HW 6 Q5

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4/14/2022

```r
suppressMessages(require(tidyverse))
suppressMessages(require(janitor))
suppressMessages(require(purrr))
suppressWarnings(require(leaps))
```

```
## Loading required package: leaps
```

```r
suppressMessages(require(ggthemes))
suppressMessages(require(ISLR2))
suppressMessages(require(randomForest))
suppressMessages(require(gbm))
suppressMessages(require(ggthemes))
# generate p = 20, n = 1000

set.seed(123)

df <- Hitters %>%
  dplyr::filter(! is.na(Salary)) %>%
  dplyr::mutate(
    log_salary = log(Salary)
  ) %>%
  dplyr::select(-c(Salary)) # %>%
  # rownames_to_column("player_name")

train <- df[1:200, ]
test <- df[201:nrow(df), ]

shrk <- seq(0.001, 1, by = 0.005)

lst <- list()
n <- 0

for (y in shrk) {
  # print(y)

  n <- n + 1
  mod <- gbm(log_salary ~ .,
             data = train,
             shrinkage = y,
             n.trees = 1000,
             distribution = "gaussian")

  train$pred_sal <- predict(mod, train, n.trees = 1000)
  test$pred_sal <- predict(mod, test, n.trees = 1000)

  mse <- mean((train$log_salary - train$pred_sal)^2)
  tmse <- mean((test$log_salary - test$pred_sal)^2)

  m <- data.frame("shrinkage" = y,
                  "MSE" = mse,
                  "tMSE" = tmse)

  lst[[n]] <- m

  print(paste0(scales::percent(n / length(shrk)), " of models tested."))

  test <- test %>%
    dplyr::select(-c(pred_sal))
  # took me to long to figure out that this was being used in future models past the first on bc I forg
  train <- train %>%
    dplyr::select(-c(pred_sal))
}
```

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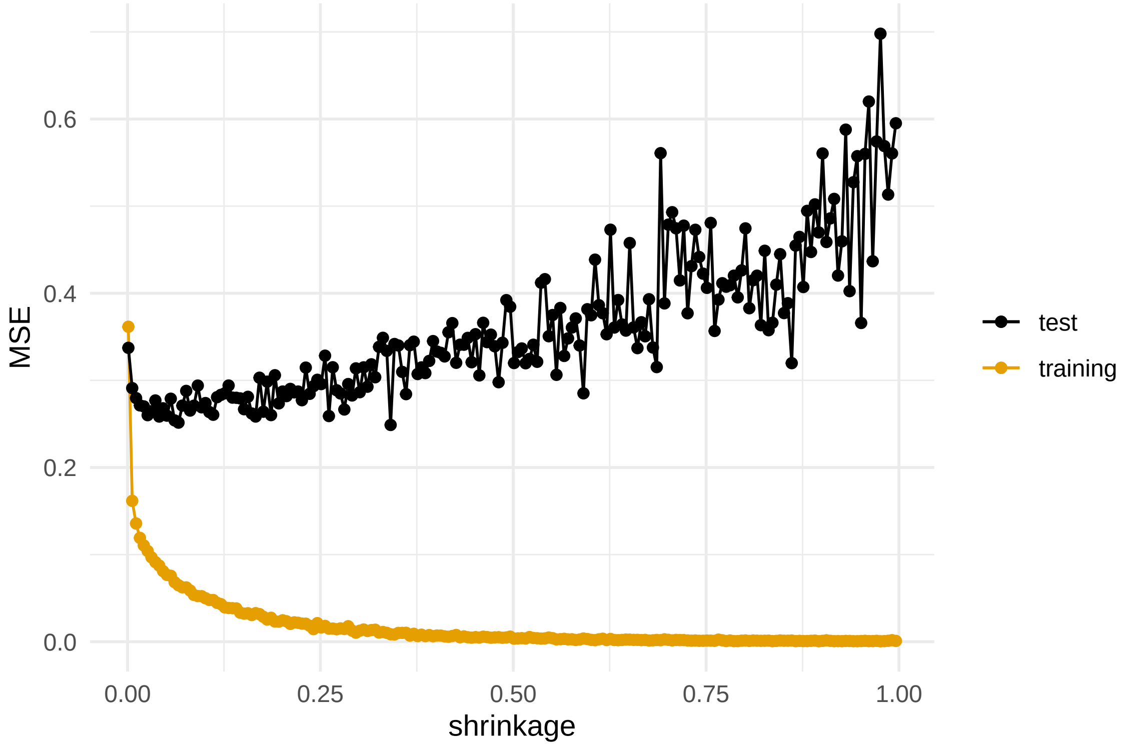
```

```
res <- dplyr::bind_rows(lst)

res %>%
  ggplot() +
  geom_point(aes(x = shrinkage, y = MSE, color = "training")) +
  geom_line(aes(x = shrinkage, y = MSE, color = "training")) +
  geom_point(aes(x = shrinkage, y = tMSE, color = "test")) +
  geom_line(aes(x = shrinkage, y = tMSE, color = "test")) +
  scale_color_colorblind() +
  theme_minimal() +
  theme(legend.title = element_blank())
```



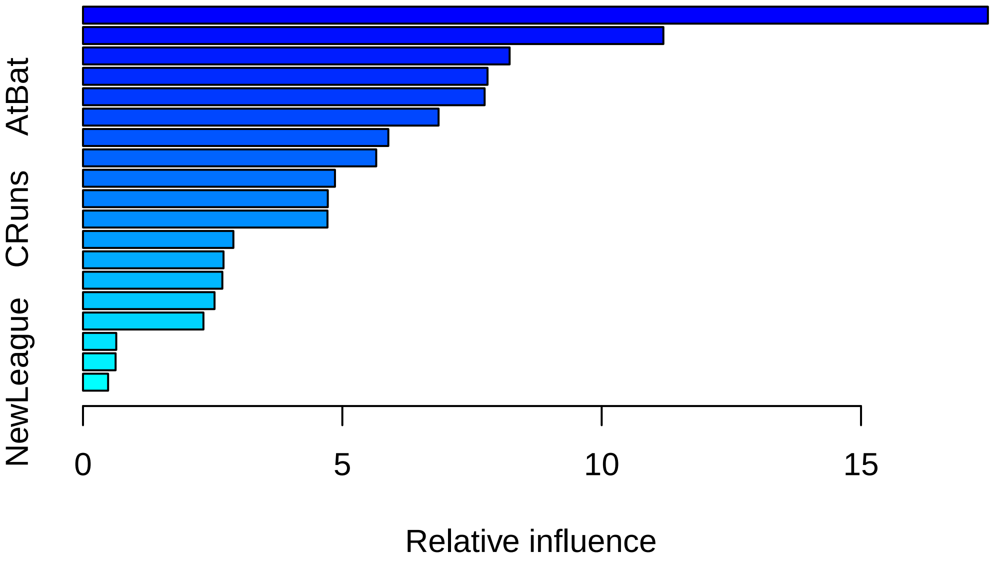
```
ml <- lm(log_salary ~ .,
         data = train)
test$lm_sal <- predict(ml, newdata = test)
```

```r
reg_m <- regsubsets(log_salary ~.,
                    data = train,
                    method = "exhaustive")
# summary(reg_m)
five_m <- glm(log_salary ~ .,
              data = train %>%
                dplyr::select(log_salary, AtBat, Hits, Walks, Years, PutOuts))
test$sub_sal <- predict(five_m, newdata = test)

simple_mse <- mean((test$log_salary - test$lm_sal)^2)
subset_mse <- mean((test$log_salary - test$sub_sal)^2)
```

I tried both a simple linear regression model and a linear regression with the five most important variables that I determined through an exhaustive search. The smallest MSE of the test dataset was 0.249, which was significantly lower than the simple MSE of 0.492 and the subset MSE of 0.498.

```r
summary.gbm(mod)
```



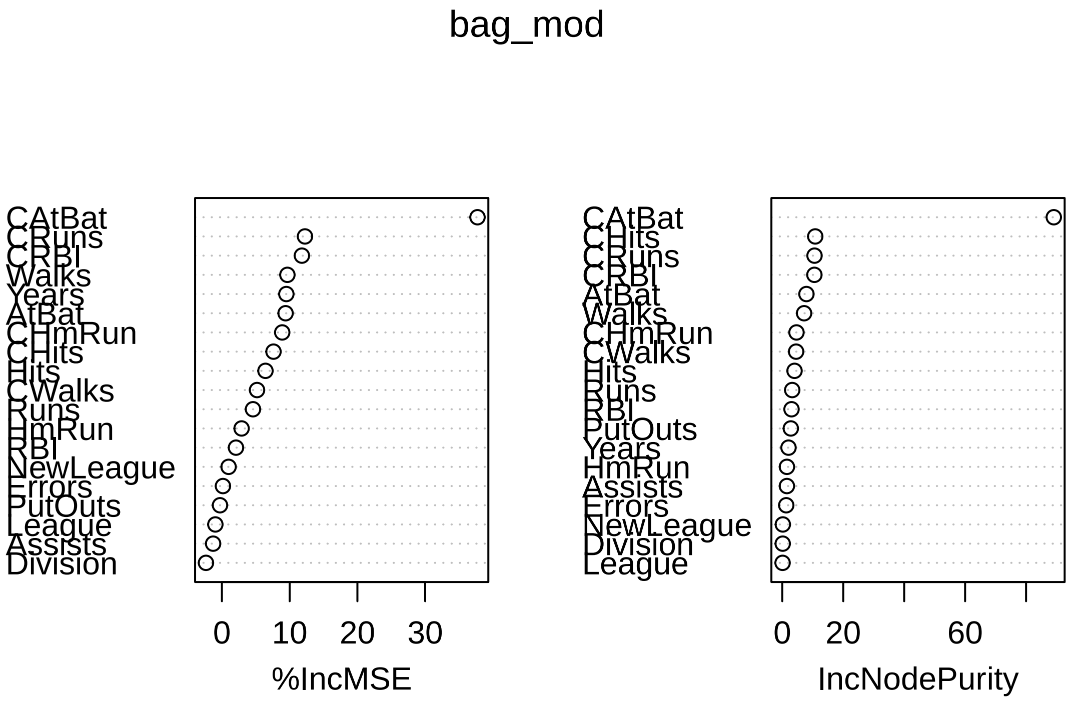
```
##                var    rel.inf
## CHits        CHits 17.4460344
## PutOuts    PutOuts 11.1895823
## Walks        Walks  8.2253561
## RBI            RBI  7.7997007
## AtBat        AtBat  7.7431950
## Assists    Assists  6.8552835
## CWalks      CWalks  5.8869679
## Hits          Hits  5.6533382
## Runs           Runs  4.8580788
## CHmRun       CHmRun  4.7195406
## CRuns         CRuns  4.7135085
## CRBI           CRBI  2.8997859
## CAtBat       CAtBat  2.7092472
## Errors       Errors  2.6867325
## HmRun         HmRun  2.5363176
## Years         Years  2.3224184
## Division   Division  0.6414369
## League       League  0.6290414
## NewLeague NewLeague  0.4844341
```

Some of the most important variables are Career Hits, Put Outs, Walks, and Runs Batted In during a player's season before hitting free agency. It's an interesting trend and there's definitely a lot of selection bias where players that play more get paid more.

```
bag_mod <- randomForest(log_salary ~ .,
                        data = train,
                        mtry = ncol(train) - 1,
                        ntree = 500,
                        importance = TRUE)

test$bag_pred <- predict(bag_mod, test)

bag_mse <- mean((test$log_salary - test$bag_pred)^2)
varImpPlot(bag_mod)
```



The bagging MSE of 0.23 is pretty similar to the MSE that we got for the GBM using the boosted method, which was certainly interesting to see. The bagging and randomForest approach puts a lot more weight on career numbers, rewarding players with long term success.