Functions

Juliette Verstaen

5/17/2019

```
library(tidyverse)
```

```
## -- Attaching packages ----------------------------------------------------- tidyverse 1.2.1 --
```

```
## v ggplot2 3.1.0     v purrr   0.2.5
## v tibble  2.0.1     v dplyr   0.7.8
## v tidyr   0.8.2     v stringr 1.3.1
## v readr   1.3.1     v forcats 0.3.0
```

```
## -- Conflicts -------------------------------------------------------- tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
```

```
source("R/auto_power.R")

### generate sample speeds from a distribution
nsample <-  10000
meanspeed <- 100 / 3.6 ### mean speed is 100 km/h
meanspeed_reduced <- 80 / 3.6 ### mean speed is 80 km/h
lowered_croll <- 0.015/2

### generate speeds
speeds <-  rnorm(mean = meanspeed, sd = meanspeed*0.1, n = nsample)
speeds_reduced <- rnorm(mean = meanspeed_reduced, sd = meanspeed*0.1, n = nsample)

### sampling different cars
possible_cars <-  data.frame(mass=c(31000,45000,38000), area = c(25,30,22))

# use model to generate power for the possible cars
possible_cars$power <-  auto_power(v=meanspeed, a = possible_cars$area, m=possible_cars$area)

### define probablity of each car in the world we created where there's only 3 cars!
possible_cars$prob <-  c(0.4, 0.4, 0.2)

summary(speeds)
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##   17.72   25.94   27.78   27.76   29.63   38.53
```

```
results <-  data.frame(speed=speeds, speeds_reduced = speeds_reduced)

### assign each car an id
possible_cars$row <-  seq(from=1, to=nrow(possible_cars))

whichcar <-  base::sample(possible_cars$row, size=nsample, prob=possible_cars$prob, replace=TRUE)

### look at the data you generated
head(whichcar)
```

```
## [1] 1 1 2 2 2 1
```

```
results$mass <-  possible_cars$mass[whichcar]

head(results)
```

```
##      speed speeds_reduced  mass
## 1 27.65022       22.64480 31000
## 2 28.70513       19.85413 31000
## 3 29.08887       19.64189 45000
## 4 22.47131       24.19886 45000
## 5 29.48894       24.00588 45000
## 6 28.03306       20.25824 31000
```

```
results$area = possible_cars$area[whichcar]

### get the power for all the cars speeds we generated
### rolling_power uses speeds with mean 100 km/h and the lowered rolling coefficient
results$rolling_power = auto_power(a=results$area, v=results$speed, m=results$mass, c_roll = lowered_cr
```

```
## Warning in if (v < 0) return(NA): the condition has length > 1 and only the
## first element will be used
```

```
### lower_speed power uses a different set of randomly generated speeds (speeds_reduced) and the normal

results$lower_speed_power = auto_power(a=results$area, v=results$speeds_reduced, m=results$mass)
```

```
## Warning in if (v < 0) return(NA): the condition has length > 1 and only the
## first element will be used
```

```
summary(results$rolling_power)
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##   72651  149444  176999  182119  209230  390956
```

```
summary(results$lower_speed_power)
```

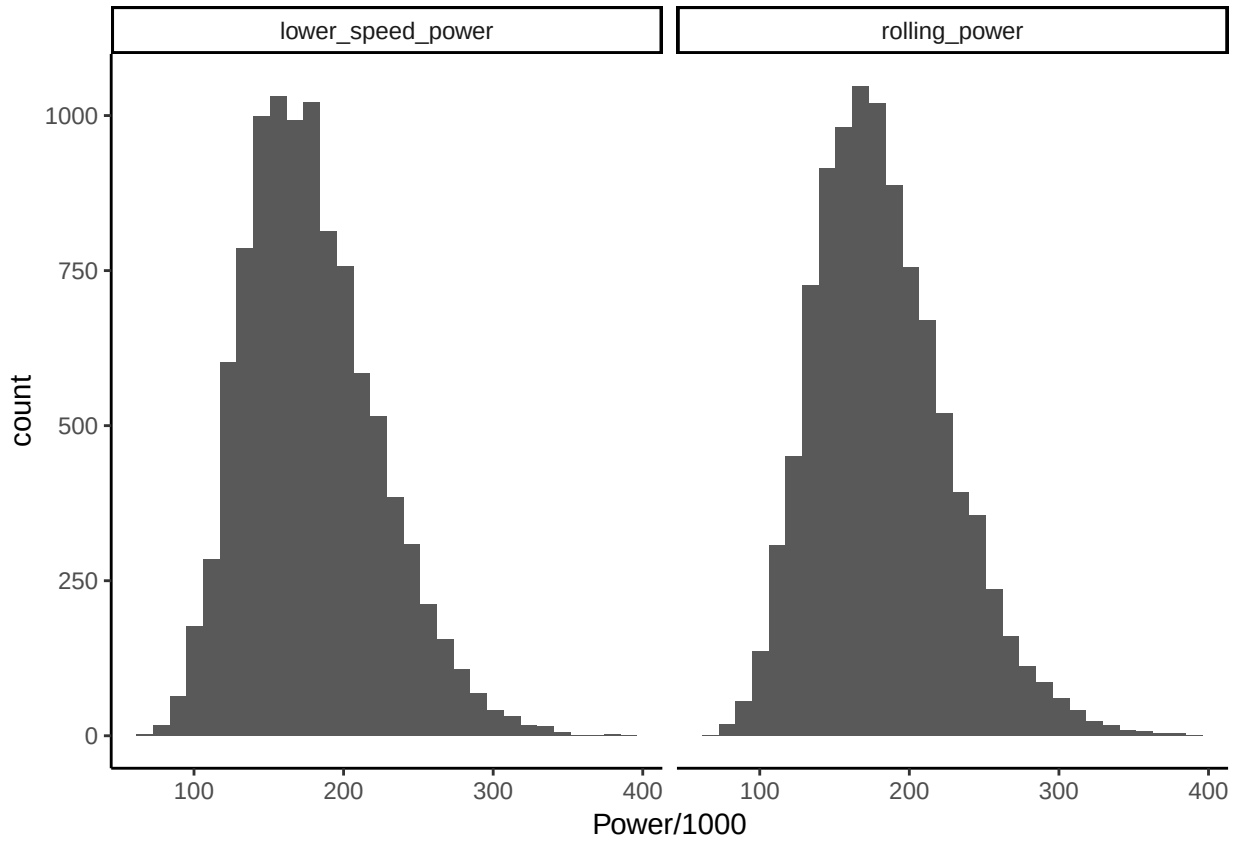
```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##   67190  146214  173510  178537  205716  381077
```

Graphs!!

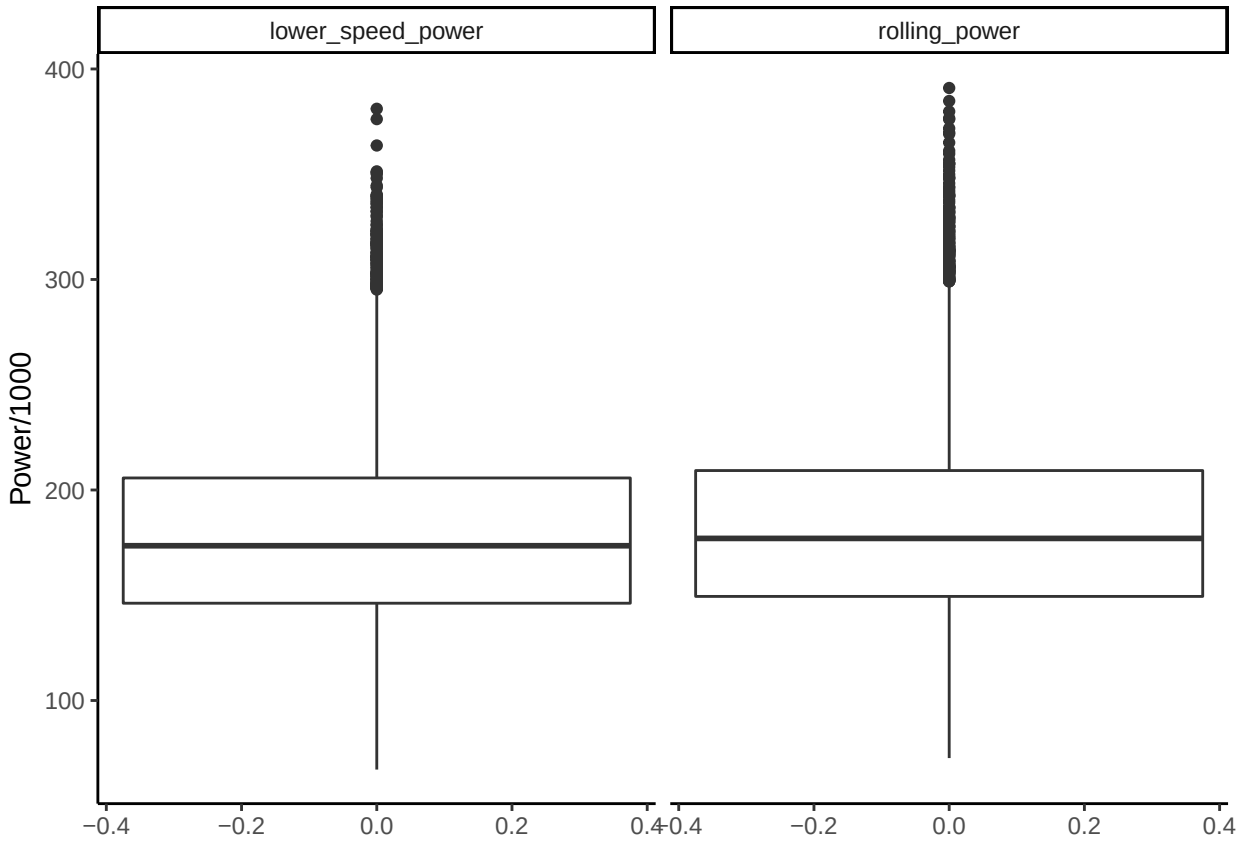
```
results_graph <- results %>%
  select(rolling_power, lower_speed_power) %>%
  gather(key = "Scenario", value = "Power" )

ggplot(results_graph) +
  geom_histogram(aes(x = Power/1000))+
  facet_wrap(~Scenario) +
  theme_classic()
```

```
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```




```
ggplot(results_graph) +
  geom_boxplot(aes(y = Power/1000))+
  facet_wrap(~Scenario) +
  theme_classic()
```




```
mean(results$rolling_power)/1000 ### 182.5571 kW reduced resistance
```

```
## [1] 182.1186
```

```
mean(results$lower_speed_power)/1000 ### 178.4378 kW reduced speed
```

```
## [1] 178.5371
```

‘‘‘