Burger Nutrition

(Burger King & McDonald)

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Outline

- Objective
- Get to know our data
- Interval Estimation
    - t.test
    - re-sampling (Bootstrap)
- Conclusion

Objective

- To determine interval estimation for Burger's nutritional mean (including calories, fat, and cholesterol)

- To compare the result of Burger's nutritional mean from 2 methods (t-test and Bootstrap)

Get to know our data...

FastFood Nutrition

https://www.kaggle.com/datasets/joebeachcapital/fast-food

Description

The dataset contains nutritional values from six of the largest and most popular fast food restaurants.

Preparation

1. Filter data from 2 restaurants (Burger King & McDonald)
2. Filter only burger product
3. Focus on 3 columns including Calories, Total Fat, and Cholesterol

DataSet

Company	Item	Calories	Total Fat (g)	Cholesterol (mg)
McDonald’s	Hamburger	250	9	25
McDonald’s	Cheeseburger	300	12	40
McDonald’s	Double Cheeseburger	440	23	80
McDonald’s	McDouble	390	19	65
McDonald’s	Quarter Pounder® with Cheese	510	26	90
McDonald’s	Double Quarter Pounder® with Cheese	740	42	155
McDonald’s	Big Mac®	540	29	75
McDonald’s	Big N’ Tasty®	460	24	70
McDonald’s	Big N’ Tasty® with Cheese	510	28	85
McDonald’s	Angus Bacon & Cheese	790	39	145
McDonald’s	Angus Deluxe	750	39	135
McDonald’s	Angus Mushroom & Swiss	770	40	135
McDonald’s	Filet-O-Fish®	380	18	40
McDonald’s	McChicken ®	360	16	35
McDonald’s	McRib ®	500	26	70
McDonald’s	Premium Grilled Chicken Classic Sandwich	360	9	65
McDonald’s	Premium Crispy Chicken Classic Sandwich	510	22	45
McDonald’s	Premium Grilled Chicken Club Sandwich	460	17	90
McDonald’s	Premium Crispy Chicken Club Sandwich	620	29	70
McDonald’s	Premium Grilled Chicken Ranch BLT Sandwich	380	10	75
McDonald’s	Premium Crispy Chicken Ranch BLT Sandwich	540	23	55
McDonald’s	Southern Style Crispy Chicken Sandwich	400	17	45
Burger King	Whopper® Sandwich	660	40	90
Burger King	Whopper® Sandwich with Cheese	740	46	115

Burger King

- 29 observations

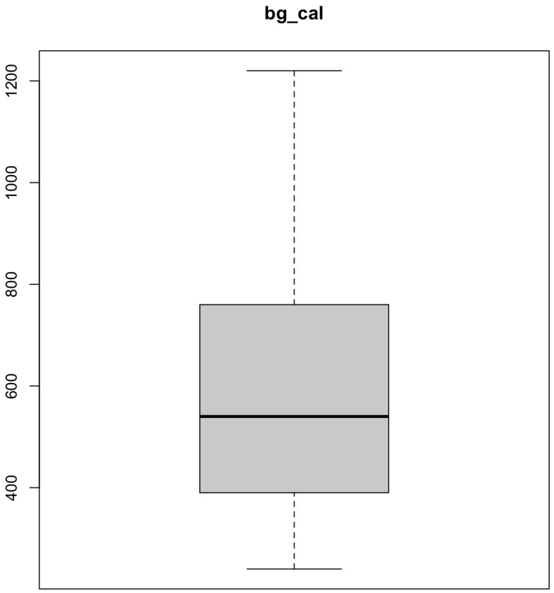
McDonalds

- 22 observations

Variables

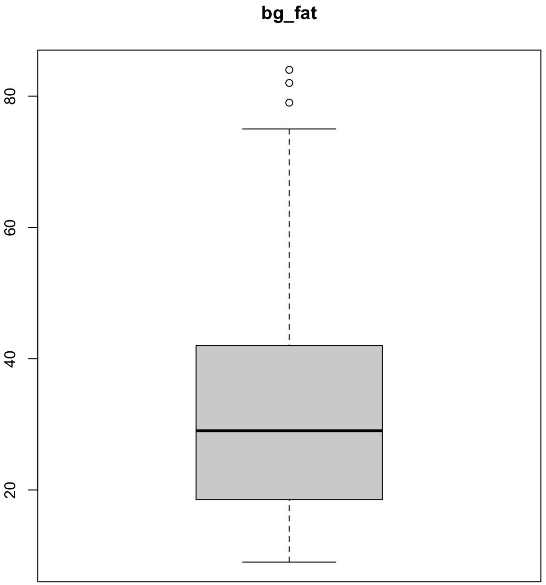
- Calories (Cal)
- Total Fat (g)
- Cholesterol (mg)

Variable Distribution



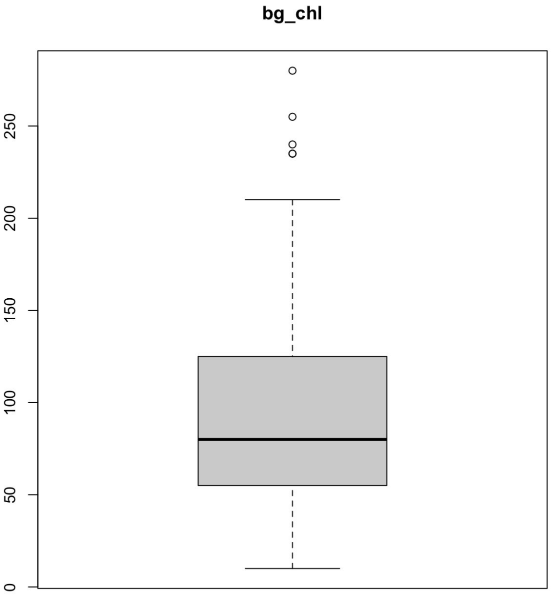
Calories (Cal)

Mean = 607.451



Total Fat (g)

Mean = 34.41176



Cholesterol (mg)

Mean = 98.82353

Interval Estimation

One Sample

```
## t-test
t.test(bg_cal, conf.level = 0.95)
t.test(bg_fat, conf.level = 0.95)
t.test(bg_chl, conf.level = 0.95)
```

Definition:

- A comparison of 1 group of data with standard values or values that already exist

Application for this study:

- Utilize one sample because the data set is combine into one group

```
        One Sample t-test
```

Calories

```
data:  bg_cal
t = 16.813, df = 50, p-value < 2.2e-16
alternative hypothesis: true mean is not equal to 0
95 percent confidence interval:
 534.8833 680.0187
sample estimates:
mean of x
  607.451
```

Total Fat

```
data:  bg_fat
t = 12.397, df = 50, p-value < 2.2e-16
alternative hypothesis: true mean is not equal to 0
95 percent confidence interval:
 28.83634 39.98718
sample estimates:
mean of x
 34.41176
```

Cholesterol

```
data:  bg_chl
t = 10.726, df = 50, p-value = 1.444e-14
alternative hypothesis: true mean is not equal to 0
95 percent confidence interval:
  80.31709 117.32997
sample estimates:
mean of x
 98.82353
```

```r
## Performing Bootstrap re-sampling
set.seed(100)
mean.fun<-function(bg_cal,i)
          {m<-mean(bg_cal[i])}
bg_cal_b <-boot(bg_cal,mean.fun,R=2000)
bg_cal_b

set.seed(100)
mean.fun<-function(bg_fat,i)
          {m<-mean(bg_fat[i])}
bg_fat_b <-boot(bg_fat,mean.fun,R=2000)
bg_fat_b

set.seed(100)
mean.fun<-function(bg_chl,i)
          {m<-mean(bg_chl[i])}
bg_chl_b <-boot(bg_chl,mean.fun,R=2000)
bg_chl_b

## Plot
plot(bg_cal_b)
plot(bg_fat_b)
plot(bg_chl_b)

## Find Confidence Interval of Bootstrap
bg_cal_ci<-boot.ci(bg_cal_b,conf = 0.95,type = c("norm", "perc"))
bg_cal_ci

bg_fat_ci<-boot.ci(bg_fat_b,conf = 0.95,type = c("norm", "perc"))
bg_fat_ci

bg_chl_ci<-boot.ci(bg_chl_b,conf = 0.95,type = c("norm", "perc"))
bg_chl_ci
```

Bootstrap

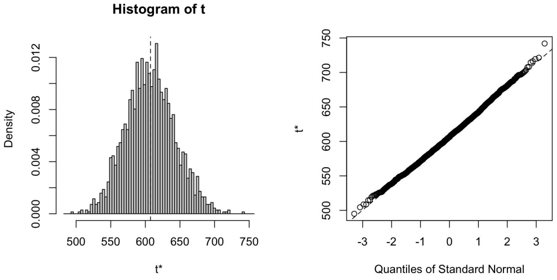
The main purpose of bootstrap is to evaluate the variance of the estimator.

Other applications might be:

- To estimate confidence intervals, standard errors for the estimator
- To estimate precision for an estimator θ to deal with non-normally distributed data
- To create sample sizes for experiments

Result of Bootstrap

Calories (Cal)



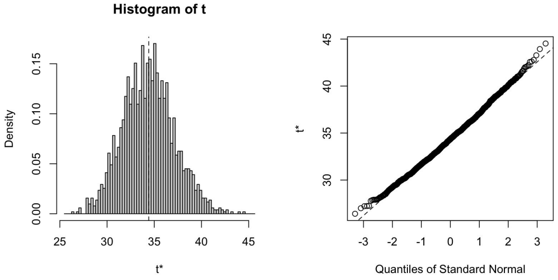

```
BOOTSTRAP CONFIDENCE INTERVAL CALCULATIONS
Based on 2000 bootstrap replicates

CALL :
boot.ci(boot.out = bg_cal_b, conf = 0.95, type = c("norm", "perc"))

Intervals :
Level      Normal              Percentile
95%   (537.8, 677.4 )   (539.4, 679.4 )
Calculations and Intervals on Original Scale
```

Bias = 0.5

Total Fat (g)



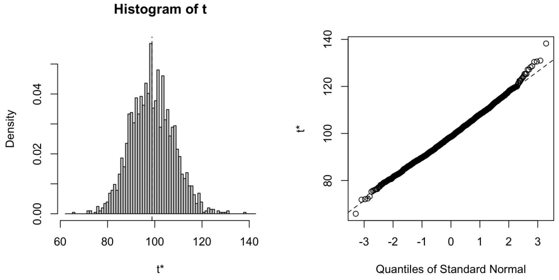

```
BOOTSTRAP CONFIDENCE INTERVAL CALCULATIONS
Based on 2000 bootstrap replicates

CALL :
boot.ci(boot.out = bg_fat_b, conf = 0.95, type = c("norm", "perc"))

Intervals :
Level      Normal              Percentile
95%   (29.08, 39.77 )   (29.35, 39.92 )
Calculations and Intervals on Original Scale
```

Bias = 0.04

Cholesterol (mg)




```
BOOTSTRAP CONFIDENCE INTERVAL CALCULATIONS
Based on 2000 bootstrap replicates

CALL :
boot.ci(boot.out = bg_chl_b, conf = 0.95, type = c("norm", "perc"))

Intervals :
Level      Normal              Percentile
95%   ( 80.80, 116.65 )   ( 81.86, 117.25 )
Calculations and Intervals on Original Scale
```

Bias = 0.1

Conclusion

Summary

	Calories (Cal)	Total Fat (g)	Cholesterol (mg)
Mean	607.451	34.41176	98.92353
Interval Estimation (t-test)	(534.88 680.02)	(28.84 39.99)	(80.317 117.32)
Bootstrap	(537.8 677.4)	(29.08 39.77)	(80.80 116.65)
Range (t-test)	145.14	11.15	37.003
Range (Bootstrap)	139.6	10.69	35.85
Difference	(2.93 -2.62)	(0.24 -0.22)	(0.483 -0.67)

From the result, it can be seen that **the range of data** from t-test method is wider than Bootstrap method. However, **the different value** of 3 variables' mean from these methods is not significantly different. Therefore, it can be implied that the distribution of data is nearly **'Normal Distribution'**.

THANK YOU