SF

October 29, 2024

```
knitr::opts_chunk$set(message = FALSE, warning = FALSE)
```

```
library(plotly)
library(dplyr)

# helper functions
standardize <- function(vector) {return((vector - mean(vector)) / sd(vector))}
convert_to_binary <- function(input_vector) {return(ifelse(input_vector != 0, 1, 0))}

################################################################################
################################## PREPARE THE DATA #############################
################################################################################


# loading the data
load("~/Desktop/Spring 2024/Sanfrancisco_data_analysis/Data_files/data_on_graph_with_covari

data = data_on_graph_with_covariates %>%
  mutate(across(starts_with(c("class_", "upto")), list(ind = convert_to_binary))) %>%
  mutate(across(c("bus", "signal", "stop", "crossing"), ~round(., 5))) %>%
  mutate(across(c("density_per_hour"), standardize))
```

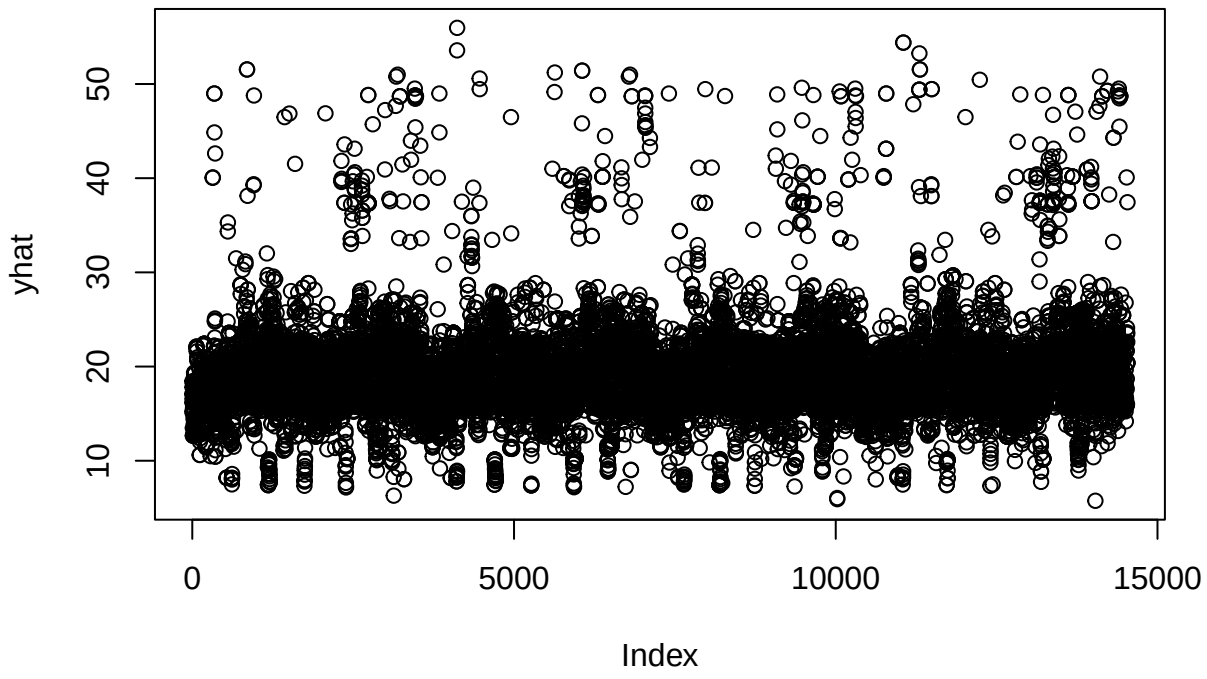
0.1 All covariates

```
res = lm(speed ~ SpeedLimit +
           density_per_hour +
           bus +
           signal +
           stop +
           crossing +
           upto1_ind +
           bus_number +
           signal_number +
           stop_number +
           crossing_number,
         data = data)
```

```r
summary(res)
```

```
##
## Call:
## lm(formula = speed ~ SpeedLimit + density_per_hour + bus + signal +
##     stop + crossing + upto1_ind + bus_number + signal_number +
##     stop_number + crossing_number, data = data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -53.572  -9.360   0.225   8.455  69.151
##
## Coefficients:
##                  Estimate Std. Error t value Pr(>|t|)
## (Intercept)       7.87713    0.53053  14.848  < 2e-16 ***
## SpeedLimit        0.36960    0.01167  31.679  < 2e-16 ***
## density_per_hour  0.62079    0.11235   5.525 3.34e-08 ***
## bus              -7.71252    1.15342  -6.687 2.37e-11 ***
## signal           -4.01630    0.34602 -11.607  < 2e-16 ***
## stop             -5.54105    0.66902  -8.282  < 2e-16 ***
## crossing         -2.92879    0.37166  -7.880 3.49e-15 ***
## upto1_ind         2.24544    0.40205   5.585 2.38e-08 ***
## bus_number        0.81119    0.64318   1.261    0.207
## signal_number    -0.10220    0.14116  -0.724    0.469
## stop_number      -0.35749    0.35374  -1.011    0.312
## crossing_number   0.02104    0.11595   0.181    0.856
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 12.43 on 14522 degrees of freedom
## Multiple R-squared:  0.1515, Adjusted R-squared:  0.1508
## F-statistic: 235.7 on 11 and 14522 DF,  p-value: < 2.2e-16
```

```r
yhat = res$fitted.values
plot(yhat)
```



0.2 Only SpeedLimit

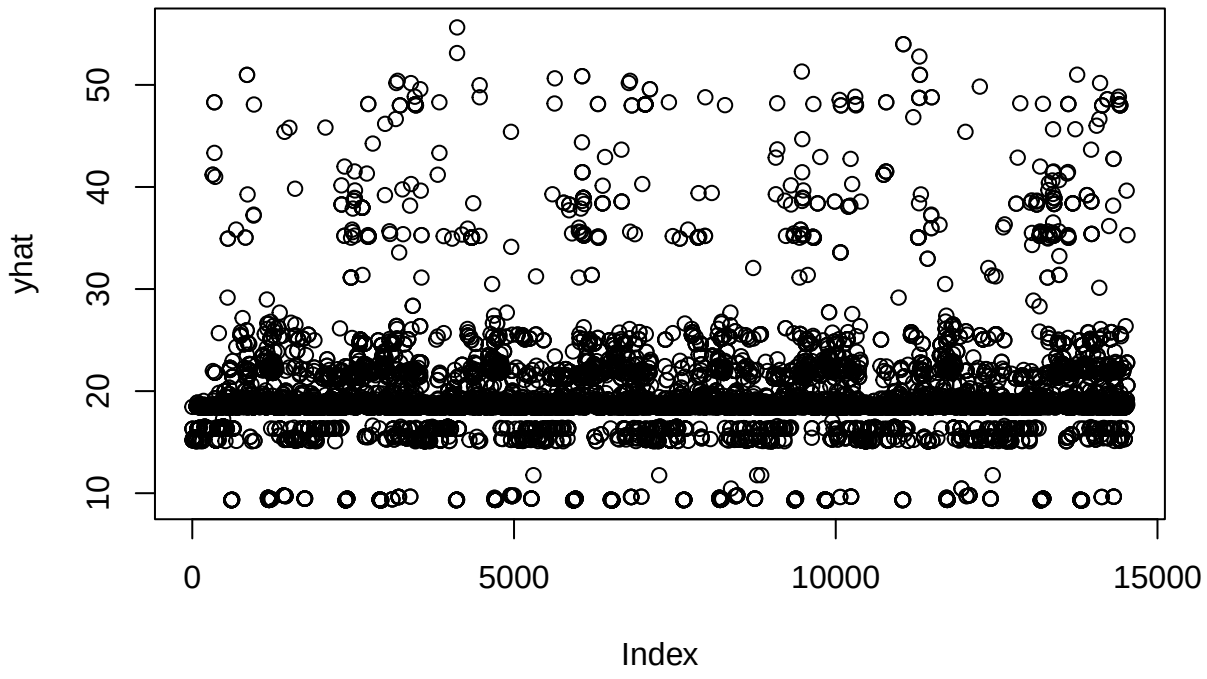
```
res = lm(speed ~ SpeedLimit +
           density_per_hour +
           #bus +
           #signal +
           #stop +
           #crossing +
           upto1_ind,
           #bus_number +
           #signal_number +
           #stop_number +
           #crossing_number,
         data = data)

summary(res)
```

```
##
## Call:
## lm(formula = speed ~ SpeedLimit + density_per_hour + upto1_ind,
##     data = data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -53.118  -9.884   0.282   8.856  73.070
##
## Coefficients:
##                   Estimate Std. Error t value Pr(>|t|)
```

```
## (Intercept)       2.21457    0.48530   4.563 5.08e-06 ***
## SpeedLimit        0.41331    0.01178  35.077  < 2e-16 ***
## density_per_hour  0.65309    0.11301   5.779 7.67e-09 ***
## upto1_ind         2.62324    0.40590   6.463 1.06e-10 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 12.7 on 14530 degrees of freedom
## Multiple R-squared:  0.114,  Adjusted R-squared:  0.1138
## F-statistic:   623 on 3 and 14530 DF,  p-value: < 2.2e-16
```

```
yhat = res$fitted.values
plot(yhat)
```




```
res = lm(speed ~ SpeedLimit,
           #density_per_hour +
           #bus +
           #signal +
           #stop +
           #crossing +
           #upto1_ind,
           #bus_number +
           #signal_number +
           #stop_number +
           #crossing_number,
         data = data)

summary(res)
```

```
##
```

```
## Call:
## lm(formula = speed ~ SpeedLimit, data = data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -48.708  -9.283   0.373   8.420  72.794
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.61933    0.46004   1.346    0.178
## SpeedLimit   0.45799    0.01093  41.912   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 12.75 on 14532 degrees of freedom
## Multiple R-squared:  0.1078, Adjusted R-squared:  0.1078
## F-statistic:  1757 on 1 and 14532 DF,  p-value: < 2.2e-16
```

```
yhat = res$fitted.values
plot(yhat)
```