm(n = 1000, mean = c(25, 65), sd = 8))
meanness=round(rnorm(n = 1000, mean = c(45, 55), sd = 10))
mohawk=rbinom(n=1000, 1, .1)
bs=round(rnorm(n = 1000, mean = c(5, 6), sd = 1.5))
sf=rpois(1000, lambda = 5)
agility=round(rnorm(n = 1000, mean = c(60, 40), sd = 10))
e=rnorm(n = 1000, mean = 0, sd = .5)

a=5
error=rnorm(n = 1000, mean = 0, sd = 2)

b1=5
b2=2
b3=2
b4=1
b5=2

dangerousness = a + (b1 \* sex + e) + (b2\* height + e) + (b3\*beefiness + e) + (b4\*bs + e) + (b5\*agility + e) + error

TD=data.frame(id, weapon, sex, height, beefiness, meanness, mohawk, bs, sf, agility, dangerousness)