Estimación de parámetros para AR(2)

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AR(2)

Descripción

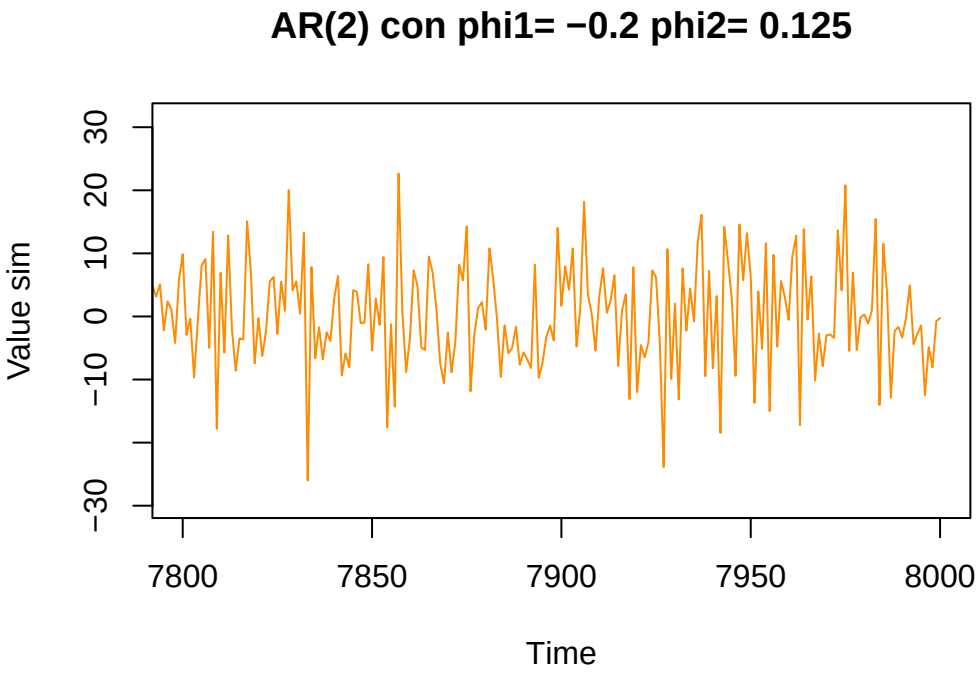
Vamos a estimar los parámetros de una simulación para un AR(2) de 8000 observaciones. El modelo a simular es:

$$
\begin{aligned}
x_t &= \phi_1 x_{t-1} + \phi_2 x_{t-2} + Z_t \\
\phi_1 &= -\frac{1}{5} \\
\phi_2 &= \frac{1}{8} \\
Z_t &\sim N(0, 8) \\
t &= 1, 2, ..., 8000
\end{aligned}
$$

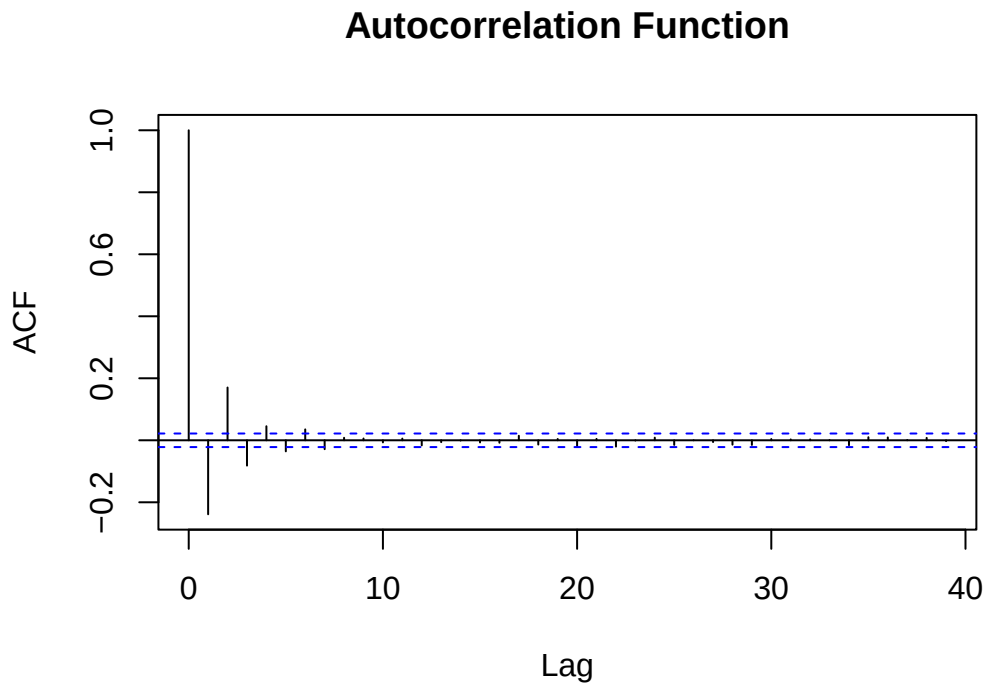
Visualización

Simulando el proceso anterior AR(2), viendo el gráfico correspondiente (últimas 200 observaciones) y mostrando las primeras 30 observaciones

```
##  [1]  -1.5472792  -9.2061857  -9.8249453  11.3101351  -3.4153930   7.0949670
##  [7]  -4.1911386   0.4998924   9.3199285  -5.7541373  -5.5595979  -5.1525411
## [13]   6.2761490  -4.9097341   7.0257079  -4.1427130  20.1714716  15.7472272
## [19]  11.4546692 -12.2120197 -17.5501330   4.5315953   4.6427213  -9.0737577
## [25]   3.3792268   2.9218561 -11.7552357  -9.0664397  10.7876128 -16.5350663
```

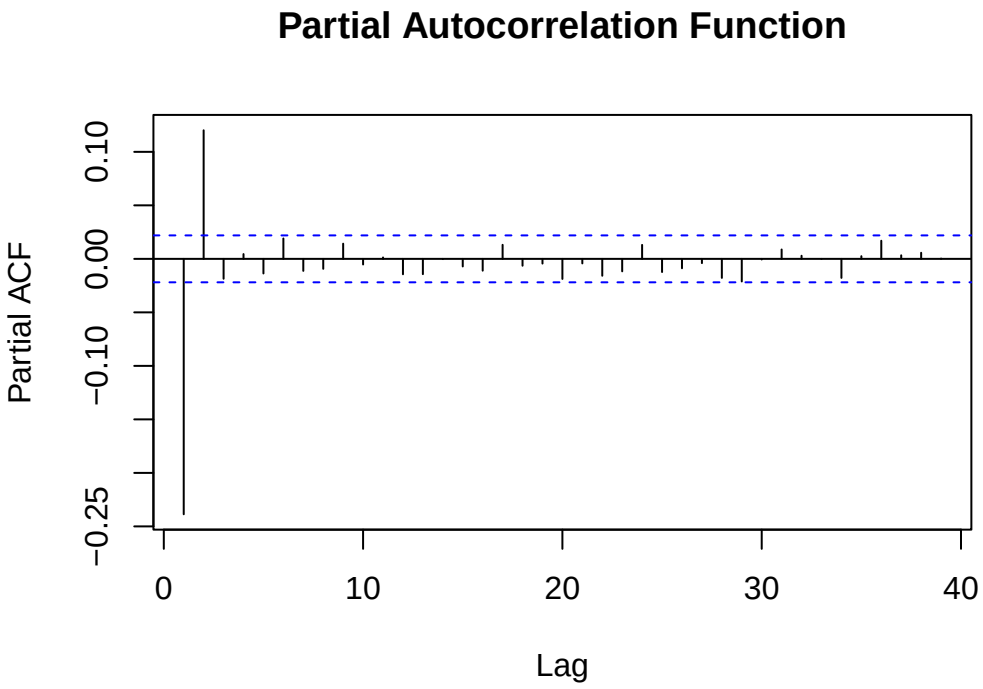


ACF




```
##
## Autocorrelations of series 'ar2.process', by lag
##
##      0      1      2      3      4      5      6      7      8      9     10
##  1.000 -0.239  0.170 -0.082  0.045 -0.036  0.035 -0.029  0.008  0.006 -0.007
##     11     12     13     14     15     16     17     18     19     20     21
##  0.006 -0.016 -0.006 -0.001 -0.007 -0.008  0.015 -0.014  0.004 -0.021  0.005
##     22     23     24     25     26     27     28     29     30     31     32
## -0.020 -0.001  0.009 -0.015  0.000 -0.006 -0.014 -0.015  0.004  0.003  0.003
##     33     34     35     36     37     38     39
##  0.001 -0.016  0.010  0.009  0.001  0.008 -0.003
```

PACF




```
##
## Partial autocorrelations of series 'ar2.process', by lag
##
##      1      2      3      4      5      6      7      8      9     10     11
## -0.239  0.120 -0.019  0.004 -0.014  0.019 -0.011 -0.009  0.014 -0.005  0.001
##     12     13     14     15     16     17     18     19     20     21     22
## -0.014 -0.014  0.000 -0.007 -0.011  0.013 -0.006 -0.004 -0.019 -0.004 -0.016
##     23     24     25     26     27     28     29     30     31     32     33
## -0.012  0.013 -0.012 -0.009 -0.004 -0.018 -0.021 -0.001  0.009  0.003  0.000
##     34     35     36     37     38     39
## -0.018  0.003  0.017  0.003  0.006  0.000
```

Estimando parámetros

Para estimar $\hat{\phi_1}$ y $\hat{\phi_2}$ se debe resolver el sistema:

$$b = R\hat{\phi}$$

Equivalente a:

$$\begin{bmatrix} r_1 \\ r_2 \end{bmatrix} = \begin{bmatrix} 1 & r_1 \\ r_1 & 1 \end{bmatrix} = \begin{bmatrix} \hat{\phi_1} \\ \hat{\phi_2} \end{bmatrix}$$

Donde b es igual a:

```
##            [,1]
## [1,] -0.2386835
## [2,]  0.1702806
```

Donde nuestra matriz R es:

```
##            [,1]       [,2]
## [1,]  1.0000000 -0.2386835
## [2,] -0.2386835  1.0000000
```

De tal modo resolviendo se tiene que nuestros estimadores son:

```
##            [,1]
## [1,] -0.2100042
## [2,]  0.1201561
```

Estimando la varianza

Estimando la varianza del modelo AR(2) simulado es:

```
## [1] 63.526
```

Cuya desviación del modelo AR(2) simulado es:

```
## [1] 7.97032
```

Comparando parámetros por linea de comando

```
##
## Call:
## arima(x = ar2.process, order = c(2, 0, 0), include.mean = FALSE)
##
## Coefficients:
##           ar1     ar2
##       -0.2099  0.1202
## s.e.   0.0111  0.0111
##
## sigma^2 estimated as 63.53:  log likelihood = -27957.49,  aic = 55920.99
```