

```
library(tidyverse)
```

R Markdown

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When you click the **Knit** button a document will be generated that includes both content as well as the output of any embedded R code chunks within the document. You can embed an R code chunk like this:

10%

```
validation <- read_csv("./10%/IoU.csv")
```

```
## Rows: 30 Columns: 3
## -- Column specification -----
## Delimiter: ","
## dbl (3): Femur, Patella, QT
##
## i Use `spec()` to retrieve the full column specification for this data.
## i Specify the column types or set `show_col_types = FALSE` to quiet this message.
```

```
glimpse(validation)
```

```
## Rows: 30
## Columns: 3
## $ Femur   <dbl> 88.36140, 0.00000, 0.00000, 0.00000, 0.00000, 54.16606, 0.0000~
## $ Patella <dbl> 95.42595, 60.68824, 0.00000, 0.00000, 0.00000, 0.00000, 0.0000~
## $ QT      <dbl> 0.000000, 42.527826, 98.086396, 58.027314, 0.000000, 0.000000,~
```

```
# Summary table
```

```
validation %>%
  dplyr::select(Femur, Patella, QT)%>%
  summarize(n=n(),
            value = c("mean", "median"),
            Femur = c(round(mean(Femur, na.rm=TRUE),2), round(median(Femur, na.rm=TRUE),2)),
            Patella = c(round(mean(Patella, na.rm=TRUE),2), round(median(Patella, na.rm=TRUE),2)),
            QT = c(round(mean(QT, na.rm=TRUE),2), round(median(QT, na.rm=TRUE),2)))
```

```
## # A tibble: 2 x 5
##       n value  Femur Patella   QT
##   <int> <chr>   <dbl>   <dbl> <dbl>
## 1    30 mean    23.1    29.3  24.1
## 2    30 median    0         0    2.6
```

Use R to find a 95% bootstrap confidence interval for the *mean*. Use 1000 bootstrap samples. *NOTE:* More bootstrap samples is better, but if you find this times out or takes too long in RStudio Cloud, try using 1000 bootstrap samples instead.

```
repetitions <- 1000
Femur_means <- rep(NA, repetitions) # where we'll store the bootstrap means
Patella_means <- rep(NA, repetitions) # where we'll store the bootstrap means
QT_means <- rep(NA, repetitions) # where we'll store the bootstrap means
sample_size <- as.numeric(validation %>% summarize(n()))
set.seed(50)
for (i in 1:repetitions)
{
```

```

boot_samp <- validation %>% sample_n(size = sample_size, replace=TRUE)
Femur_means[i] <- as.numeric(boot_samp %>% summarize(mean(Femur, na.rm=TRUE)))
Patella_means[i] <- as.numeric(boot_samp %>% summarize(mean(Patella, na.rm=TRUE)))
QT_means[i] <- as.numeric(boot_samp %>% summarize(mean(QT, na.rm=TRUE)))
}
round(quantile(Femur_means, c(0.025, 0.975)), 2)

```

```

## 2.5% 97.5%
## 10.68 37.57

```

```

round(quantile(Patella_means, c(0.025, 0.975)), 2)

```

```

## 2.5% 97.5%
## 14.92 44.68

```

```

round(quantile(QT_means, c(0.025, 0.975)), 2)

```

```

## 2.5% 97.5%
## 12.23 36.90

```

5%

```

validation <- read_csv("./5%/IoU.csv")

```

```

## Rows: 30 Columns: 3
## -- Column specification -----
## Delimiter: ","
## dbl (3): Femur, Patella, QT
##
## i Use `spec()` to retrieve the full column specification for this data.
## i Specify the column types or set `show_col_types = FALSE` to quiet this message.
glimpse(validation)

```

```

## Rows: 30
## Columns: 3
## $ Femur   <dbl> 76.90230, 0.00000, 96.46267, 0.00000, 96.07826, 42.59755, 0.00~
## $ Patella <dbl> 93.56793, 70.82023, 71.78658, 0.00000, 0.00000, 0.00000, 0.000~
## $ QT      <dbl> 0.000000, 17.249930, 0.000000, 0.000000, 46.668986, 92.122925, ~

```

Summary table

```

validation %>%
  dplyr::select(Femur, Patella, QT)%>%
  summarize(n=n(),
            value = c("mean", "median"),
            Femur = c(round(mean(Femur, na.rm=TRUE), 2), round(median(Femur, na.rm=TRUE), 2)),
            Patella = c(round(mean(Patella, na.rm=TRUE), 2), round(median(Patella, na.rm=TRUE), 2)),
            QT = c(round(mean(QT, na.rm=TRUE), 2), round(median(QT, na.rm=TRUE), 2)))

```

```

## # A tibble: 2 x 5
##       n value  Femur Patella   QT
##   <int> <chr>   <dbl>   <dbl> <dbl>
## 1    30 mean    22.4    20.5  25.3
## 2    30 median    0         0    7.31

```

Use R to find a 95% bootstrap confidence interval for the *mean*. Use 1000 bootstrap samples. *NOTE:* More bootstrap samples is better, but if you find this times out or takes too long in RStudio Cloud, try using 1000

bootstrap samples instead.

```
repetitions <- 1000
Femur_means <- rep(NA, repetitions) # where we'll store the bootstrap means
Patella_means <- rep(NA, repetitions) # where we'll store the bootstrap means
QT_means <- rep(NA, repetitions) # where we'll store the bootstrap means
sample_size <- as.numeric(validation %>% summarize(n()))
set.seed(50)
for (i in 1:repetitions)
{
  boot_samp <- validation %>% sample_n(size = sample_size, replace=TRUE)
  Femur_means[i] <- as.numeric(boot_samp %>% summarize(mean(Femur, na.rm=TRUE)))
  Patella_means[i] <- as.numeric(boot_samp %>% summarize(mean(Patella, na.rm=TRUE)))
  QT_means[i] <- as.numeric(boot_samp %>% summarize(mean(QT, na.rm=TRUE)))
}
round(quantile(Femur_means, c(0.025, 0.975)), 2)
```

```
## 2.5% 97.5%
## 10.17 34.80
```

```
round(quantile(Patella_means, c(0.025, 0.975)), 2)
```

```
## 2.5% 97.5%
## 9.19 34.08
```

```
round(quantile(QT_means, c(0.025, 0.975)), 2)
```

```
## 2.5% 97.5%
## 13.90 38.39
```

2%

```
validation <- read_csv("./2%/IoU.csv")
```

```
## Rows: 30 Columns: 3
## -- Column specification -----
## Delimiter: ","
## dbl (3): Femur, Patella, QT
##
## i Use `spec()` to retrieve the full column specification for this data.
## i Specify the column types or set `show_col_types = FALSE` to quiet this message.
glimpse(validation)
```

```
## Rows: 30
## Columns: 3
## $ Femur <dbl> 74.3941118, 0.0000000, 0.0000000, 0.0000000, 92.1675618, 49.40~
## $ Patella <dbl> 92.25926, 69.25537, 57.23577, 0.00000, 0.00000, 0.00000, 94.97~
## $ QT <dbl> 0.000000, 8.672151, 84.184787, 41.198092, 94.627545, 97.075294~
```

Summary table

```
validation %>%
  dplyr::select(Femur, Patella, QT)%>%
  summarize(n=n(),
            value = c("mean", "median"),
            Femur = c(round(mean(Femur, na.rm=TRUE), 2), round(median(Femur, na.rm=TRUE), 2)),
            Patella = c(round(mean(Patella, na.rm=TRUE), 2), round(median(Patella, na.rm=TRUE), 2)),
            QT = c(round(mean(QT, na.rm=TRUE), 2), round(median(QT, na.rm=TRUE), 2)))
```

```
## # A tibble: 2 x 5
##       n value Femur Patella QT
##   <int> <chr> <dbl>   <dbl> <dbl>
## 1    30 mean   23.0    34.9 25.9
## 2    30 median 0      18.6 5.67
```

Use R to find a 95% bootstrap confidence interval for the *mean*. Use 1000 bootstrap samples. *NOTE:* More bootstrap samples is better, but if you find this times out or takes too long in RStudio Cloud, try using 1000 bootstrap samples instead.

```
repetitions <- 1000
Femur_means <- rep(NA, repetitions) # where we'll store the bootstrap means
Patella_means <- rep(NA, repetitions) # where we'll store the bootstrap means
QT_means <- rep(NA, repetitions) # where we'll store the bootstrap means
sample_size <- as.numeric(validation %>% summarize(n()))
set.seed(50)
for (i in 1:repetitions)
{
  boot_samp <- validation %>% sample_n(size = sample_size, replace=TRUE)
  Femur_means[i] <- as.numeric(boot_samp %>% summarize(mean(Femur, na.rm=TRUE)))
  Patella_means[i] <- as.numeric(boot_samp %>% summarize(mean(Patella, na.rm=TRUE)))
  QT_means[i] <- as.numeric(boot_samp %>% summarize(mean(QT, na.rm=TRUE)))
}
round(quantile(Femur_means, c(0.025, 0.975)), 2)
```

```
## 2.5% 97.5%
## 11.02 36.47
```

```
round(quantile(Patella_means, c(0.025, 0.975)), 2)
```

```
## 2.5% 97.5%
## 20.33 50.38
```

```
round(quantile(QT_means, c(0.025, 0.975)), 2)
```

```
## 2.5% 97.5%
## 13.05 39.07
```

```
1%
```

```
validation <- read_csv("./1%/IoU.csv")
```

```
## Rows: 30 Columns: 3
## -- Column specification -----
## Delimiter: ","
## dbl (3): Femur, Patella, QT
##
## i Use `spec()` to retrieve the full column specification for this data.
## i Specify the column types or set `show_col_types = FALSE` to quiet this message.
glimpse(validation)
```

```
## Rows: 30
## Columns: 3
## $ Femur   <dbl> 87.915858, 0.000000, 0.000000, 0.000000, 0.000000, 70.406320, ~
## $ Patella <dbl> 0.000000, 0.000000, 0.000000, 0.000000, 0.000000, 60.73288, 0.00000~
```

```
## $ QT      <dbl> 85.3741525, 11.4356448, 90.4945517, 63.1801459, 0.0000000, 0.0~
# Summary table
validation %>%
  dplyr::select(Femur, Patella, QT)%>%
  summarize(n=n(),
            value = c("mean", "median"),
            Femur = c(round(mean(Femur, na.rm=TRUE),2), round(median(Femur, na.rm=TRUE),2)),
            Patella = c(round(mean(Patella, na.rm=TRUE),2), round(median(Patella, na.rm=TRUE),2)),
            QT = c(round(mean(QT, na.rm=TRUE),2), round(median(QT, na.rm=TRUE),2)))
```

```
## # A tibble: 2 x 5
##       n value  Femur Patella   QT
##   <int> <chr>  <dbl>   <dbl> <dbl>
## 1    30 mean    19.6    26.7  31.1
## 2    30 median    0         0   11.0
```

Use R to find a 95% bootstrap confidence interval for the *mean*. Use 1000 bootstrap samples. *NOTE:* More bootstrap samples is better, but if you find this times out or takes too long in RStudio Cloud, try using 1000 bootstrap samples instead.

```
repetitions <- 1000
Femur_means <- rep(NA, repetitions) # where we'll store the bootstrap means
Patella_means <- rep(NA, repetitions) # where we'll store the bootstrap means
QT_means <- rep(NA, repetitions) # where we'll store the bootstrap means
sample_size <- as.numeric(validation %>% summarize(n()))
set.seed(50)
for (i in 1:repetitions)
{
  boot_samp <- validation %>% sample_n(size = sample_size, replace=TRUE)
  Femur_means[i] <- as.numeric(boot_samp %>% summarize(mean(Femur, na.rm=TRUE)))
  Patella_means[i] <- as.numeric(boot_samp %>% summarize(mean(Patella, na.rm=TRUE)))
  QT_means[i] <- as.numeric(boot_samp %>% summarize(mean(QT, na.rm=TRUE)))
}
round(quantile(Femur_means,c(0.025,0.975)),2)
```

```
## 2.5% 97.5%
## 7.90 32.05
round(quantile(Patella_means,c(0.025,0.975)),2)
```

```
## 2.5% 97.5%
## 11.54 42.87
round(quantile(QT_means,c(0.025,0.975)),2)
```

```
## 2.5% 97.5%
## 18.57 44.99
```

Score

10%

```
score <- read_csv("./10%/score.csv")
```

```
## Rows: 30 Columns: 3
## -- Column specification -----
## Delimiter: ","
```

```
## dbl (3): Femur, Patella, QT
##
## i Use `spec()` to retrieve the full column specification for this data.
## i Specify the column types or set `show_col_types = FALSE` to quiet this message.
glimpse(score)

## Rows: 30
## Columns: 3
## $ Femur    <dbl> 0.71, 0.85, 0.43, 0.52, 0.28, 0.30, 0.11, 0.15, 0.16, 0.76, 0.~
## $ Patella  <dbl> 0.70, 0.52, 0.00, 0.94, 0.87, 0.00, 0.22, 0.81, 0.93, 0.90, 0.~
## $ QT       <dbl> 0.87, 0.14, 0.97, 0.14, 0.84, 0.90, 0.94, 0.93, 0.95, 0.00, 0.~

# Summary table
score %>%
  dplyr::select(Femur, Patella, QT)%>%
  summarize(n=n(),
            value = c("mean", "median"),
            Femur = c(round(mean(Femur, na.rm=TRUE),2), round(median(Femur, na.rm=TRUE),2)),
            Patella = c(round(mean(Patella, na.rm=TRUE),2), round(median(Patella, na.rm=TRUE),2)),
            QT = c(round(mean(QT, na.rm=TRUE),2), round(median(QT, na.rm=TRUE),2)))

## # A tibble: 2 x 5
##       n value Femur Patella QT
##   <int> <chr> <dbl>   <dbl> <dbl>
## 1     30 mean   0.49     0.35  0.77
## 2     30 median 0.5      0.2    0.9
```

Use R to find a 95% bootstrap confidence interval for the *mean*. Use 1000 bootstrap samples. *NOTE:* More bootstrap samples is better, but if you find this times out or takes too long in RStudio Cloud, try using 1000 bootstrap samples instead.

```
repetitions <- 1000
Femur_means <- rep(NA, repetitions) # where we'll store the bootstrap means
Patella_means <- rep(NA, repetitions) # where we'll store the bootstrap means
QT_means <- rep(NA, repetitions) # where we'll store the bootstrap means
sample_size <- as.numeric(score %>% summarize(n()))
set.seed(50)
for (i in 1:repetitions)
{
  boot_samp <- score %>% sample_n(size = sample_size, replace=TRUE)
  Femur_means[i] <- as.numeric(boot_samp %>% summarize(mean(Femur, na.rm=TRUE)))
  Patella_means[i] <- as.numeric(boot_samp %>% summarize(mean(Patella, na.rm=TRUE)))
  QT_means[i] <- as.numeric(boot_samp %>% summarize(mean(QT, na.rm=TRUE)))
}
round(quantile(Femur_means, c(0.025, 0.975)), 2)
```

```
## 2.5% 97.5%
## 0.40 0.57
```

```
round(quantile(Patella_means, c(0.025, 0.975)), 2)
```

```
## 2.5% 97.5%
## 0.23 0.49
```

```
round(quantile(QT_means, c(0.025, 0.975)), 2)
```

```
## 2.5% 97.5%
```

```
## 0.66 0.87
```

```
5%
```

```
score <- read_csv("./5%/score.csv")
```

```
## Rows: 30 Columns: 3
## -- Column specification -----
## Delimiter: ","
## dbl (3): Femur, Patella, QT
##
## i Use `spec()` to retrieve the full column specification for this data.
## i Specify the column types or set `show_col_types = FALSE` to quiet this message.
```

```
glimpse(score)
```

```
## Rows: 30
## Columns: 3
## $ Femur   <dbl> 0.85, 0.16, 0.37, 0.64, 0.83, 0.84, 0.61, 0.36, 0.91, 0.28, 0.~
## $ Patella <dbl> 0.89, 0.91, 0.70, 0.96, 0.95, 0.86, 0.42, 0.97, 0.79, 0.96, 0.~
## $ QT      <dbl> 0.95, 0.85, 0.96, 0.00, 0.63, 0.80, 0.95, 0.20, 0.93, 0.90, 0.~
```

```
# Summary table
```

```
score %>%
  dplyr::select(Femur, Patella, QT)%>%
  summarize(n=n(),
            value = c("mean", "median"),
            Femur = c(round(mean(Femur, na.rm=TRUE),2), round(median(Femur, na.rm=TRUE),2)),
            Patella = c(round(mean(Patella, na.rm=TRUE),2), round(median(Patella, na.rm=TRUE),2)),
            QT = c(round(mean(QT, na.rm=TRUE),2), round(median(QT, na.rm=TRUE),2)))
```

```
## # A tibble: 2 x 5
##       n value  Femur Patella   QT
##   <int> <chr>   <dbl>   <dbl> <dbl>
## 1    30 mean    0.64    0.55 0.74
## 2    30 median 0.74    0.68 0.92
```

Use R to find a 95% bootstrap confidence interval for the *mean*. Use 1000 bootstrap samples. *NOTE:* More bootstrap samples is better, but if you find this times out or takes too long in RStudio Cloud, try using 1000 bootstrap samples instead.

```
repetitions <- 1000
Femur_means <- rep(NA, repetitions) # where we'll store the bootstrap means
Patella_means <- rep(NA, repetitions) # where we'll store the bootstrap means
QT_means <- rep(NA, repetitions) # where we'll store the bootstrap means
sample_size <- as.numeric(score %>% summarize(n()))
set.seed(50)
for (i in 1:repetitions)
{
  boot_samp <- score %>% sample_n(size = sample_size, replace=TRUE)
  Femur_means[i] <- as.numeric(boot_samp %>% summarize(mean(Femur, na.rm=TRUE)))
  Patella_means[i] <- as.numeric(boot_samp %>% summarize(mean(Patella, na.rm=TRUE)))
  QT_means[i] <- as.numeric(boot_samp %>% summarize(mean(QT, na.rm=TRUE)))
}
round(quantile(Femur_means, c(0.025, 0.975)), 2)
```

```
## 2.5% 97.5%
```

```
## 0.53 0.73
round(quantile(Patella_means, c(0.025, 0.975)), 2)

## 2.5% 97.5%
## 0.43 0.68
round(quantile(QT_means, c(0.025, 0.975)), 2)

## 2.5% 97.5%
## 0.62 0.85

2%

score <- read_csv("./2%/score.csv")

## Rows: 30 Columns: 3
## -- Column specification -----
## Delimiter: ","
## dbl (3): Femur, Patella, QT
##
## i Use `spec()` to retrieve the full column specification for this data.
## i Specify the column types or set `show_col_types = FALSE` to quiet this message.
glimpse(score)

## Rows: 30
## Columns: 3
## $ Femur <dbl> 0.93, 0.81, 0.82, 0.68, 0.92, 0.91, 0.78, 0.29, 0.93, 0.96, 0.~
## $ Patella <dbl> 0.92, 0.91, 0.14, 0.94, 0.97, 0.00, 0.42, 0.80, 0.94, 0.97, 0.~
## $ QT <dbl> 0.95, 0.94, 0.97, 0.17, 0.65, 0.87, 0.96, 0.95, 0.97, 0.14, 0.~

# Summary table
score %>%
  dplyr::select(Femur, Patella, QT)%>%
  summarize(n=n(),
            value = c("mean", "median"),
            Femur = c(round(mean(Femur, na.rm=TRUE), 2), round(median(Femur, na.rm=TRUE), 2)),
            Patella = c(round(mean(Patella, na.rm=TRUE), 2), round(median(Patella, na.rm=TRUE), 2)),
            QT = c(round(mean(QT, na.rm=TRUE), 2), round(median(QT, na.rm=TRUE), 2)))

## # A tibble: 2 x 5
##       n value Femur Patella QT
##   <int> <chr> <dbl>   <dbl> <dbl>
## 1    30 mean   0.79    0.48 0.8
## 2    30 median 0.86    0.4 0.94
```

Use R to find a 95% bootstrap confidence interval for the *mean*. Use 1000 bootstrap samples. *NOTE:* More bootstrap samples is better, but if you find this times out or takes too long in RStudio Cloud, try using 1000 bootstrap samples instead.

```
repetitions <- 1000
Femur_means <- rep(NA, repetitions) # where we'll store the bootstrap means
Patella_means <- rep(NA, repetitions) # where we'll store the bootstrap means
QT_means <- rep(NA, repetitions) # where we'll store the bootstrap means
sample_size <- as.numeric(score %>% summarize(n()))
set.seed(50)
for (i in 1:repetitions)
```



```

{
  boot_samp <- score %>% sample_n(size = sample_size, replace=TRUE)
  Femur_means[i] <- as.numeric(boot_samp %>% summarize(mean(Femur, na.rm=TRUE)))
  Patella_means[i] <- as.numeric(boot_samp %>% summarize(mean(Patella, na.rm=TRUE)))
  QT_means[i] <- as.numeric(boot_samp %>% summarize(mean(QT, na.rm=TRUE)))
}
round(quantile(Femur_means, c(0.025, 0.975)), 2)

## 2.5% 97.5%
## 0.71 0.85

round(quantile(Patella_means, c(0.025, 0.975)), 2)

## 2.5% 97.5%
## 0.34 0.63

round(quantile(QT_means, c(0.025, 0.975)), 2)

## 2.5% 97.5%
## 0.69 0.89

1%

score <- read_csv("./1%/score.csv")

## Rows: 30 Columns: 3
## -- Column specification -----
## Delimiter: ","
## dbl (3): Femur, Patella, QT
##
## i Use `spec()` to retrieve the full column specification for this data.
## i Specify the column types or set `show_col_types = FALSE` to quiet this message.
glimpse(score)

## Rows: 30
## Columns: 3
## $ Femur <dbl> 0.86, 0.44, 0.91, 0.82, 0.38, 0.81, 0.77, 0.25, 0.63, 0.89, 0.~
## $ Patella <dbl> 0.83, 0.00, 0.00, 0.00, 0.00, 0.41, 0.11, 0.26, 0.65, 0.00, 0.~
## $ QT <dbl> 0.89, 0.92, 0.95, 0.29, 0.84, 0.88, 0.90, 0.94, 0.93, 0.68, 0.~

# Summary table
score %>%
  dplyr::select(Femur, Patella, QT)%>%
  summarize(n=n(),
            value = c("mean", "median"),
            Femur = c(round(mean(Femur, na.rm=TRUE), 2), round(median(Femur, na.rm=TRUE), 2)),
            Patella = c(round(mean(Patella, na.rm=TRUE), 2), round(median(Patella, na.rm=TRUE), 2)),
            QT = c(round(mean(QT, na.rm=TRUE), 2), round(median(QT, na.rm=TRUE), 2)))

## # A tibble: 2 x 5
##       n value Femur Patella QT
##   <int> <chr> <dbl> <dbl> <dbl>
## 1    30 mean    0.71    0.19 0.77
## 2    30 median 0.8     0     0.89

```

Use R to find a 95% bootstrap confidence interval for the *mean*. Use 1000 bootstrap samples. *NOTE:* More

bootstrap samples is better, but if you find this times out or takes too long in RStudio Cloud, try using 1000 bootstrap samples instead.

```
repetitions <- 1000
Femur_means <- rep(NA, repetitions) # where we'll store the bootstrap means
Patella_means <- rep(NA, repetitions) # where we'll store the bootstrap means
QT_means <- rep(NA, repetitions) # where we'll store the bootstrap means
sample_size <- as.numeric(score %>% summarize(n()))
set.seed(50)
for (i in 1:repetitions)
{
  boot_samp <- score %>% sample_n(size = sample_size, replace=TRUE)
  Femur_means[i] <- as.numeric(boot_samp %>% summarize(mean(Femur, na.rm=TRUE)))
  Patella_means[i] <- as.numeric(boot_samp %>% summarize(mean(Patella, na.rm=TRUE)))
  QT_means[i] <- as.numeric(boot_samp %>% summarize(mean(QT, na.rm=TRUE)))
}
round(quantile(Femur_means, c(0.025, 0.975)), 2)

## 2.5% 97.5%
## 0.63 0.80

round(quantile(Patella_means, c(0.025, 0.975)), 2)

## 2.5% 97.5%
## 0.11 0.28

round(quantile(QT_means, c(0.025, 0.975)), 2)

## 2.5% 97.5%
## 0.67 0.85
```