# Assignment:4

732A97 Multivariate Statistical Methods,Linkoping University

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## Canonical Correlation Analysis

```
## The Self correlation for U coeffiecients:
```

```
##            [,1]       [,2]
## [1,]  0.4528636 -1.7003784
## [2,] -0.8001929  0.3663024
```

```
## The Self correlation for V coeffiecients:
```

```
##            [,1]      [,2]
## [1,] -0.3422720  4.116022
## [2,] -0.1350379 -1.891683
```

```
## The Normalised Coeffiecients of U and V are:
```

```
##            [,1]        [,2]      [,3]
## [1,]  1.0609027 -3.18636672 2.4208189
## [2,] -0.8937762  0.11592279 0.9252005
## [3,]  0.6448512  0.05101873 0.1817802
```

```
##            [,1]      [,2]
## [1,] -1.2298402  4.366035
## [2,]  0.2602773 -1.944594
```

The U and V equations are

$U_1 = 1.061 * Z_1 - 0.894 * Z_2 + 0.644 * Z_3$
$U_2 = -3.186 * Z_1 + 0.1160 * Z_2 + 0.051 * Z_3$
$U_3 = 2.421 * Z_1 - 0.925 * Z_2 + 0.181 * Z_3$

$V_1 = -1.230 * Z_1 + 4.366 * Z_2$
$V_2 = 0.260 * Z_1 - 1.944 * Z_2$
These equation helps to define the correlation between $U_i$ and $V_i$.

```
## The loglihood constant value for all values: 67.29031
```

```
## The chisquare test value for dof of 6 is: 12.59159
```

$H_0 = \mathbf{\Sigma_{12}} = 0$
$H_\alpha = \mathbf{\Sigma_{12}} notequal 0$
The chi-square value at 5% is less than loglihood function so the null $H_0$ is rejected.

```
## The loglihood constant value for first conical value is: 62.72927
```

```
## The chisquare test value for dof of 2 is: 5.991465
```

```
## The loglihood constant value for second conical value is: 4.561035
```

```
## The chisquare test value for dof of 2 is: 5.991465
```

$H_0$

In above both the cases both the cases the null hypothesis is assumed to be the each conical variable is significant. The first conical variable is not significant in explaining the relation between primary and secondary variable. Since the loglihood constant is more than chisquare value, $H_0$ is rejected for the first variable. The loglihood constant for the second conical value is less than the chisquare value, $H_0$ is accepted. This define that the second conical value have some siginificant in expressing the relationship between them.

```
## The Squared value for canonical relation is: 0.0106
```

This helps to undertand that there is some relationship between primary and secondary variables set in terms os variance.

# Code Appendix

```
knitr::opts_chunk$set(echo = TRUE)
sf1 <- matrix(c(1106.000,396.700,108.400,0.787,26.230,396.700,2382.000,1143.000,-0.214,-23.960,108.400,
s11 <- sf1[1:3,1:3]
s12 <- sf1[1:3,4:5]
s21 <- sf1[4:5,1:3]
s22 <- sf1[4:5,4:5]
U_matrix <- solve(sqrt(s11))%*% s12 %*% solve(s22) %*% s21 %*% solve(sqrt(s11))
rho_matrix <- eigen(U_matrix)
V_matrix <- solve(sqrt(s22))%*% s21 %*% solve(s11) %*% s12 %*% solve(sqrt(s22))
rho1_matrix <- eigen(V_matrix)

U_coeffiecients <- (rho_matrix$vectors) %*% (solve(sqrt(s11)))
V_coeffiecients <- (rho1_matrix$vectors) %*% (solve(sqrt(s22)))
sqrt_matrix <- diag(sqrt(sf1))
diagonal_matrix <- diag(x=c(sqrt_matrix))
selfcorrelation <- U_coeffiecients %*% s11 %*% solve(diagonal_matrix[1:3,1:3])
selfcorrelation1 <- V_coeffiecients %*% s22 %*% solve(diagonal_matrix[4:5,4:5])
cat("The Self correlation for U coeffiecients:\n")
selfcorrelation[1:2,1:2]
cat("The Self correlation for V coeffiecients:\n")
selfcorrelation1
### Normalised Coeffiecient
normalised_U_coeffiecient <- U_coeffiecients %*% diagonal_matrix[1:3,1:3]
```

```
normalised_V_coeffiecient <- V_coeffiecients %*% diagonal_matrix[4:5,4:5]
cat("The Normalised Coeffiecients of U and V are:\n")
normalised_U_coeffiecient
normalised_V_coeffiecient
p <- 3
q <- 2
n <- 46
loglihood_function = log((abs(1-(sqrt(rho1_matrix$values[1]))))*(1-(sqrt(rho1_matrix$values[2]))))
loglihood_const <- -(n -1 - (0.5 * (p + q + 1)))*loglihood_function
cat("The loglihood constant value for all values:",loglihood_const,"\n")
test_value <- qchisq(0.95,6)
cat("The chisquare test value for dof of 6 is:",test_value,"\n")
const1 <- -(n-1-(0.5 * (p+q+1)))*log(1-(sqrt(rho1_matrix$values[1])))
cat("The loglihood constant value for first conical value is:",const1,"\n")
test_value <- qchisq(0.95,2)
cat("The chisquare test value for dof of 2 is:",test_value,"\n")
const2 <- -(n-1-(0.5 * (p+q+1)))*log(1-(sqrt(rho1_matrix$values[2])))
cat("The loglihood constant value for second conical value is:",const2,"\n")
test_value1 <- qchisq(0.95,2)
cat("The chisquare test value for dof of 2 is:",test_value1,"\n")
cat("The Squared value for canonical relation is:",signif(rho1_matrix$values[2],3),"\n")
```