

Compte Rendu d'Exercice 5 TP5 en Python

Réalisé par : MOHAMED AIT MOUALI
Licence d'Excellence : IOTR

Objectif de l'exercice:

Cet exercice vise à manipuler des données aléatoires et périodiques afin de comprendre des concepts fondamentaux tels que la covariance, la transformation de Fourier, et les lois de probabilité à travers la simulation de lancers de dés.

1. Création d'un tableau de données aléatoires et calcul de la matrice de covariance

```
In [2]: import numpy as np
data = np.random.randn(100, 3)
cov_matrix = np.cov(data, rowvar=False)
print('data : ' +str(data))

data : [[-1.42625931 -0.91400677  0.70712826]
 [ 0.37914454 -0.21499016 -1.9488531 ]
 [ 2.71333776 -1.00092328  0.17635589]
 [ 1.05529857  0.89807681  1.43307203]
 [ 1.19004845  1.41931522  0.53367905]
 [-0.70858048 -1.13893255  0.68805095]
 [-0.77400322 -1.68342967  0.43727022]
 [ 0.07808148  1.52831377 -0.23402307]
 [-0.34373672 -1.38248784 -0.1566627 ]
 [ 0.608427   1.35697288  1.84907589]
 [-0.79067454 -0.04109542 -0.48145074]
 [-0.12223146  0.6956728  -0.31066483]
 [ 1.20339408  1.08839325  1.58160063]
 [ 0.94756261  1.10227663 -0.08954867]
 [-0.21398526  0.96529753  0.6307271 ]
 [-1.08644602 -1.96539607  1.03084176]
 [-0.77114027  0.35712463  0.12603684]
 [-0.16326012 -0.63865959  0.34129468]
 [-0.2359397   0.32818288 -0.46811516]
 [-0.23159848 -1.13874055 -0.9472537 ]
 [-0.95188067  0.38145101 -2.09937265]
 [ 0.84069873 -0.22769059  1.76782329]
 [ 0.34786718 -0.15651996 -0.97913737]
 [-0.64171526 -0.39791375 -1.20676115]
 [-1.60583617  0.15175355  0.26440475]
 [ 0.37574561  0.86168546 -1.14459792]
 [-0.95801371  1.07290267  0.72701508]
 [ 0.74908546 -0.4112956  -0.02204158]
 [ 0.30616652  1.86946877 -0.71012884]
 [-0.4525294   2.10727896  0.9701686 ]
 [-1.33369747 -1.20812521  3.26914078]
 [-0.21018587 -0.43993558  1.90190532]
 [ 0.45261561  0.59694161  1.6739713 ]
 [-1.40530698  1.9450066  0.7132748 ]
 [-0.1224117  -0.04253872  0.40705797]
 [ 1.21457634 -1.52327983 -1.31470273]
 [ 0.15993272 -2.17424635 -0.55774559]
 [-1.54283198 -1.95566673  0.61449797]
 [-0.61469712 -0.02158212 -0.35305876]
 [-0.62346281 -0.29738956  0.26615465]
 [-2.14119299  0.34084964  2.26175735]
 [ 2.04901531 -1.53337395 -0.34275514]
 [-1.86309838 -0.03959264 -1.90563421]
 [ 0.35972901 -0.37588894  0.03731588]
 [-0.52970689  2.35272305  0.72598878]
 [ 0.64496492 -2.05151736  0.38068942]
 [ 0.12581959 -0.26501663 -0.05328661]
 [-0.30774653 -1.45393   1.74013303]
 [ 0.88007524  1.09044108 -2.06849885]
 [-1.14015725  0.20023156  0.15601675]
 [-0.95982409 -2.11174185  0.20668754]
 [-0.99088436  0.43508402 -0.48091079]
 [ 1.15351706 -0.25029273 -0.38367449]
 [-0.61176859 -0.53202652  0.27840937]
 [ 0.32373561  1.61305285 -1.10028811]
 [ 0.29739937  0.16823662 -1.11893825]
 [ 0.83579339  0.05454748 -0.7579268 ]
 [-3.66605255 -0.68856998  0.17852423]
 [-1.31215767  0.29909417 -0.23418017]
 [-2.11431624 -0.68806375  1.28153419]
 [-0.43947175  1.46769328  1.39478502]
 [ 0.84913112 -1.86428804 -0.53266007]
 [ 1.57156221 -0.91952699  0.03631046]
 [ 0.37882886 -0.10701774  0.01838281]
 [ 0.82160477  1.61706046  0.76807418]
 [-0.43109656 -1.80434306 -0.73657019]
 [ 0.12389888  2.08226288 -0.432902 ]
 [-0.32814129 -0.78113758  0.4650431 ]
 [ 0.20093943 -1.70902304 -0.89820547]
 [-0.38047561 -0.06263682 -0.65802619]
 [ 0.50166533 -0.25808818 -0.12749284]
 [ 1.62472316  0.09209411 -0.40203478]
 [-0.20937997 -0.01376335  0.30262555]
 [-0.05046204  2.91703319  1.57186834]
 [-0.3865247  -1.9261546  -1.49405549]
 [-1.22686315 -1.35740006 -0.99852173]
 [-0.29942668 -1.02502274 -0.45467705]
 [ 0.12510532  1.44789306 -0.2940012 ]
 [-1.54937366 -0.32200379  2.05485139]
 [-0.18010263  1.32574125  0.89547617]
 [ 1.55293379 -0.62236905 -0.25942075]
 [ 0.50766291  0.52965486 -0.6526197 ]
 [-0.03597635  0.06046839  1.06574818]
 [-0.35640573 -0.13736179  0.36033527]
 [-1.67674838 -0.13555322 -2.73514921]
 [ 1.04698474  1.05869679  0.38583082]
 [ 0.26190288  0.7977733  0.02602505]
 [ 0.71699705  0.74703845 -0.39883649]
 [-1.33386214 -0.09031004  1.43711607]
 [ 0.29725017  0.26346725  0.14201479]
 [-0.01472561 -0.3424598  1.20436176]
 [-0.0728285  -0.45645732  1.29486025]
 [-0.98853672 -0.4085296  0.54452989]
 [ 1.65646191  1.2008198  -0.78431805]
 [-0.56062836  0.60781296 -0.79247854]
 [ 0.23794502 -0.02907957  1.49490643]
 [ 0.34772054  1.19687867  2.06760646]
 [-1.7436401  -1.04899798  0.01832979]
 [-0.15064007  0.46678728 -0.97120487]
 [ 1.23352892  0.38034371 -0.73590174]]

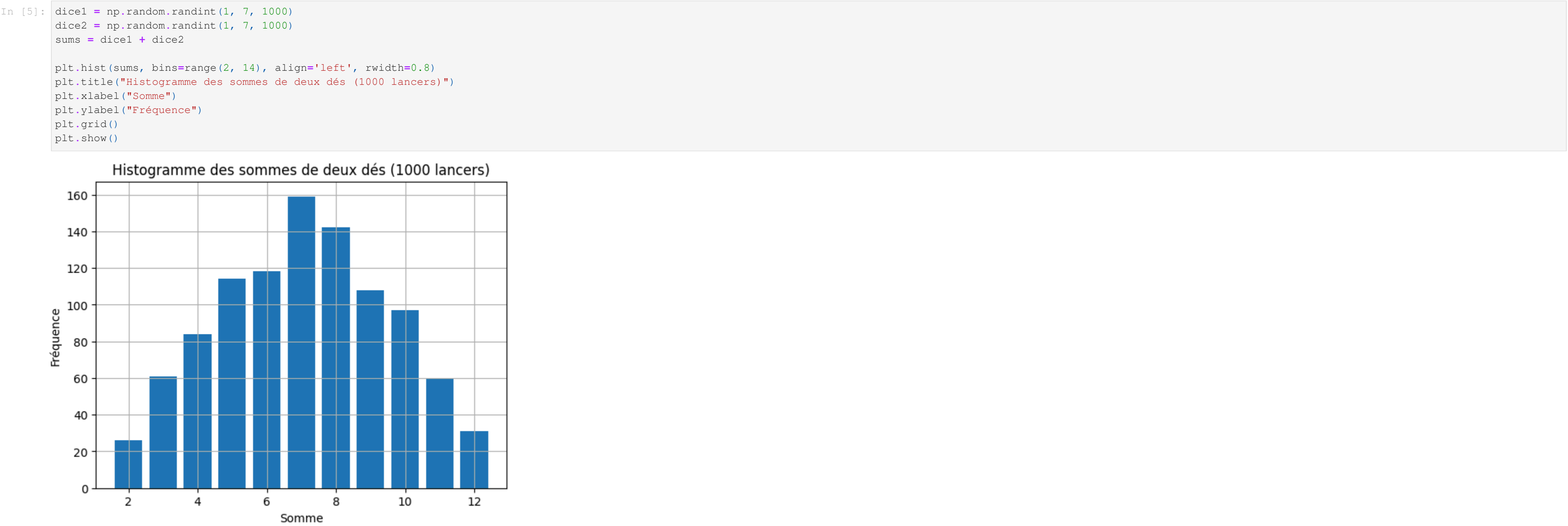
In [3]: print('matrice covariance : ' +str(cov_matrix))

matrice covariance : [[ 1.02778791  0.15669257 -0.127682 ]
 [ 0.15669257  1.2733449  0.11729472]
 [-0.127682   0.11729472  1.12699518]]
```

2. Transformation de Fourier d'un signal sinusoïdal



3. Simulation de lancers de dés et histogramme des sommes



Conclusion:

Cet exercice a permis de manipuler différents outils mathématiques et statistiques à travers trois tâches distinctes :

- ✓ **Analyse statistique** : en générant un tableau de variables aléatoires et en calculant la **matrice de covariance**, nous avons pu évaluer les relations linéaires entre les variables.
- ✓ **Traitement du signal** : l'application de la **transformation de Fourier** sur un signal sinusoïdal a mis en évidence la représentation fréquentielle d'un signal dans le domaine des fréquences.
- ✓ **Simulation probabiliste** : la simulation de **1000 lancers de deux dés** a permis de visualiser la **distribution des sommes** à travers un histogramme, qui suit une distribution en cloche centrée sur 7, conforme à la théorie.

Ces manipulations illustrent des concepts fondamentaux en data science, statistique, et analyse de signal, utiles dans de nombreuses applications pratiques.