Mediation_count_DV

1. Data Simulation

X: Mean = 5, SD=4 M = 0.3+0.5X Y =exp(0.2 + 0.2M+0.08X)

```
##########################################
###  data simulation
##########################################

# set the size of the sample
n=500
# set seed
set.seed(123)

# simulate x (normal distribution)
X <- rnorm(n, 5, 4)
# calculate the mean of X
mean_x=mean(X)

# simulate a residual for M
residual_1<-rnorm(n,0,1)
M<-0.3+0.5*X+residual_1

# mu for Poisson regression via a log link
mu_1 <- exp(0.2 + 0.2*M+0.08*X)
# use rpois to generate Y
Y <- rpois(n, lambda=mu_1)

# combine into a dataframe and print out the first 6 rows
data <- data.frame(X=X, M=M, Y=Y)
head(data)
```

```
##           X        M  Y
## 1  2.758097 1.077156  1
## 2  4.079290 1.345946  1
## 3 11.234833 6.944202  8
## 4  5.282034 3.692078  4
## 5  5.517151 1.549409  2
## 6 11.860260 6.134983 17
```

2. Key Function

```
#####################################################
###  Mediation Analysis for Count data
#####################################################
library(boot)
```

```
## Warning: package 'boot' was built under R version 4.1.3
```

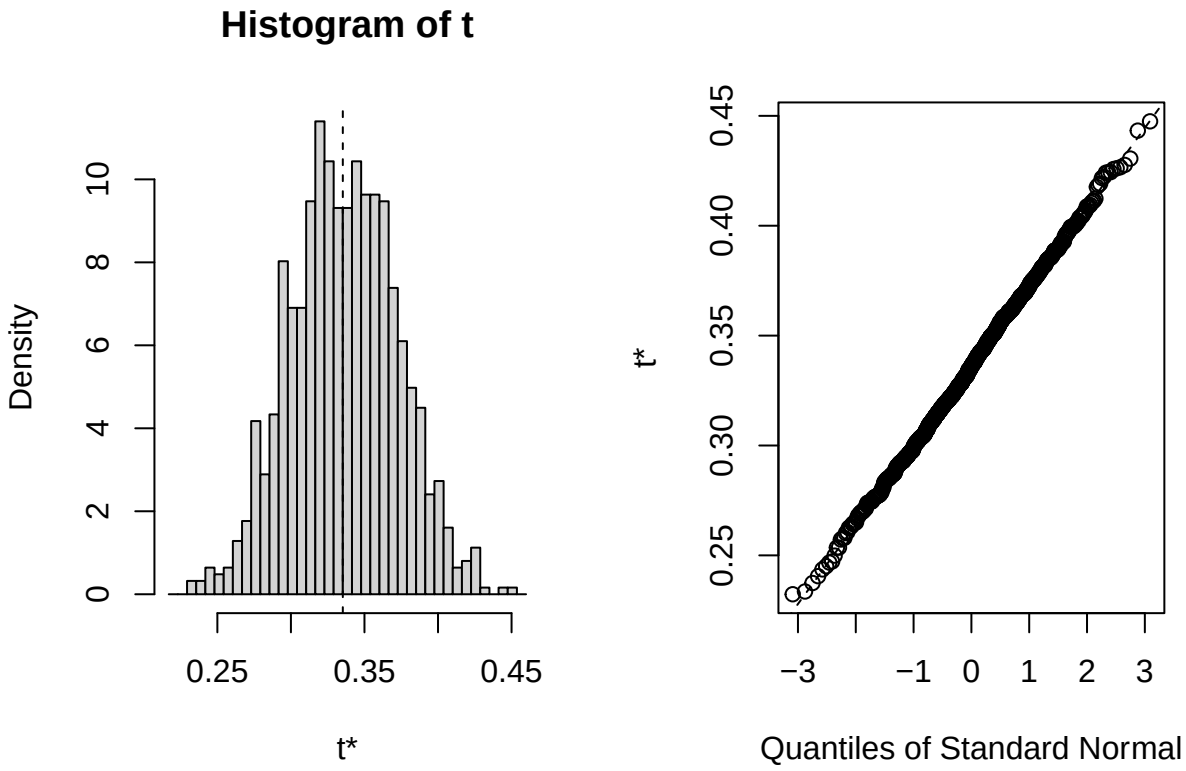
```
set.seed(123)


Mediation_function_poisson<-function(data_used,i,x_predetermined=0)
{
  # Sample a data
  data_temp=data_used[i,]

  # Deciding which X value to use
  if(x_predetermined==0){x_predetermined=mean(data_temp$X)}
  else if (x_predetermined==-1){x_predetermined=mean(data_temp$X)-sd(data_temp$X)}
  else(x_predetermined=mean(data_temp$X)+sd(data_temp$X))

  # a path
  result_a<-lm(M~X, data = data_temp)
  a_0<-result_a$coefficients[1]
  a_1<-result_a$coefficients[2]

  # b path
  result_b<-glm(Y~M+X, data = data_temp, family = quasipoisson)
  b_0<-result_b$coefficients[1]
  b_1<-result_b$coefficients[2]
  c_1_apostrophe<-result_b$coefficients[3]

  #calculating the indirect effect
  M_estimated=a_0+a_1*x_predetermined
  indirect_effect<-a_1*b_1*exp(b_0+b_1*M_estimated+c_1_apostrophe*x_predetermined)
  return(indirect_effect)
}
```

3. Use the function

```
# use boot() to do bootstrapping mediation analysis
boot_mediation <- boot(data, Mediation_function_poisson, R=1000)
boot_mediation
```

```
##
## ORDINARY NONPARAMETRIC BOOTSTRAP
##
##
## Call:
## boot(data = data, statistic = Mediation_function_poisson, R = 1000)
##
##
## Bootstrap Statistics :
##      original       bias    std. error
## t1* 0.3352801 0.0009118087  0.03610191
```

```
# plot the 1000 indirect effects
plot(boot_mediation)
```




```
# print out confidence intervals
boot.ci(boot.out = boot_mediation, type = c("norm", "perc"))
```

```
## BOOTSTRAP CONFIDENCE INTERVAL CALCULATIONS
## Based on 1000 bootstrap replicates
##
## CALL :
## boot.ci(boot.out = boot_mediation, type = c("norm", "perc"))
##
## Intervals :
## Level      Normal             Percentile
## 95%   ( 0.2636,  0.4051 )   ( 0.2681,  0.4062 )
## Calculations and Intervals on Original Scale
```

4. Check

```
#################################################
###  calculate the theoretical value
#################################################

mean_x<-mean(data$X)
theoretical_indirect_effect<-0.5*0.2*exp(0.2+0.2*(0.3+0.5*mean_x)+0.08*mean_x)
theoretical_indirect_effect
```

```
## [1] 0.3270377
```