Problem_13_3

November 2, 2021

1 13_3_b

Initializing

[ ]:
```
using LinearAlgebra

include("time_series_data.jl")
```

```
function toeplitz(vect,n) ==>
        forms the toeplitz matrix as described in section 7.4 in textbook
        n is the size of the vector to convolve with
        select the rows you need from this

data given is x_train and x_test
```

[ ]:
```
100-element Vector{Float64}:
  0.140126610206199
 -0.3266617955319319
 -0.3190213361122029
 -0.07285822610013504
  0.10625789758760604
  0.06124284356474724
 -0.46306782099841665
  0.13028759972404974
  0.3285691916684773
 -0.04611914392286799
 -0.29126645858125566
 -0.1336195642051234
 -0.11155462013022835

  1.329897476359537
  1.5076467764325698
 -1.2476869129326498
 -1.4682439883434155
  0.9317559762963956
  1.5366874780961386
 -1.1309996959748272
 -1.588768005489042
```

```
 0.6139908129155712
 1.8193852647716864
-0.4834015865194686
-1.9298247132201785
```

Computing the Mean-Square Error in train and test set

[ ]:
```
for M in 2:12
    A = toeplitz(x_train,M)[M:length(x_train),:]
    A_test = toeplitz(x_test,M)[M:length(x_test),:]
    b = x_train[M:length(x_train)]
    dagger = A\b
    ms_error_train = (norm(A * (dagger) - b)^2)/(length(x_train)-M)
    ms_error_test = (norm(A_test * (dagger) - x_test[M:length(x_test)])^2)/
 ↪(length(x_test)-M)
    println("M = ", M)
    println("Mean Square Error in Train = ", ms_error_train)
    println("Mean Square Error in Test = ", ms_error_test)
end
```

```
M = 2
Mean Square Error in Train = 7.666758204892745e-32
Mean Square Error in Test = 4.7721984610868757e-32
M = 3
Mean Square Error in Train = 1.1872847966836048e-31
Mean Square Error in Test = 8.592529621745319e-32
M = 4
Mean Square Error in Train = 2.438845462890193e-31
Mean Square Error in Test = 1.5241252865756037e-31
M = 5
Mean Square Error in Train = 2.5849986928314285e-35
Mean Square Error in Test = 1.5339335124498666e-35
M = 6
Mean Square Error in Train = 1.5110970876033992e-32
Mean Square Error in Test = 1.0053764082029966e-32
M = 7
Mean Square Error in Train = 2.0482001445588078e-31
Mean Square Error in Test = 1.224340393102175e-31
M = 8
Mean Square Error in Train = 1.6294656897927318e-31
Mean Square Error in Test = 9.665140247376206e-32
M = 9
Mean Square Error in Train = 2.5455296581503754e-32
Mean Square Error in Test = 2.266489517400147e-32
M = 10
Mean Square Error in Train = 2.5560768353231864e-32
Mean Square Error in Test = 2.552515871103095e-32
M = 11
```

```
Mean Square Error in Train = 4.676589895183796e-32
Mean Square Error in Test = 3.2993798684610946e-32
M = 12
Mean Square Error in Train = 1.2150339199852827e-32
Mean Square Error in Test = 7.829980694401994e-33
```