Trabalho 1 - Tipo de Imagem: SÍSMICA

Descrição do trabalho:

http://webserver2.tecgraf.puc-rio.br/~mgattass/visao/trb/T1.html (http://webserver2.tecgraf.puc-rio.br/~mgattass/visao/trb/T1.html)

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Mudando o diretório para o meu Google Drive.

In [1]:

```
from google.colab import drive
drive.mount('/content/drive/')
```

```
Drive already mounted at /content/drive/; to attempt to forcibly remount,
call drive.mount("/content/drive/", force_remount=True).
```

In [2]:

```
cd "drive/MyDrive/Doutorado/Disciplinas/[2022.2] [PUC-Rio] Visão Computacional - Profes
sor Marcelo Gattass/Trabalhos/Trabalho 1/"
```

```
/content/drive/MyDrive/Doutorado/Disciplinas/[2022.2] [PUC-Rio] Visão Comp
utacional - Professor Marcelo Gattass/Trabalhos/Trabalho 1
```

In [3]:

```
!pwd
```

```
/content/drive/MyDrive/Doutorado/Disciplinas/[2022.2] [PUC-Rio] Visão Comp
utacional - Professor Marcelo Gattass/Trabalhos/Trabalho 1
```

In [4]:

```
!curl -o ./imagens/sismica/f3_seismic_with_null_traces.sgy http://webserver2.tecgraf.pu
c-rio.br/~mgattass/dat/segy/f3_seismic_with_null_traces.sgy
```

```
  % Total    % Received % Xferd  Average Speed   Time    Time     Time  Cu
rrent
                                 Dload  Upload   Total   Spent    Left  Sp
eed
100 1235M  100 1235M    0     0  20.8M      0  0:00:59  0:00:59 --:--:-- 2
1.3M
```

In [5]:

```
path = './imagens/sismica/'
```

Imports

In [6]:

```
!pip install segyio
```

```
Looking in indexes: https://pypi.org/simple, https://us-python.pkg.dev/col
ab-wheels/public/simple/
Requirement already satisfied: segyio in /usr/local/lib/python3.7/dist-pac
kages (1.9.9)
Requirement already satisfied: numpy>=1.10 in /usr/local/lib/python3.7/dis
t-packages (from segyio) (1.21.6)
```

In [7]:

```
import numpy as np
import segyio
import matplotlib.pyplot as plt
```

In [8]:

```
def load_segy( fname ):

    with segyio.open( fname, ignore_geometry=True ) as file:

        # Get basic attributes
        n_traces = file.tracecount
        sample_rate = segyio.tools.dt( file ) / 1000
        n_samples = file.samples.size
        time = file.samples
        amplitude = file.trace.raw[:]

        return n_traces, n_samples, sample_rate, time, amplitude
```

In [9]:

```
fname = path + 'f3_seismic_with_null_traces.sgy'
```

In [10]:

```
%%time

n_traces, n_samples, dt_samples, time_axis, data = load_segy( fname )

print( f'Número de traços do volume: {n_traces}' )
print( f'Número de amostras por traço: {n_samples}' )
print( f'Delta t de amostragem (dta): {dt_samples} ms' )
print()
```

```
Número de traços do volume: 619101
Número de amostras por traço: 463
Delta t de amostragem (dta): 4.0 ms

CPU times: user 1.53 s, sys: 1.15 s, total: 2.68 s
Wall time: 3.81 s
```

In [11]:

```
# informação tirada da internet 915 traços por seção inline
n_inlines = 651
n_crosslines = 951

print( f'n_inlines: {n_inlines}' )
print( f'n_crosslines: {n_crosslines}' )
print( f'n_traces: {n_traces}' )
print( f'n_inlines * n_crosslines: {n_inlines * n_crosslines}' )
```

```
n_inlines: 651
n_crosslines: 951
n_traces: 619101
n_inlines * n_crosslines: 619101
```

In [12]:

```
data.shape
```

Out[12]:

```
(619101, 463)
```

In [13]:

```
vol = data.reshape( ( n_inlines, n_crosslines, n_samples ) )
print( vol.shape )
```

```
(651, 951, 463)
```

In [14]:

```
inline = n_inlines//2
crossline = n_crosslines//2
timeline = n_samples//2

print( f'inline: {inline}' )
print( f'crossline: {crossline}' )
print( f'timeline: {timeline}' )
```

```
inline: 325
crossline: 475
timeline: 231
```

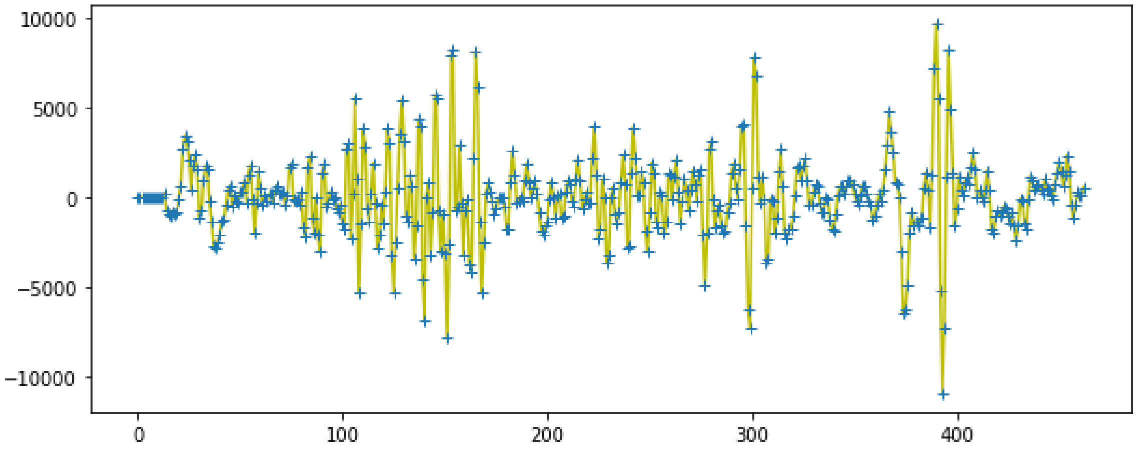
In [15]:

```
inline_section = vol[ inline, :, : ]
crossline_section = vol[ :, crossline, : ]
timeline_section = vol[ :, :, timeline ]

print( f'inline_section: {inline_section}' )
print( f'crossline_section: {crossline_section}' )
print( f'timeline_section: {timeline_section}' )
```

```
inline_section: [[    0.     0.     0. ...   608. -1693. -3152.]
 [    0.     0.     0. ...  -537. -2508. -3410.]
 [    0.     0.     0. ... -1961. -2303. -1463.]
 ...
 [    0.     0.     0. ... -5486. -4913. -5984.]
 [    0.     0.     0. ... -5706. -4790. -5846.]
 [    0.     0.     0. ... -6444. -6135. -5796.]]
crossline_section: [[    0.     0.     0. ... -1537.  1085.  1190.]
 [    0.     0.     0. ... -2583.  -473.  1384.]
 [    0.     0.     0. ... -1504.   431.  1013.]
 ...
 [    0.     0.    15. ... -2282.  1050.  3284.]
 [    0.     0.  -307. ... -1951.   263.  1501.]
 [    0.     0.  -441. ... -1360.  2708.  3596.]]
timeline_section: [[ 2635.  3799.  2111. ... -1354. -2727. -1763.]
 [ 3512.  2564.  2567. ... -1647. -2335. -2780.]
 [ 3237.  2890.  2564. ... -1647. -2276. -2058.]
 ...
 [    0.     0.     0. ...  2377.  3618.  4333.]
 [    0.     0.     0. ...  2192.  3753.  4801.]
 [    0.     0.     0. ...  2540.  3344.  4011.]]
```

In [16]:

```
x = np.linspace(
    0,
    n_samples - 1,
    n_samples )
trace1 = inline_section[ crossline, : ]
trace2 = crossline_section[ inline, : ]

plt.figure( figsize=(10, 4) )
plt.plot( x, trace1, 'y' )
plt.plot( x, trace2, '+' )
plt.show()
```

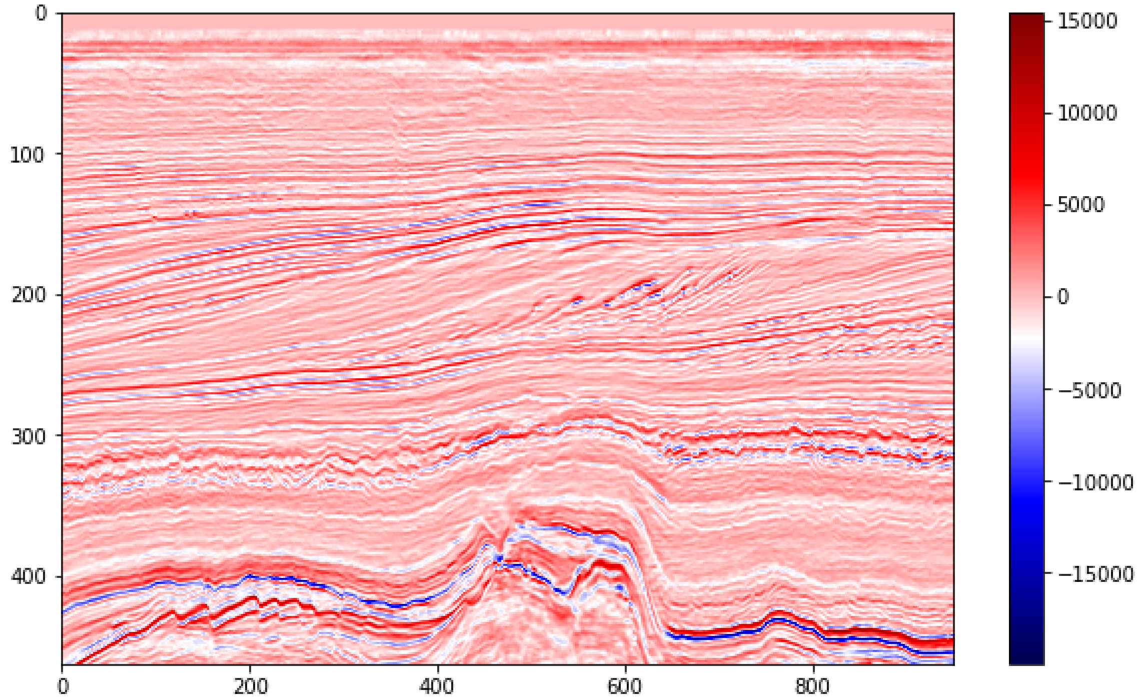


In [17]:

```
def show_img(img, map, clim = None):

    plt.figure( figsize=( 10, 6 ) )
    plt.imshow( img, cmap=map, aspect='auto' )
    if clim:
        plt.clim(clim)
    plt.colorbar()
    plt.show()
```

In [18]:

```
show_img( inline_section.T, 'seismic' )
show_img( crossline_section.T, 'seismic' )
show_img( timeline_section, 'seismic' )
```


0
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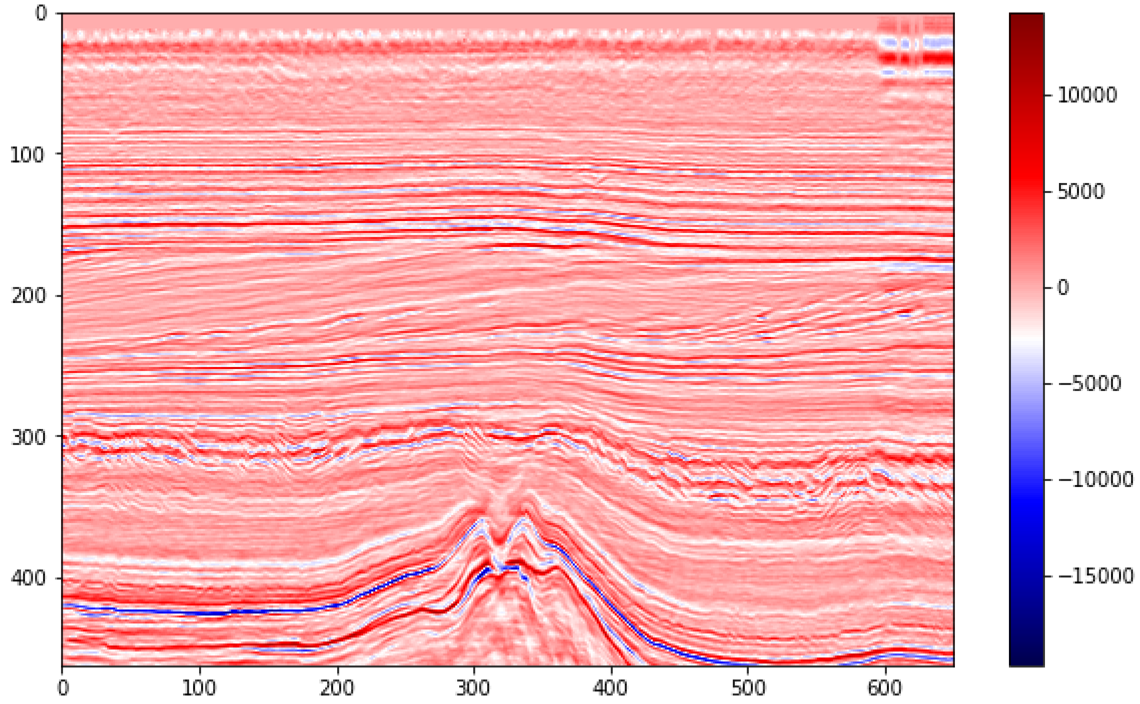
−5000
−10000
−15000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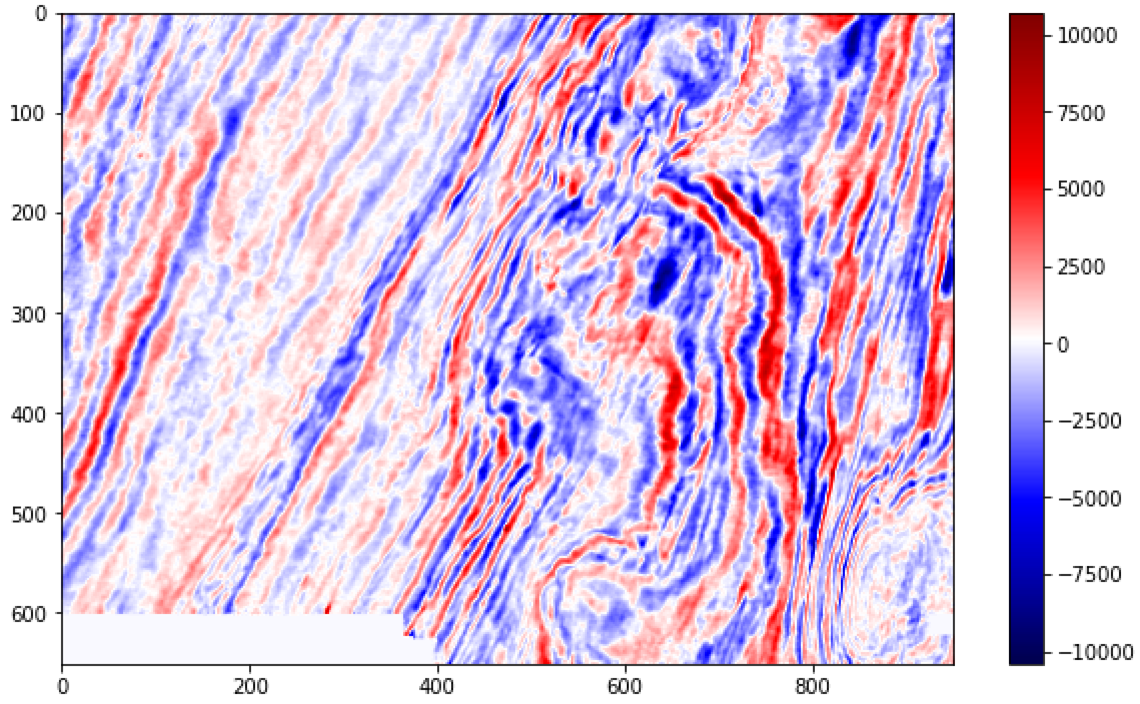
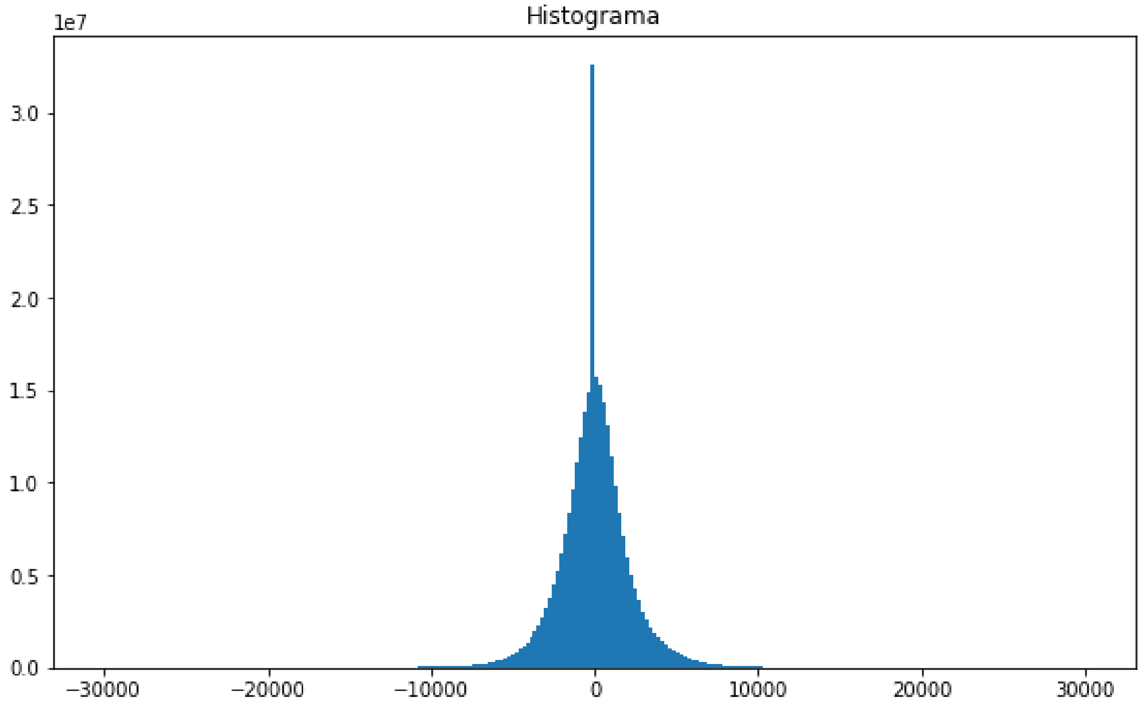


In [19]:

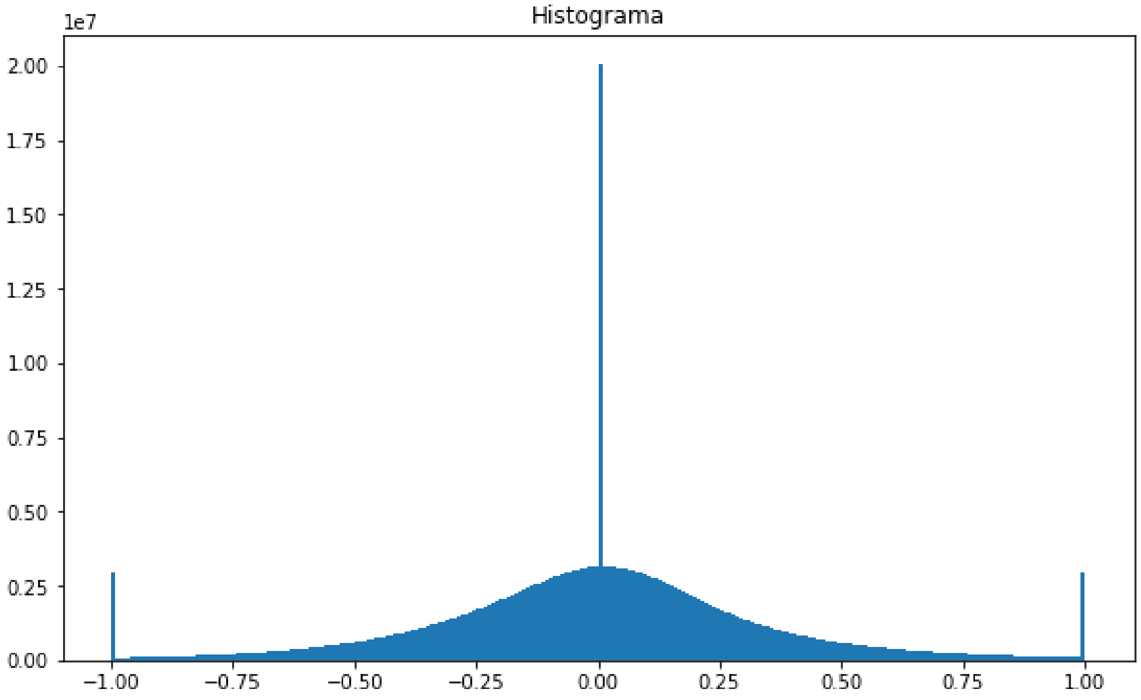
```
%%time

def show_hist( data ):

    plt.figure( figsize=(10, 6) )
    plt.title( 'Histograma' )
    plt.hist( data.ravel(), 256 )
    plt.show()

show_hist( vol )
```



```
CPU times: user 9.21 s, sys: 1 s, total: 10.2 s
Wall time: 17.9 s
```

In [20]:

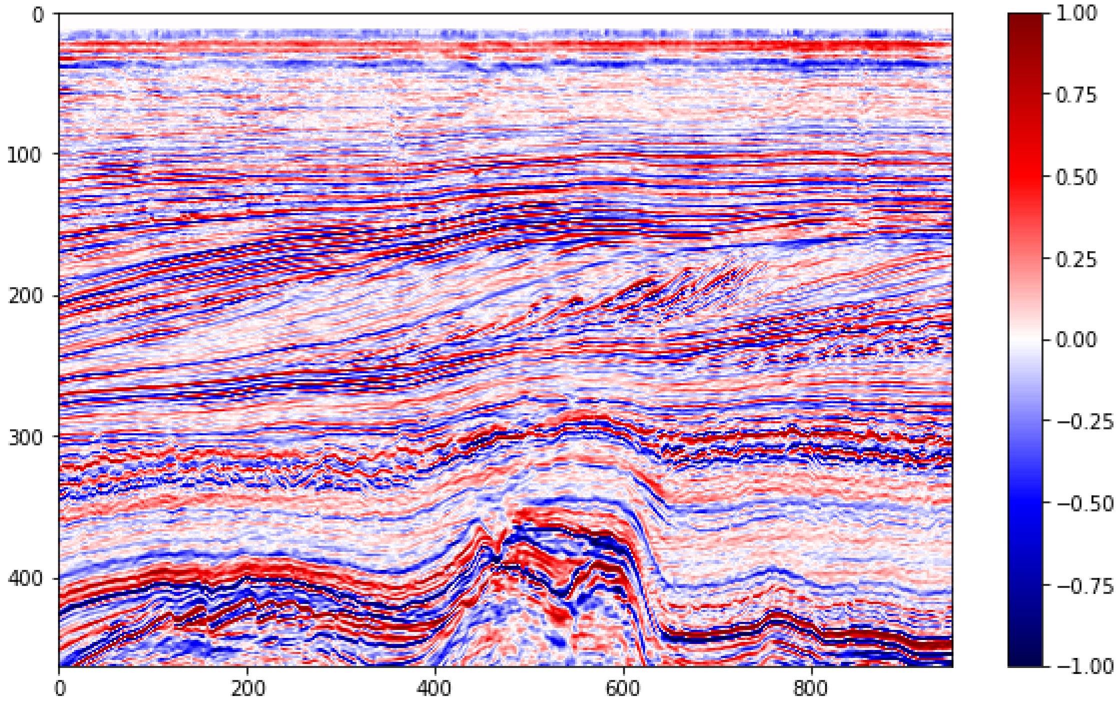
```
%%time

p1, p99, = np.percentile( vol.ravel(), (1, 99) )
factor = np.amax( np.abs( [p1, p99] ) )
volp = vol/factor
volp[ volp > 1 ] = 1
volp[ volp < -1 ] = -1
show_hist( volp )
```



```
CPU times: user 13.5 s, sys: 676 ms, total: 14.1 s
Wall time: 17.9 s
```

In [21]:

```
show_img( volp[ inline, :, :].T, 'seismic', clim=(-1, 1) )
show_img( volp[ :, crossline, :].T, 'seismic', clim=(-1, 1) )
show_img( volp[ :, :, timeline], 'seismic', clim=(-1, 1) )
```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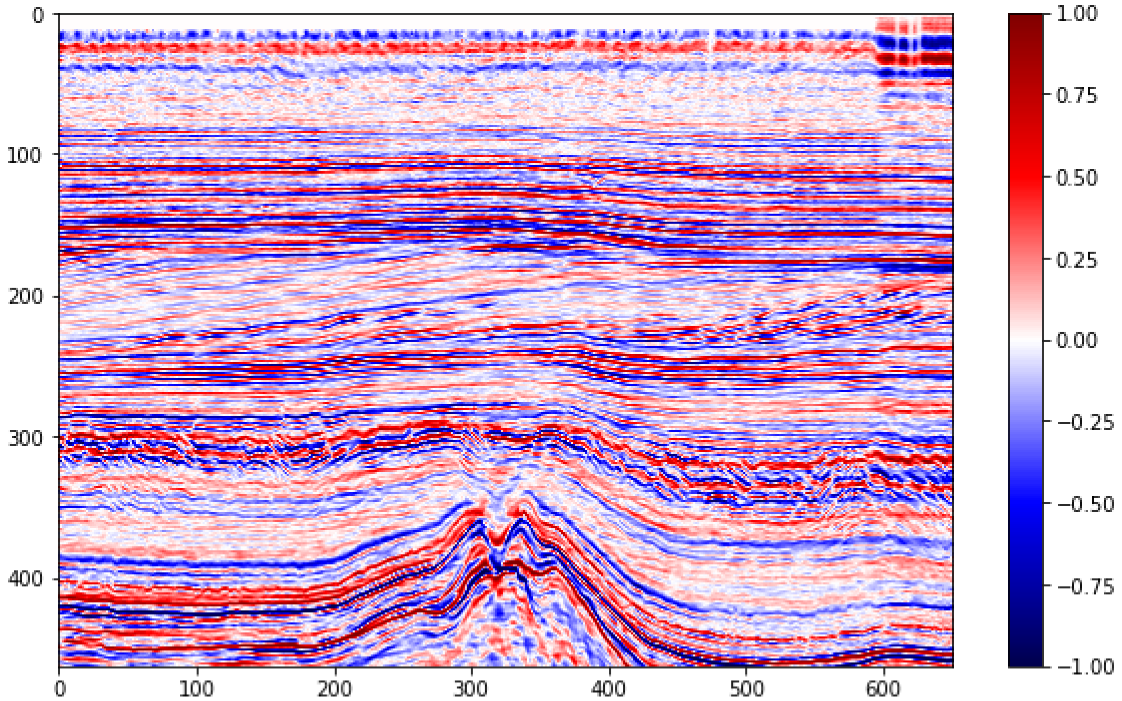
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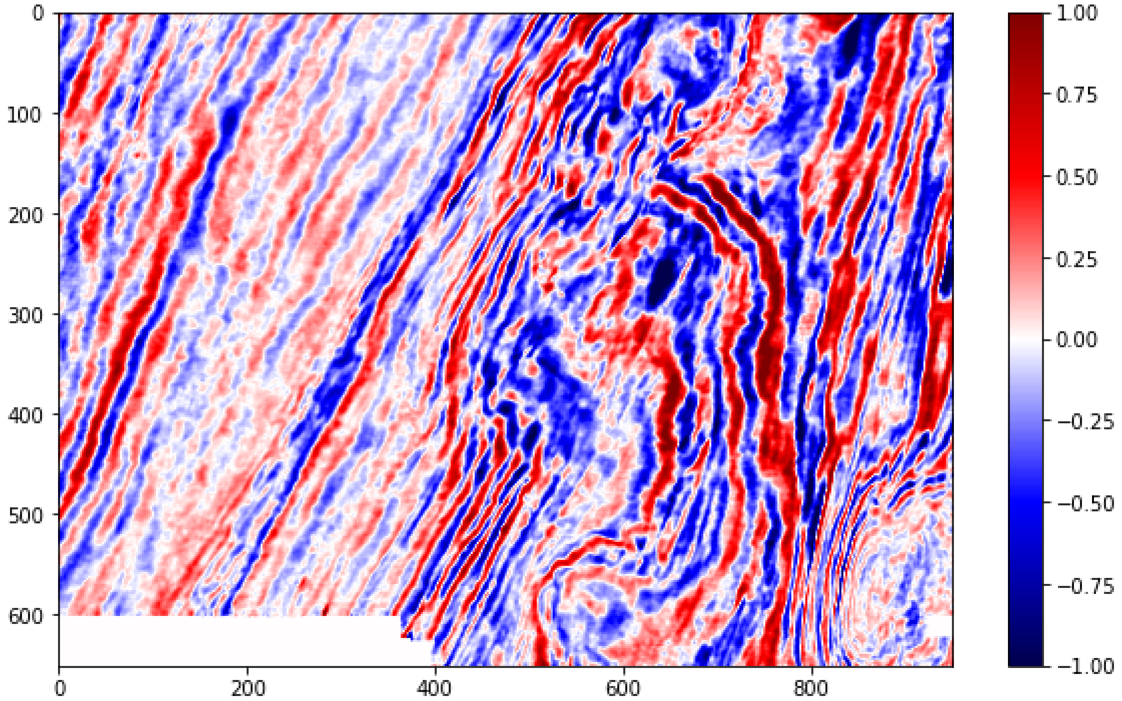
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−0.75
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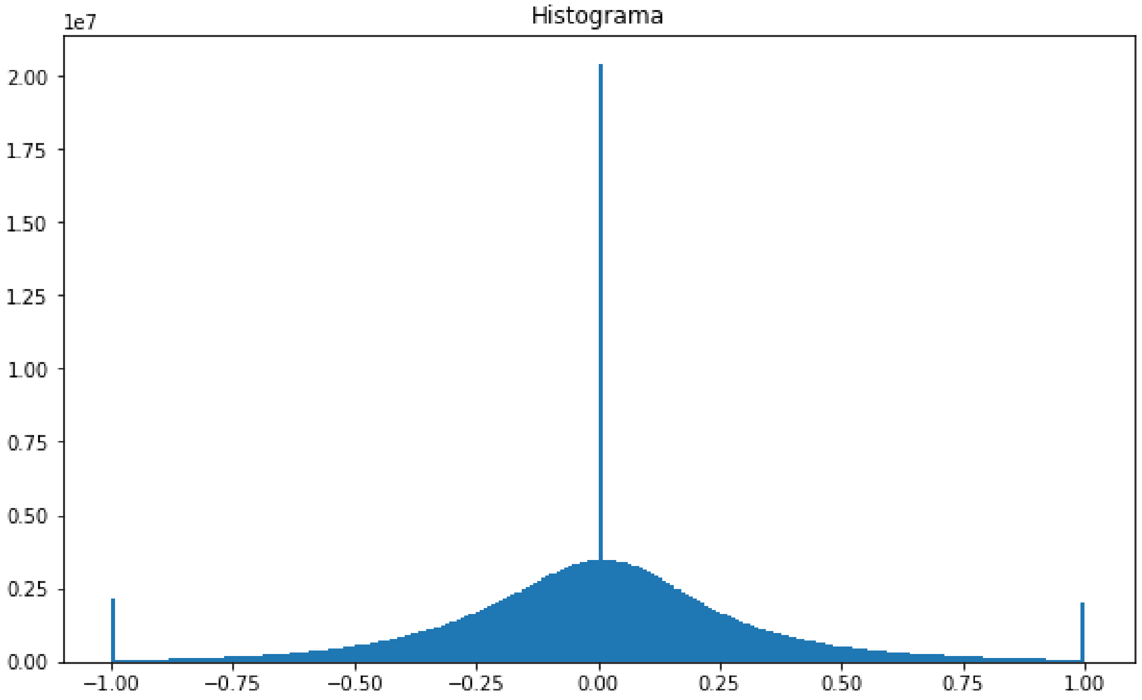
In [30]:

```
%%time

s3 = 3 * np.std( vol )
vols = vol/s3
vols[vols > 1] = 1
vols[vols < -1] = -1
show_hist( vols )
```



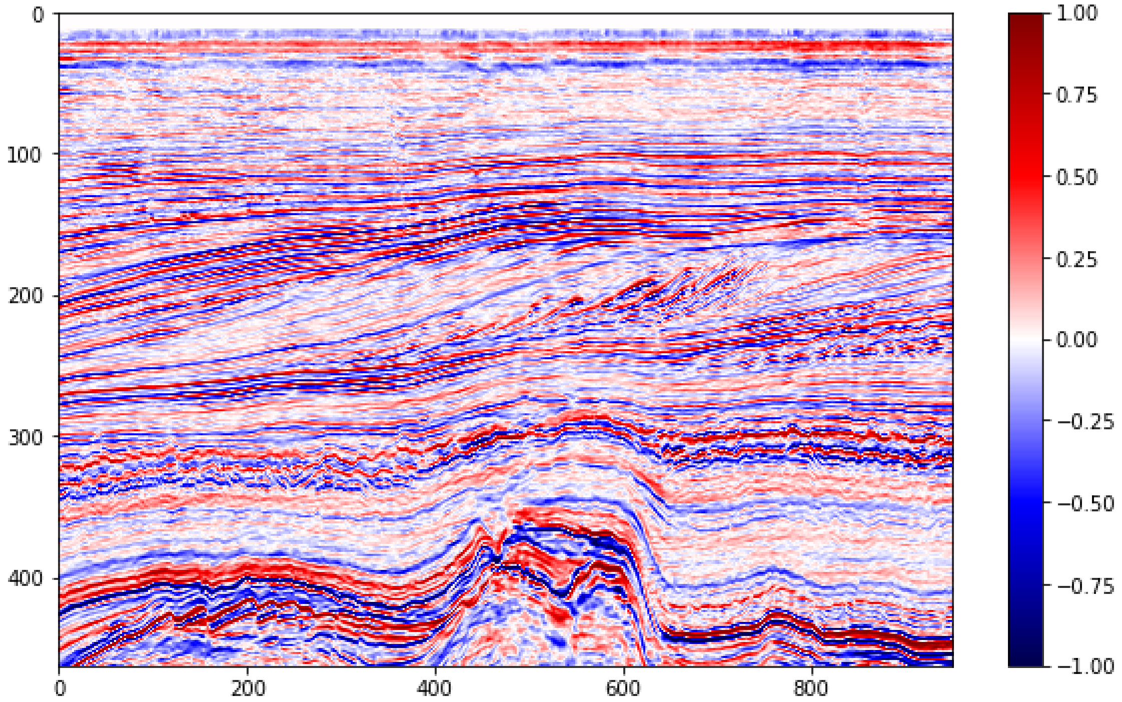
```
CPU times: user 7 s, sys: 103 ms, total: 7.11 s
Wall time: 7.11 s
```

Observação: calculando usando o desvio padrão, o processamento ficou mais rápido.

- Usando percentil: 13.5 s
- Usando o desvio padrão: 7.37 s

In [ ]:

```
show_img( vols[ inline, :, :].T, 'seismic', clim=(-1, 1) )
show_img( vols[ :, crossline, :].T, 'seismic', clim=(-1, 1) )
show_img( vols[ :, :, timeline], 'seismic', clim=(-1, 1) )
```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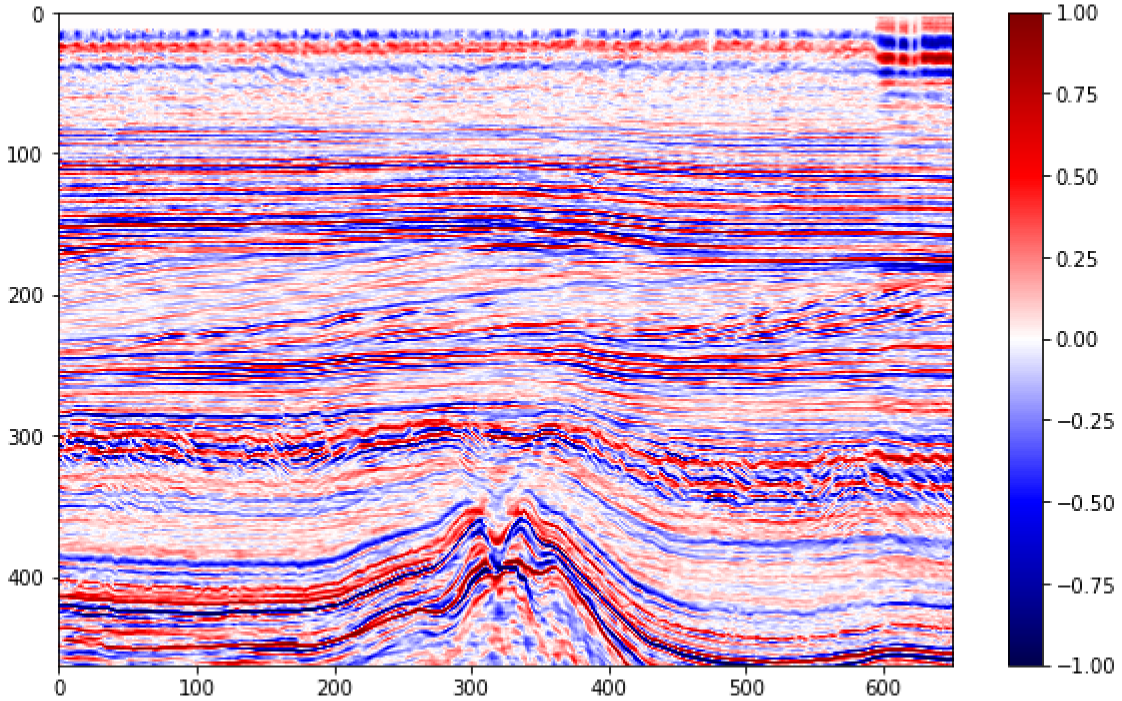
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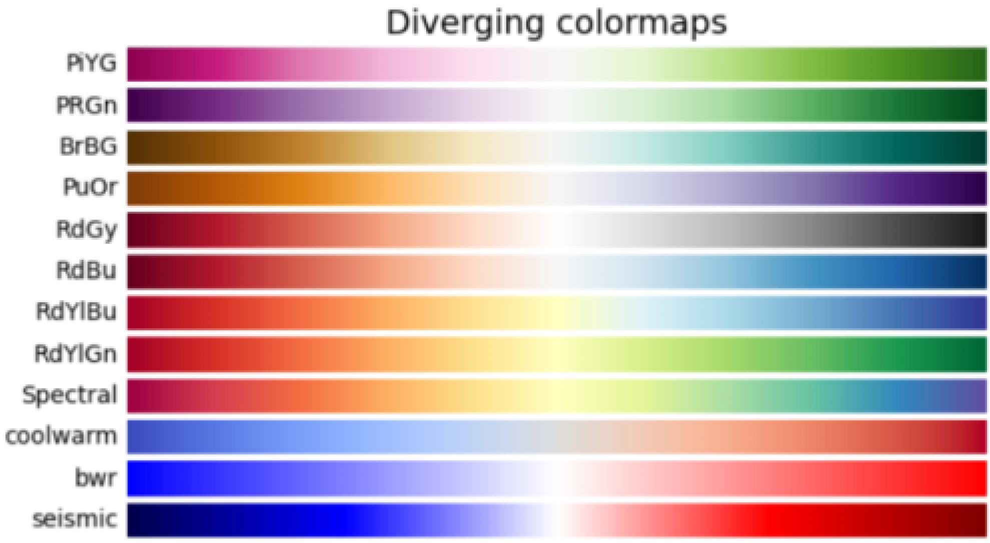
Usando outro colormap.

Colormap reference do Matplotlib:

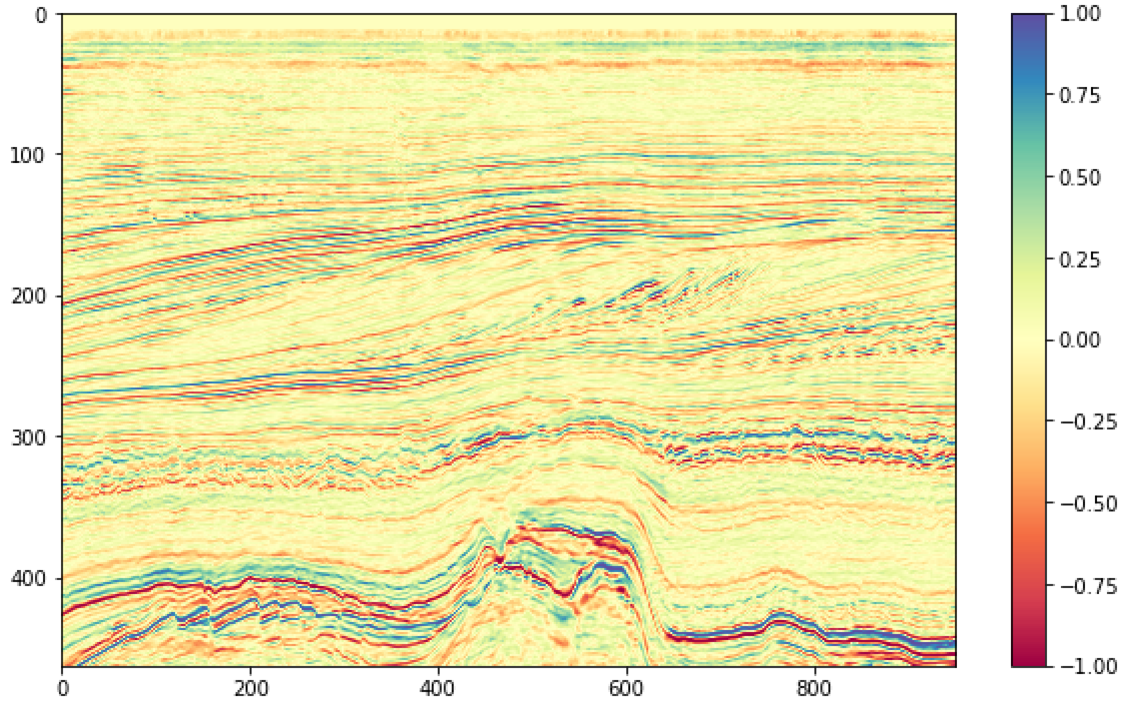
https://matplotlib.org/stable/gallery/color/colormap_reference.html (https://matplotlib.org/stable/gallery/color/colormap_reference.html)

Diverging colormaps



In [28]:

```
show_img( vols[ inline, :, :].T, 'Spectral', clim=(-1, 1) )
show_img( vols[ :, crossline, :].T, 'coolwarm', clim=(-1, 1) )
show_img( vols[ :, :, timeline], 'RdGy', clim=(-1, 1) )
```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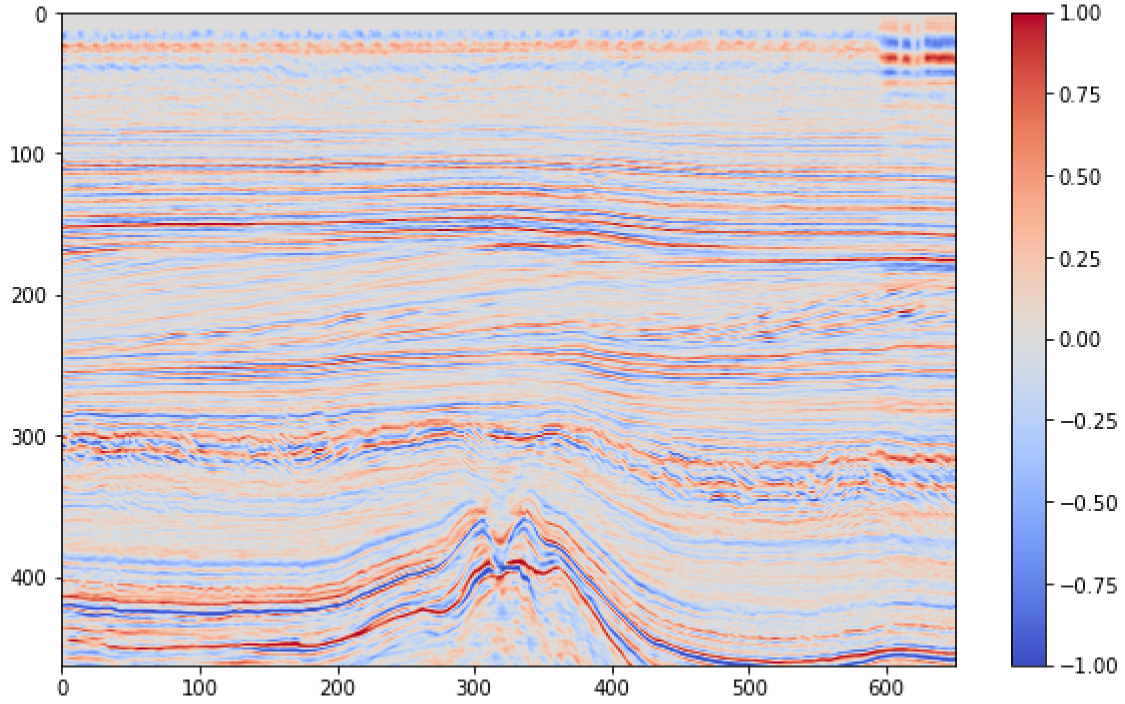
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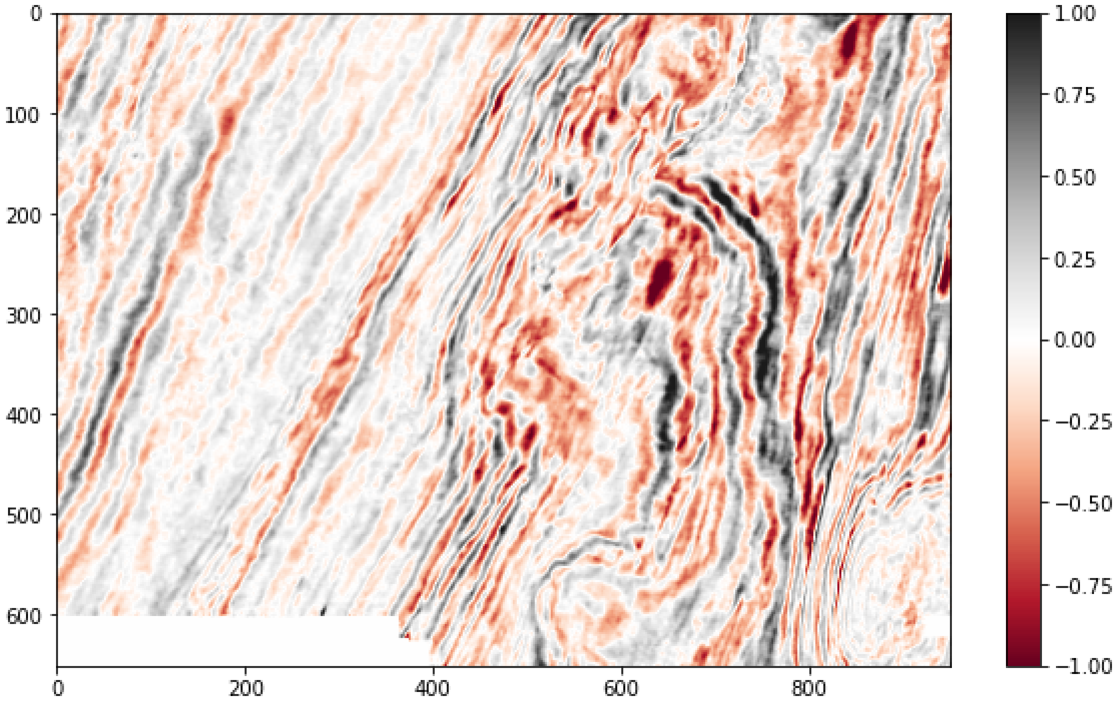

Para exportar para PDF.

In [29]:

```
%%time

!jupyter nbconvert --to html ./T1_DanielCosta_SISMICA.ipynb
```

```
[NbConvertApp] Converting notebook ./T1_DanielCosta_SISMICA.ipynb to html
[NbConvertApp] Writing 4370845 bytes to ./T1_DanielCosta_SISMICA.html
CPU times: user 22.8 ms, sys: 20.4 ms, total: 43.3 ms
Wall time: 1.65 s
```