AR(1)_process

February 2, 2024

1 AR(1) process

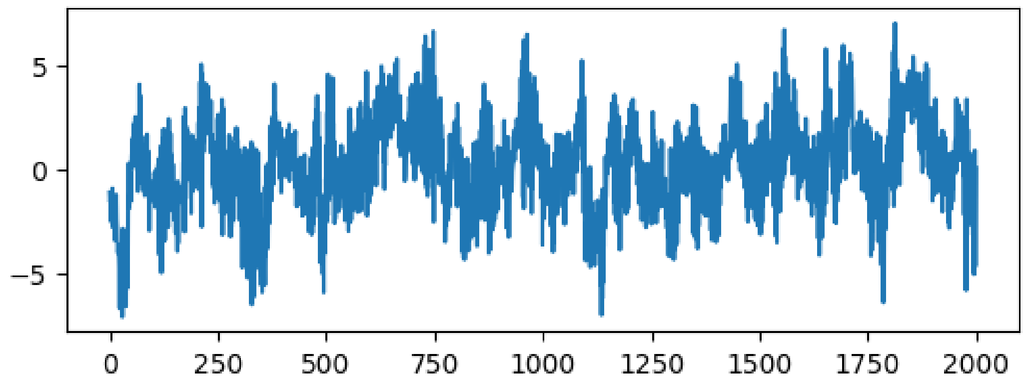
Consider a AR(1) process for r_{t+1} with $\phi_0 = 0.02$, and $\phi_1 = 0.9$

Import Modules

[ ]:
```
#import the module for simulating data
from statsmodels.tsa.arima_process import ArmaProcess
import matplotlib.pyplot as plt
import pandas as pd
import numpy as np
import math
import matplotlib.pyplot as plt
from datetime import datetime
from scipy.stats import norm
import sympy as sym
import statsmodels.api
from pandas import read_csv
from matplotlib import pyplot
from statsmodels.graphics.tsaplots import plot_acf
from statsmodels.tsa.stattools import acf
from sklearn.linear_model import LinearRegression
from statsmodels.stats.diagnostic import het_white
import statsmodels.api as sm
from statsmodels.tsa.ar_model import AutoReg, ar_select_order
```

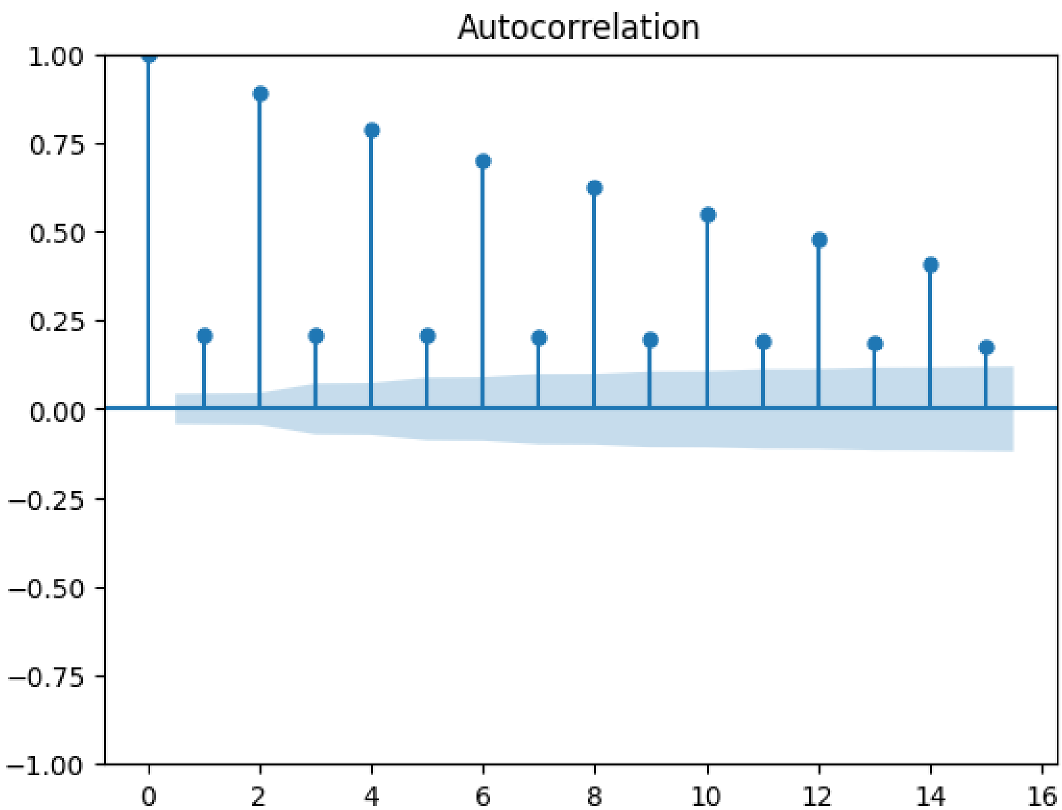
[ ]:
```
# Plot 1 : AR parameter 0.2, 0.9
plt.subplot(2,1,1)
ar1 = np.array([1, -0.02, -0.9])
AR_object1 = ArmaProcess(ar1)

# Creating and plotting time series function of AR(1) process
simulated_data_1 = AR_object1.generate_sample(nsample = 2000)
plt.plot(simulated_data_1)
```

[ ]:
```
[<matplotlib.lines.Line2D at 0x7e599d12f250>]
```



1. Plot the autocorrelation function for this process

[ ]:
```
# Plotting the autocorrelation function for AR(1) Process with 10 lags
plot_acf(simulated_data_1, lags = 15)
pyplot.show()
```



###2. Is the process stationary?

Yes, because the plot indicates the mean and the variance of r_{t+1} is very apporximate

Note that we can express the current value of an AR(1) as a function of past shocks, ϵ In particular, define $x_t = r_t - \mu$, where $\mu = E(r_t)$. Then