covaraince_matrix_fsky

December 9, 2021

```python
import matplotlib
import numpy as np
import matplotlib.pyplot as plt
%matplotlib inline
#import pandas as pd
import astropy.io.fits as fits
#from astropy import units as u
#from astropy import constants as const


plt.style.use(['science'])#,'no-latex'])

#load cosmolike interface tools
import sys
sys.path.append('../2pt_modified/')

import cosmolike_metadata
import twopoint
```

```python
filename = "../6x2pt_Roman_SO_v1_2_bf26108.fits"


two_point_data = twopoint.TwoPointFile.from_fits(filename)
#cosmosis = loop_comosis_datavector(two_point_data)
```

```python
covmat = two_point_data.covmat#_info
covmat.shape
```

```
(2360, 2360)
```

```python
#inverting works
np.linalg.inv(covmat)
```

```
array([[ 3.30711111e+18, -1.98058247e+16, -2.54157471e+16, …,
        -1.49738041e+15, -9.37743139e+14, -3.62717567e+14],
       [-1.98058247e+16,  6.87697800e+18, -4.37552252e+16, …,
        -2.58516745e+15, -1.62031234e+15, -6.25813709e+14],
       [-2.54157471e+16, -4.37552252e+16,  1.19792974e+19, …,
        -3.75596689e+15, -2.34405975e+15, -9.02783130e+14],
```

```
           …,
          [-1.49738041e+15, -2.58516745e+15, -3.75596688e+15, …,
            1.31591418e+19,  1.17143617e+16,  4.39756602e+15],
          [-9.37743139e+14, -1.62031234e+15, -2.34405975e+15, …,
            1.17143617e+16,  1.08280463e+19,  2.67802223e+15],
          [-3.62717567e+14, -6.25813710e+14, -9.02783132e+14, …,
            4.39756602e+15,  2.67802223e+15,  5.76791522e+18]])
```

```python
[ ]: covmat_samearea = np.copy(covmat)

     #kappa kappa is covmat[2340:, 2340:]
     #rescale to same area
     covmat_samearea[:,2340: ] = np.sqrt(0.0484813681/0.4) * covmat_samearea[:,2340:␣
      ↪]
     covmat_samearea[2340: , :] = np.sqrt(0.0484813681/0.4) * covmat_samearea[2340:,␣
      ↪: ]


     #inverting works
     np.linalg.inv(covmat_samearea)
```

```
[ ]: array([[ 3.30711111e+18, -1.98058247e+16, -2.54157471e+16, …,
          -4.30105215e+15, -2.69355878e+15, -1.04186429e+15],
         [-1.98058247e+16,  6.87697800e+18, -4.37552252e+16, …,
          -7.42559472e+15, -4.65415993e+15, -1.79757755e+15],
         [-2.54157471e+16, -4.37552252e+16,  1.19792974e+19, …,
          -1.07885808e+16, -6.73304070e+15, -2.59314020e+15],
         …,
         [-4.30105215e+15, -7.42559472e+15, -1.07885807e+16, …,
           1.08570713e+20,  9.66504221e+16,  3.62825241e+16],
         [-2.69355878e+15, -4.65415993e+15, -6.73304071e+15, …,
           9.66504221e+16,  8.93377951e+19,  2.20952694e+16],
         [-1.04186429e+15, -1.79757755e+15, -2.59314020e+15, …,
           3.62825241e+16,  2.20952694e+16,  4.75887166e+19]])
```

```python
[ ]: covmat_uselargearea = np.copy(covmat)

     #kappa kappa is covmat[2340:, 2340:]
     #rescale to same area
     covmat_uselargearea[:2340,2340: ] = np.sqrt(0.4/0.0484813681) *␣
      ↪covmat_uselargearea[:2340,2340: ]
     covmat_uselargearea[2340: , :2340] = np.sqrt(0.4/0.0484813681) *␣
      ↪covmat_uselargearea[2340:, :2340 ]


     #inverting works
     np.linalg.inv(covmat_uselargearea)
```

```
[ ]: array([[ 3.30709437e+18, -1.98350296e+16, -2.54581853e+16, …,
         -4.70294477e+15, -2.54475156e+15, -9.17764613e+14],
        [-1.98350296e+16,  6.87692703e+18, -4.38292892e+16, …,
         -8.09931013e+15, -4.38735610e+15, -1.57967826e+15],
        [-2.54581853e+16, -4.38292892e+16,  1.19791898e+19, …,
         -1.17634530e+16, -6.33961727e+15, -2.27499933e+15],
        …,
        [-4.70294477e+15, -8.09931013e+15, -1.17634530e+16, …,
          1.75450854e+19,  1.16585166e+17,  4.05312274e+16],
        [-2.54475156e+15, -4.38735611e+15, -6.33961728e+15, …,
          1.16585166e+17,  1.22942465e+19,  2.12134894e+16],
        [-9.17764613e+14, -1.57967826e+15, -2.27499934e+15, …,
          4.05312274e+16,  2.12134894e+16,  6.04711526e+18]])
```

```
[ ]: np.linalg.cholesky(covmat_uselargearea)
```

```
    ␣
→----------------------------------------------------------------------

    LinAlgError                               Traceback (most recent call␣
→last)

    <ipython-input-37-5ee0e090fbbb> in <module>
  ----> 1 np.linalg.cholesky(covmat_uselargearea)


    <__array_function__ internals> in cholesky(*args, **kwargs)


    ~/anaconda3/envs/cosmology/lib/python3.8/site-packages/numpy/linalg/
→linalg.py in cholesky(a)
      762     t, result_t = _commonType(a)
      763     signature = 'D->D' if isComplexType(t) else 'd->d'
  --> 764     r = gufunc(a, signature=signature, extobj=extobj)
      765     return wrap(r.astype(result_t, copy=False))
      766


    ~/anaconda3/envs/cosmology/lib/python3.8/site-packages/numpy/linalg/
→linalg.py in _raise_linalgerror_nonposdef(err, flag)
      89
      90 def _raise_linalgerror_nonposdef(err, flag):
  ---> 91     raise LinAlgError("Matrix is not positive definite")
      92
      93 def _raise_linalgerror_eigenvalues_nonconvergence(err, flag):
```

```
      LinAlgError: Matrix is not positive definite
```

[ ]: `np.all(np.linalg.eigvals(covmat_uselargearea) > 0)`

[ ]: False

[ ]: `np.all(np.linalg.eigvals(covmat) > 0)`

[ ]: True

[ ]: `np.all(np.linalg.eigvals(covmat_samearea) > 0)`

[ ]: True

[ ]: `np.linalg.cholesky(covmat)`

[ ]: array([[8.82423910e-10, 0.00000000e+00, 0.00000000e+00, …,
            0.00000000e+00, 0.00000000e+00, 0.00000000e+00],
          [3.15997012e-11, 5.62470448e-10, 0.00000000e+00, …,
            0.00000000e+00, 0.00000000e+00, 0.00000000e+00],
          [2.29046182e-11, 2.51424751e-11, 3.93470956e-10, …,
            0.00000000e+00, 0.00000000e+00, 0.00000000e+00],
          …,
          [1.76372521e-13, 1.96773995e-13, 1.96075148e-13, …,
            2.75668080e-10, 0.00000000e+00, 0.00000000e+00],
          [1.11374466e-13, 1.24446607e-13, 1.24061072e-13, …,
           -2.98180580e-13, 3.03895992e-10, 0.00000000e+00],
          [6.92062802e-14, 7.74102246e-14, 7.72159208e-14, …,
           -2.10036036e-13, -1.41097813e-13, 4.16380676e-10]])

[ ]:

```