

AR(2) Model Fitting for cmort Dataset

Generated Report

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Q3: AR(2) Model: Least Squares vs. Yule-Walker Estimation

```
# Load necessary Libraries
library(astsa)
```

```
## Warning: package 'astsa' was built under R version 4.3.2
```

```
library(forecast)
```

```
## Warning: package 'forecast' was built under R version 4.3.3
```

```
## Registered S3 method overwritten by 'quantmod':
##   method           from
##   as.zoo.data.frame zoo
```

```
##
## Attaching package: 'forecast'
```

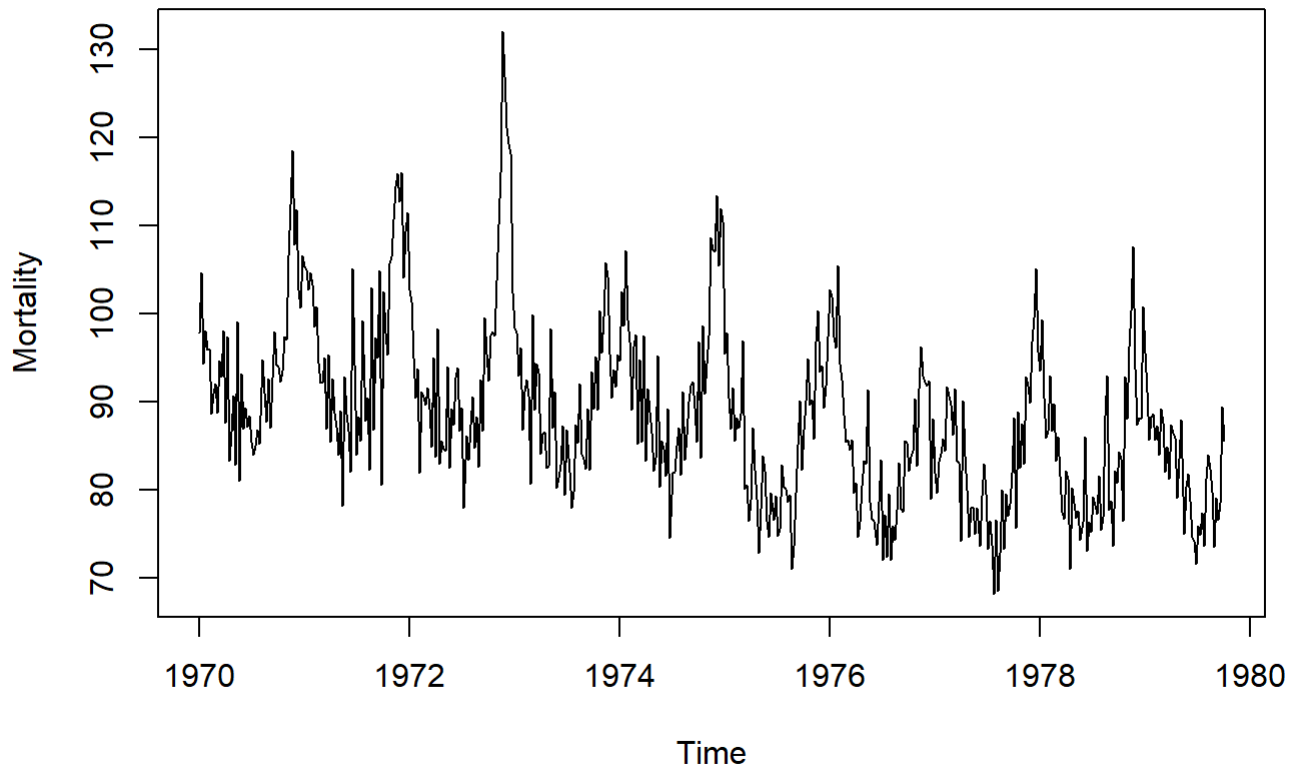
```
## The following object is masked from 'package:astsa':
##
##   gas
```

```
library(stats)
```

```
# Load the cmort dataset
data(cmort)
```

```
# Plot the dataset
plot(cmort, main="Cardiovascular Mortality", ylab="Mortality", xlab="Time")
```

Cardiovascular Mortality



Fit AR(2) Model using Least Squares

```
# Fit AR(2) using least squares
reg1 <- ar.ols(cmort, order=2)

# Coefficients from the Least squares model
coeff_ls <- reg1$ar
sigma2_ls <- reg1$var.pred

# Standard errors for the coefficients
se_ls <- reg1$asy.se.coef

# Print the results
coeff_ls
```

```
## , , 1
##
##      [,1]
## [1,] 0.4285906
## [2,] 0.4417874
```

```
sigma2_ls
```

```
## [1] 32.31749
```

```
se_ls
```

```
## $x.mean  
## [1] 0.2527231  
##  
## $ar  
## [1] 0.03979433 0.03976163
```

Fit AR(2) Model using Yule-Walker Equations

```
# Fit AR(2) using Yule-Walker  
reg2 <- ar.yw(cmort, order=2)  
  
# Coefficients from Yule-Walker estimation  
coeff_yw <- reg2$ar  
sigma2_yw <- reg2$var.pred  
  
# Standard errors for Yule-Walker coefficients  
se_yw <- sqrt(diag(reg2$asy.var.coef))  
  
# Print the results  
coeff_yw
```

```
## [1] 0.4339481 0.4375768
```

```
sigma2_yw
```

```
## [1] 32.84056
```

```
se_yw
```

```
## [1] 0.04001303 0.04001303
```

Compare the Results

```
# Compare the two methods  
comparison <- data.frame(  
  Method = c("Least Squares", "Yule-Walker"),  
  Coefficient_1 = c(coeff_ls[1], coeff_yw[1]),  
  Coefficient_2 = c(coeff_ls[2], coeff_yw[2]),  
  Sigma2 = c(sigma2_ls, sigma2_yw),  
  SE_Coeff_1 = c(se_ls[1], se_yw[1]),  
  SE_Coeff_2 = c(se_ls[2], se_yw[2])  
)  
  
# Display the comparison  
comparison
```

##	Method	Coefficient_1	Coefficient_2	Sigma2	SE_Coeff_1.x.mean
## 1	Least Squares	0.4285906	0.4417874	32.31749	0.2527231
## 2	Yule-Walker	0.4339481	0.4375768	32.84056	0.2527231
##	SE_Coeff_1.0.0400130313449369	SE_Coeff_2.ar	SE_Coeff_2.0.0400130313449369		
## 1		0.04001303	0.03979433		0.04001303
## 2		0.04001303	0.03976163		0.04001303

Conclusion

The AR(2) model fitted to the `cmort` dataset using both least squares and Yule-Walker methods provides similar estimates, as shown in the comparison table above.