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**COVARIANCE AND CORRELATION**

# Load the mtcars dataset

data <- mtcars

# Display the first few rows of the dataset

print("First few rows of the mtcars dataset:")

print(head(data))

> print("First few rows of the mtcars dataset:")

[1] "First few rows of the mtcars dataset:"

> print(head(data))

mpg cyl disp hp drat wt qsec vs am gear carb

Mazda RX4 21.0 6 160 110 3.90 2.620 16.46 0 1 4 4

Mazda RX4 Wag 21.0 6 160 110 3.90 2.875 17.02 0 1 4 4

Datsun 710 22.8 4 108 93 3.85 2.320 18.61 1 1 4 1

Hornet 4 Drive 21.4 6 258 110 3.08 3.215 19.44 1 0 3 1

Hornet Sportabout 18.7 8 360 175 3.15 3.440 17.02 0 0 3 2

Valiant 18.1 6 225 105 2.76 3.460 20.22 1 0 3 1

# Calculate and display covariance

cov\_matrix <- cov(data)

print("Covariance Matrix:")

print(cov\_matrix)

> print("Covariance Matrix:")

[1] "Covariance Matrix:"

> print(cov\_matrix)

mpg cyl disp hp drat wt qsec vs am

mpg 36.324103 -9.1723790 -633.09721 -320.732056 2.19506351 -5.1166847 4.50914919 2.01713710 1.80393145

cyl -9.172379 3.1895161 199.66028 101.931452 -0.66836694 1.3673710 -1.88685484 -0.72983871 -0.46572581

disp -633.097208 199.6602823 15360.79983 6721.158669 -47.06401915 107.6842040 -96.05168145 -44.37762097 -36.56401210

hp -320.732056 101.9314516 6721.15867 4700.866935 -16.45110887 44.1926613 -86.77008065 -24.98790323 -8.32056452

drat 2.195064 -0.6683669 -47.06402 -16.451109 0.28588135 -0.3727207 0.08714073 0.11864919 0.19015121

wt -5.116685 1.3673710 107.68420 44.192661 -0.37272073 0.9573790 -0.30548161 -0.27366129 -0.33810484

qsec 4.509149 -1.8868548 -96.05168 -86.770081 0.08714073 -0.3054816 3.19316613 0.67056452 -0.20495968

vs 2.017137 -0.7298387 -44.37762 -24.987903 0.11864919 -0.2736613 0.67056452 0.25403226 0.04233871

am 1.803931 -0.4657258 -36.56401 -8.320565 0.19015121 -0.3381048 -0.20495968 0.04233871 0.24899194

gear 2.135685 -0.6491935 -50.80262 -6.358871 0.27598790 -0.4210806 -0.28040323 0.07661290 0.29233871

carb -5.363105 1.5201613 79.06875 83.036290 -0.07840726 0.6757903 -1.89411290 -0.46370968 0.04637097

gear carb

mpg 2.1356855 -5.36310484

cyl -0.6491935 1.52016129

disp -50.8026210 79.06875000

hp -6.3588710 83.03629032

drat 0.2759879 -0.07840726

wt -0.4210806 0.67579032

qsec -0.2804032 -1.89411290

vs 0.0766129 -0.46370968

am 0.2923387 0.04637097

gear 0.5443548 0.32661290

carb 0.3266129 2.60887097

# Calculate and display correlation

cor\_matrix <- cor(data)

print("Correlation Matrix:")

print(cor\_matrix)

> print("Correlation Matrix:")

[1] "Correlation Matrix:"

> print(cor\_matrix)

mpg cyl disp hp drat wt qsec vs am gear

mpg 1.0000000 -0.8521620 -0.8475514 -0.7761684 0.68117191 -0.8676594 0.41868403 0.6640389 0.59983243 0.4802848

cyl -0.8521620 1.0000000 0.9020329 0.8324475 -0.69993811 0.7824958 -0.59124207 -0.8108118 -0.52260705 -0.4926866

disp -0.8475514 0.9020329 1.0000000 0.7909486 -0.71021393 0.8879799 -0.43369788 -0.7104159 -0.59122704 -0.5555692

hp -0.7761684 0.8324475 0.7909486 1.0000000 -0.44875912 0.6587479 -0.70822339 -0.7230967 -0.24320426 -0.1257043

drat 0.6811719 -0.6999381 -0.7102139 -0.4487591 1.00000000 -0.7124406 0.09120476 0.4402785 0.71271113 0.6996101

wt -0.8676594 0.7824958 0.8879799 0.6587479 -0.71244065 1.0000000 -0.17471588 -0.5549157 -0.69249526 -0.5832870

qsec 0.4186840 -0.5912421 -0.4336979 -0.7082234 0.09120476 -0.1747159 1.00000000 0.7445354 -0.22986086 -0.2126822

vs 0.6640389 -0.8108118 -0.7104159 -0.7230967 0.44027846 -0.5549157 0.74453544 1.0000000 0.16834512 0.2060233

am 0.5998324 -0.5226070 -0.5912270 -0.2432043 0.71271113 -0.6924953 -0.22986086 0.1683451 1.00000000 0.7940588

gear 0.4802848 -0.4926866 -0.5555692 -0.1257043 0.69961013 -0.5832870 -0.21268223 0.2060233 0.79405876 1.0000000

carb -0.5509251 0.5269883 0.3949769 0.7498125 -0.09078980 0.4276059 -0.65624923 -0.5696071 0.05753435 0.2740728

carb

mpg -0.55092507

cyl 0.52698829

disp 0.39497686

hp 0.74981247

drat -0.09078980

wt 0.42760594

qsec -0.65624923

vs -0.56960714

am 0.05753435

gear 0.27407284

carb 1.00000000

# Visualize the correlation matrix

library(corrplot)

corrplot::corrplot(cor\_matrix, method = "circle", title = "Correlation Matrix", mar = c(0, 0, 1, 0))

# Save the correlation plot as a PNG

png(file = "correlationMatrix\_mtcars.png")

corrplot::corrplot(cor\_matrix, method = "circle", title = "Correlation Matrix", mar = c(0, 0, 1, 0))

dev.off()

> dev.off()

RStudioGD

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# Save the covariance and correlation matrices to CSV files

write.csv(cov\_matrix, file = "covarianceMatrix\_mtcars.csv", row.names = TRUE)

write.csv(cor\_matrix, file = "correlationMatrix\_mtcars.csv", row.names = TRUE)

# Display the saved CSV files

print("Covariance Matrix (from CSV):")

cov\_csv <- read.csv("covarianceMatrix\_mtcars.csv", row.names = 1)

print(cov\_csv)

> print("Covariance Matrix (from CSV):")

[1] "Covariance Matrix (from CSV):"

> cov\_csv <- read.csv("covarianceMatrix\_mtcars.csv", row.names = 1)

> print(cov\_csv)

mpg cyl disp hp drat wt qsec vs am

mpg 36.324103 -9.1723790 -633.09721 -320.732056 2.19506351 -5.1166847 4.50914919 2.01713710 1.80393145

cyl -9.172379 3.1895161 199.66028 101.931452 -0.66836694 1.3673710 -1.88685484 -0.72983871 -0.46572581

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hp -320.732056 101.9314516 6721.15867 4700.866935 -16.45110887 44.1926613 -86.77008065 -24.98790323 -8.32056452

drat 2.195064 -0.6683669 -47.06402 -16.451109 0.28588135 -0.3727207 0.08714073 0.11864919 0.19015121

wt -5.116685 1.3673710 107.68420 44.192661 -0.37272073 0.9573790 -0.30548161 -0.27366129 -0.33810484

qsec 4.509149 -1.8868548 -96.05168 -86.770081 0.08714073 -0.3054816 3.19316613 0.67056452 -0.20495968

vs 2.017137 -0.7298387 -44.37762 -24.987903 0.11864919 -0.2736613 0.67056452 0.25403226 0.04233871

am 1.803931 -0.4657258 -36.56401 -8.320565 0.19015121 -0.3381048 -0.20495968 0.04233871 0.24899194

gear 2.135685 -0.6491935 -50.80262 -6.358871 0.27598790 -0.4210806 -0.28040323 0.07661290 0.29233871

carb -5.363105 1.5201613 79.06875 83.036290 -0.07840726 0.6757903 -1.89411290 -0.46370968 0.04637097

gear carb

mpg 2.1356855 -5.36310484

cyl -0.6491935 1.52016129

disp -50.8026210 79.06875000

hp -6.3588710 83.03629032

drat 0.2759879 -0.07840726

wt -0.4210806 0.67579032

qsec -0.2804032 -1.89411290

vs 0.0766129 -0.46370968

am 0.2923387 0.04637097

gear 0.5443548 0.32661290

carb 0.3266129 2.60887097

print("Correlation Matrix (from CSV):")

cor\_csv <- read.csv("correlationMatrix\_mtcars.csv", row.names = 1)

print(cor\_csv)

> print("Correlation Matrix (from CSV):")

[1] "Correlation Matrix (from CSV):"

> cor\_csv <- read.csv("correlationMatrix\_mtcars.csv", row.names = 1)

> print(cor\_csv)

mpg cyl disp hp drat wt qsec vs am gear

mpg 1.0000000 -0.8521620 -0.8475514 -0.7761684 0.68117191 -0.8676594 0.41868403 0.6640389 0.59983243 0.4802848

cyl -0.8521620 1.0000000 0.9020329 0.8324475 -0.69993811 0.7824958 -0.59124207 -0.8108118 -0.52260705 -0.4926866

disp -0.8475514 0.9020329 1.0000000 0.7909486 -0.71021393 0.8879799 -0.43369788 -0.7104159 -0.59122704 -0.5555692

hp -0.7761684 0.8324475 0.7909486 1.0000000 -0.44875912 0.6587479 -0.70822339 -0.7230967 -0.24320426 -0.1257043

drat 0.6811719 -0.6999381 -0.7102139 -0.4487591 1.00000000 -0.7124406 0.09120476 0.4402785 0.71271113 0.6996101

wt -0.8676594 0.7824958 0.8879799 0.6587479 -0.71244065 1.0000000 -0.17471588 -0.5549157 -0.69249526 -0.5832870

qsec 0.4186840 -0.5912421 -0.4336979 -0.7082234 0.09120476 -0.1747159 1.00000000 0.7445354 -0.22986086 -0.2126822

vs 0.6640389 -0.8108118 -0.7104159 -0.7230967 0.44027846 -0.5549157 0.74453544 1.0000000 0.16834512 0.2060233

am 0.5998324 -0.5226070 -0.5912270 -0.2432043 0.71271113 -0.6924953 -0.22986086 0.1683451 1.00000000 0.7940588

gear 0.4802848 -0.4926866 -0.5555692 -0.1257043 0.69961013 -0.5832870 -0.21268223 0.2060233 0.79405876 1.0000000

carb -0.5509251 0.5269883 0.3949769 0.7498125 -0.09078980 0.4276059 -0.65624923 -0.5696071 0.05753435 0.2740728

carb

mpg -0.55092507

cyl 0.52698829

disp 0.39497686

hp 0.74981247

drat -0.09078980

wt 0.42760594

qsec -0.65624923

vs -0.56960714

am 0.05753435

gear 0.27407284

carb 1.00000000