Computação científica com Python

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Programando Ciência

Por que Python?

Por que não uma linguagem compilada?

C / C++: menos produtivo

Fortran:

- **menos produtivo**
- **restrito**

Por que não outra linguagem interpretada?

Matlab / Octave:

- restrito
- lento
- caro

R: curva de aprendizado maior

Julia: poucos pacotes

“Every tool has its place”.

Python:

- **adoção confusa (2 ou 3?)**
- **lento**

Vamos falar de Python :)

Qual a melhor distribuição?

sudo VS

```
$ sudo apt-get install idle-
python3.4 ipython3-qtconsole
python3-numpy python3-scipy
python3-matplotlib mayavi2
python3-pandas python3-
skimage python3-simpy...
```

```
$ bash Anaconda3-2.3.0-Linux-x86_64.sh
```

```
$ conda install
<pacote>
```

E o ambiente?

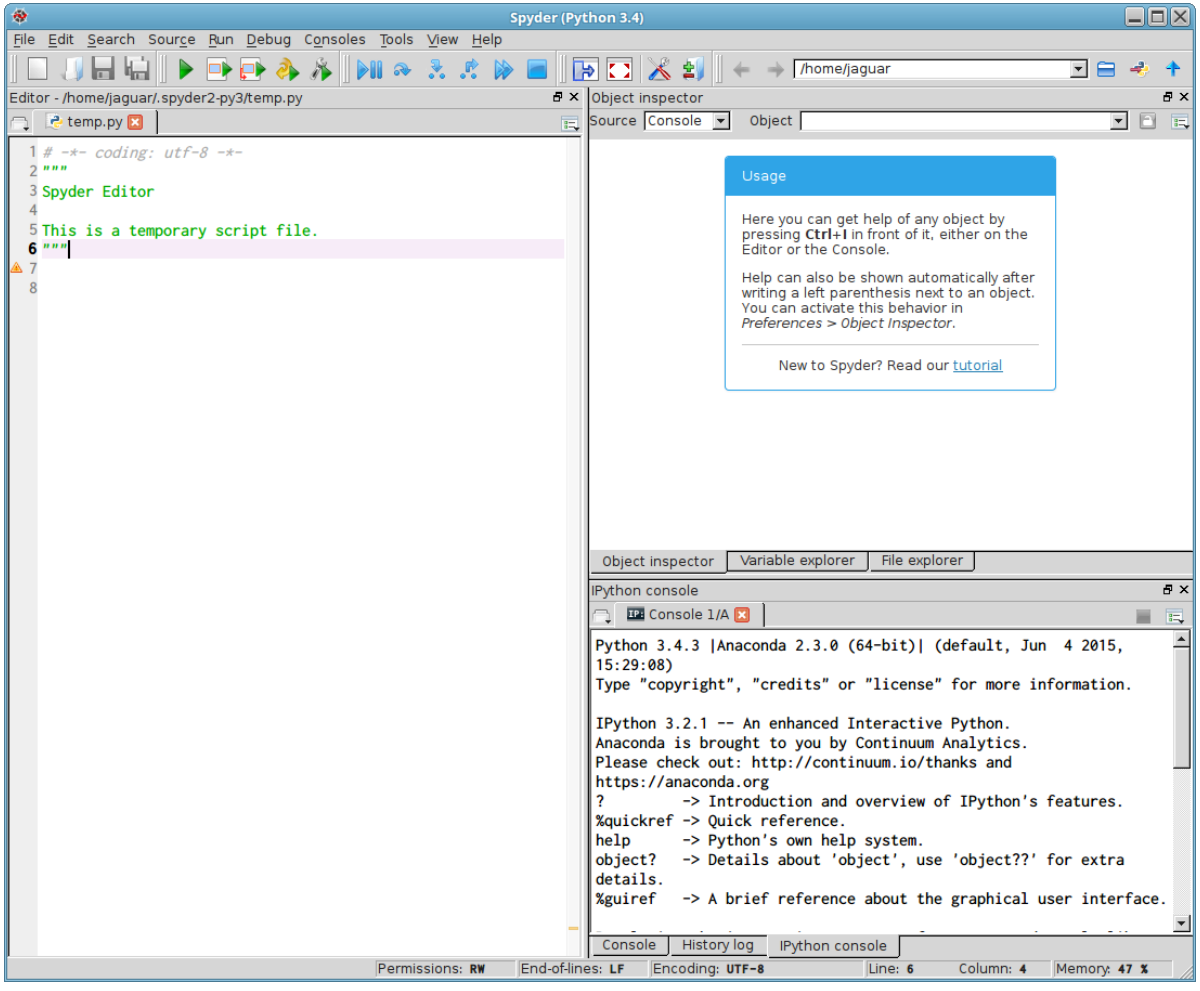
IP[y]?

?

idle?

?

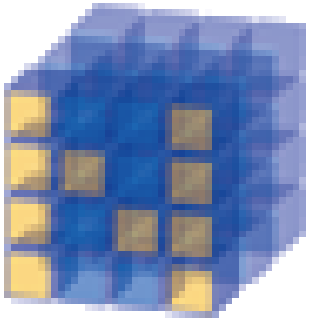
```
$ conda install
spyder
```



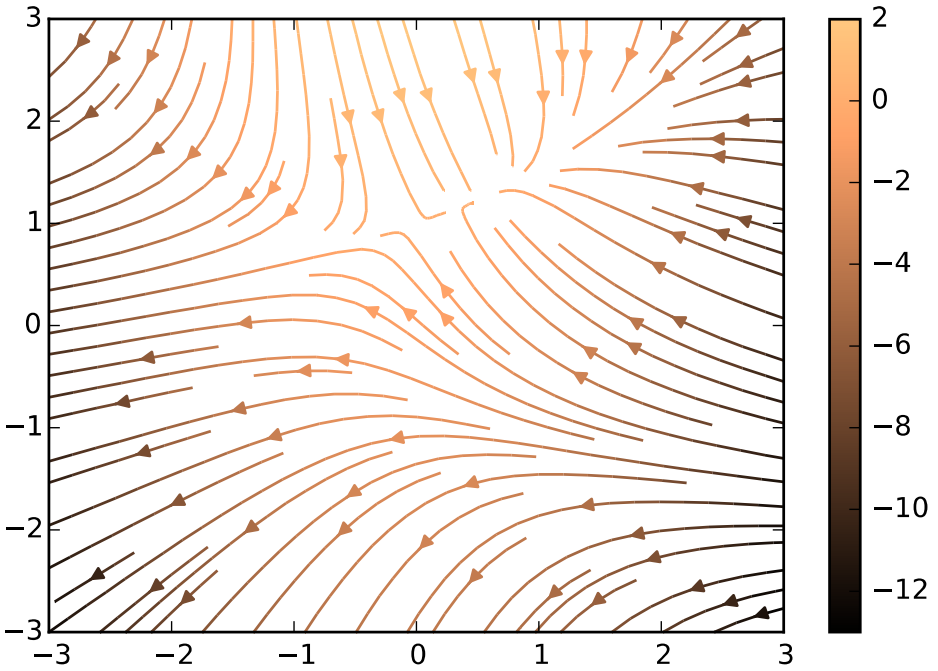
https://github.com/spyder-ide/spyder

E o que posso fazer com isso?

- o básico

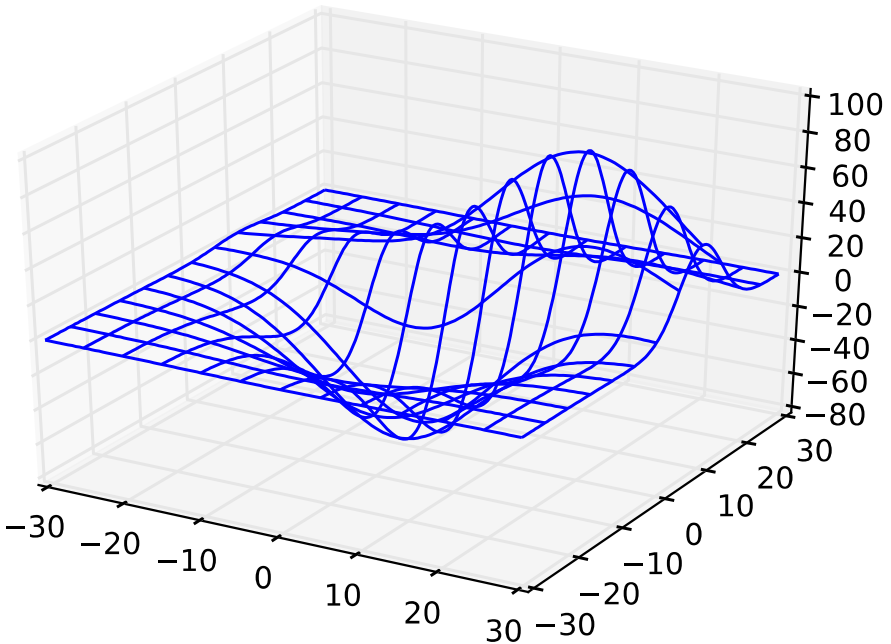


```
import matplotlib.pyplot as plt
import numpy as np

Y, X = np.mgrid[-3:3:100j,
-3:3:100j]
U = -1 - X**2 + Y
V = 1 + X - Y**2
speed = np.sqrt(U*U + V*V)

plt.streamplot(X, Y, U, V, color=U,
cmap='copper')
plt.colorbar()
plt.show()
```



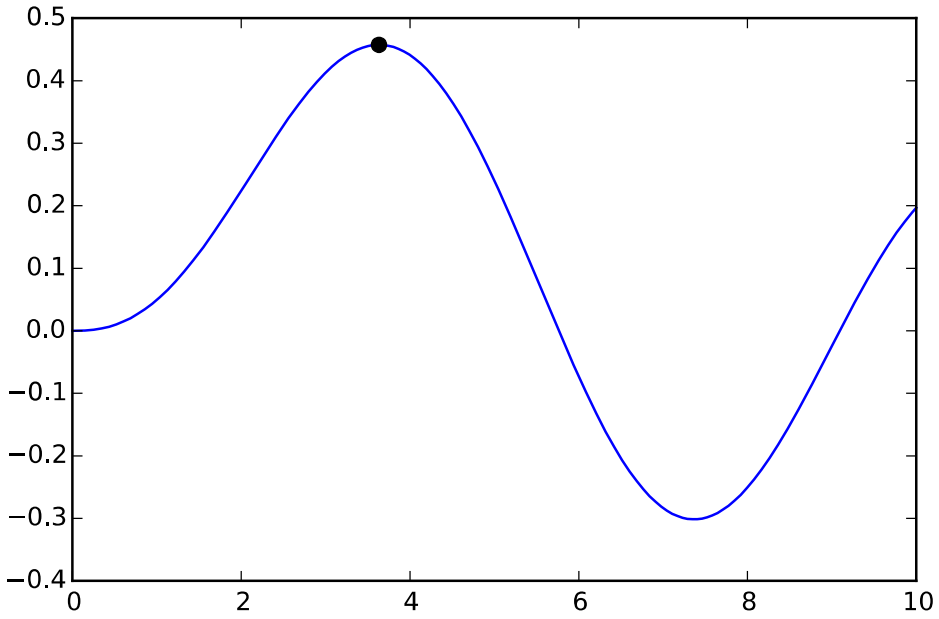
http://matplotlib.org/examples/images_contours_and_fields/streamplot_demo_features.html

```
from mpl_toolkits.mplot3d import
axes3d
import matplotlib.pyplot as plt
import numpy as np

fig = plt.figure()
ax = fig.add_subplot(111,
projection='3d')
X, Y, Z =
axes3d.get_test_data(0.05)
ax.plot_wireframe(X, Y, Z,
rstride=10, cstride=10)

plt.show()
```



http://matplotlib.org/examples/mplot3d/wire3d_demo.html

```
from scipy import optimize, special
import matplotlib.pyplot as plt
import numpy as np

def f(x):
    output = -special.jv(2.5, x)
    return output

sol = optimize.minimize(f, 1.0)
x = np.linspace(0, 10, 5000)
plt.plot(x, special.jv(2.5, x),
'-', sol.x, -sol.fun, 'ko')
plt.show()
```



http://www.scipy.org/getting-started.html

- **matemática simbólica**

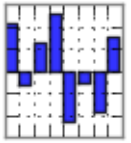
```
In [30]: from sympy import *

In [31]: f, g = symbols('f g',
cls=Function)

In [32]: f(x)
Out[32]: f(x)

In [33]: f(x).diff(x)
Out[33]: Derivative(f(x), x)

In [34]: diffeq =
Eq(f(x).diff(x, x) -
2*f(x).diff(x) + f(x), sin(x))

In [35]: diffeq
Out[35]: f(x) - 2*Derivative(f(x),
x) + Derivative(f(x), x, x) ==
sin(x)

In [36]: dsolve(diffeq, f(x))
Out[36]: f(x) == (C1 + C2*x)*exp(x)
+ cos(x)/2
```

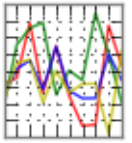
http://docs.sympy.org/latest/tutorial/solvers.html#solving-differential-equations

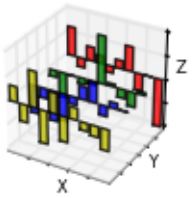
- **estatística**

pandas

$$y_{it} = \beta' x_{it} + \mu_i + \epsilon_{it}$$

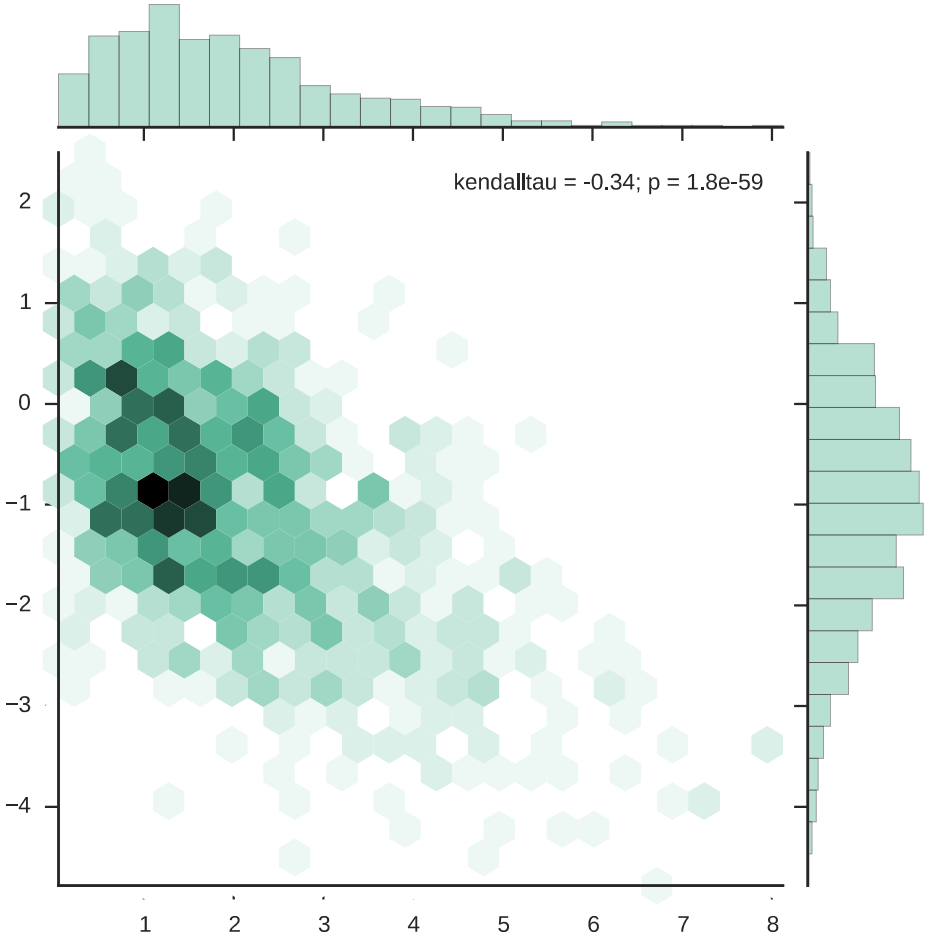






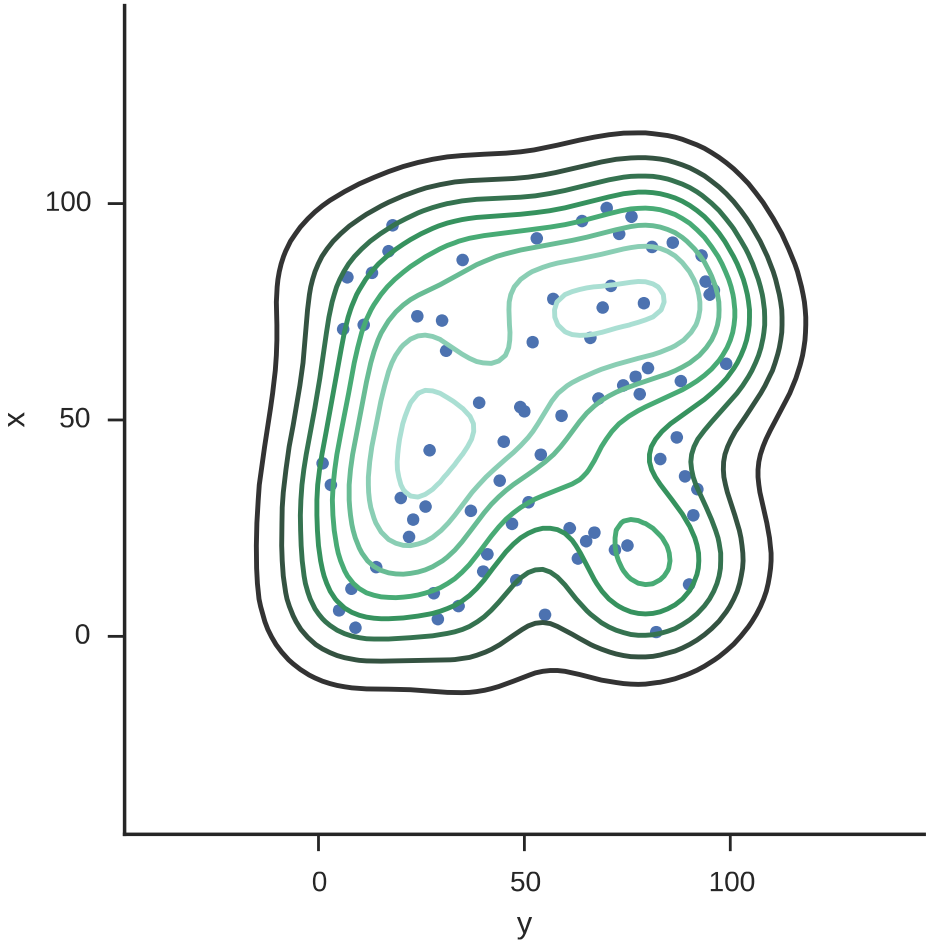
seaborn

```
from scipy.stats import kendalltau
import numpy as np
import seaborn as sns
sns.set(style="ticks")

rs = np.random.RandomState(11)
x = rs.gamma(2, size=1000)
y = -.5 * x + rs.normal(size=1000)

sns.jointplot(x, y, kind="hex",
stat_func=kendalltau,
color="#4CB391")
```



http://stanford.edu/~mwaskom/software/seaborn/examples/hexbin_marginals.html

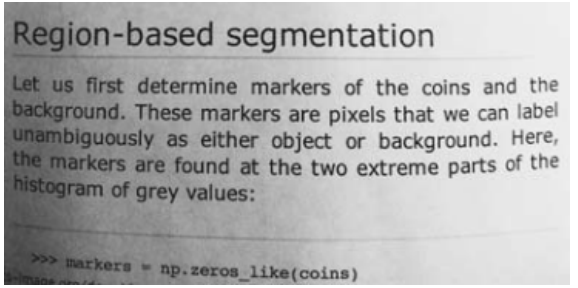
```
import pandas as pd
import random as rd
import seaborn as sns

df = pd.DataFrame()
df['x'] = rd.sample(range(1, 100),
75)
df['y'] = rd.sample(range(1, 100),
75)

sns.lmplot('x', 'y', data=df,
fit_reg=False)
sns.kdeplot(df.y, df.x)
```

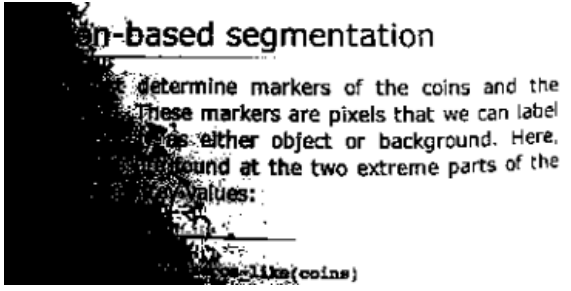


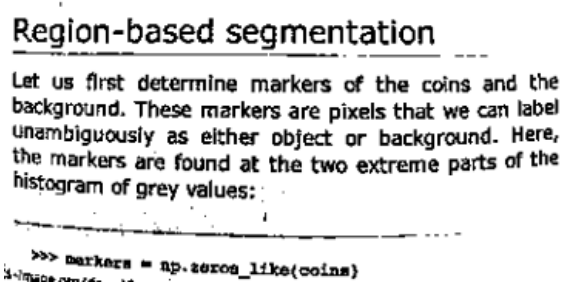
http://chrisalbon.com/python/pandas_with_seaborn.html

- **processamento de imagens**

```
from skimage import data
from skimage.filters import threshold_otsu,
threshold_adaptive
import matplotlib.pyplot as plt

image = data.page()
global_thresh = threshold_otsu(image)
binary_global = image > global_thresh
block_size = 40
binary_adaptive = threshold_adaptive(image,
block_size, offset=10)
fig, axes = plt.subplots(nrows=3, figsize=(7,
8))
ax0, ax1, ax2 = axes
plt.gray()

ax0.imshow(image)
ax1.imshow(binary_global)
ax2.imshow(binary_adaptive)
for ax in axes:
    ax.axis('off')

plt.show()
```





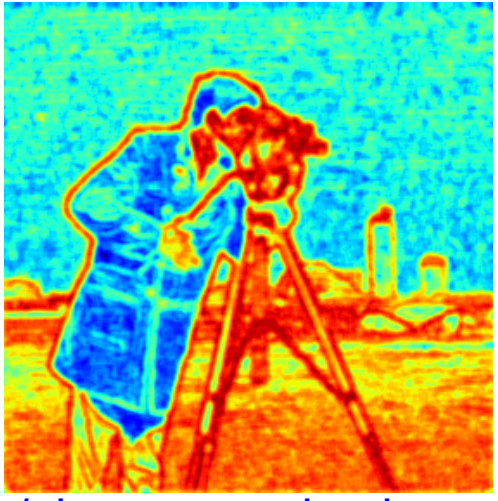


http://scikit-image.org/docs/dev/auto_examples/plot_threshold_adaptive.html

```
from skimage import data
from skimage.filters.rank import
entropy
from skimage.morphology import disk
from skimage.util import img_as_ubyte
import matplotlib.pyplot as plt

image = img_as_ubyte(data.camera())
fig, (ax0, ax1) = plt.subplots(nrows=2,
figsize=(4, 8))

img0 = ax0.imshow(image,
cmap=plt.cm.gray)
ax0.set_title('Image')
ax0.axis('off')
img1 = ax1.imshow(entropy(image,
disk(5)), cmap=plt.cm.jet)
ax1.set_title('Entropy')
ax1.axis('off')

plt.show()
```

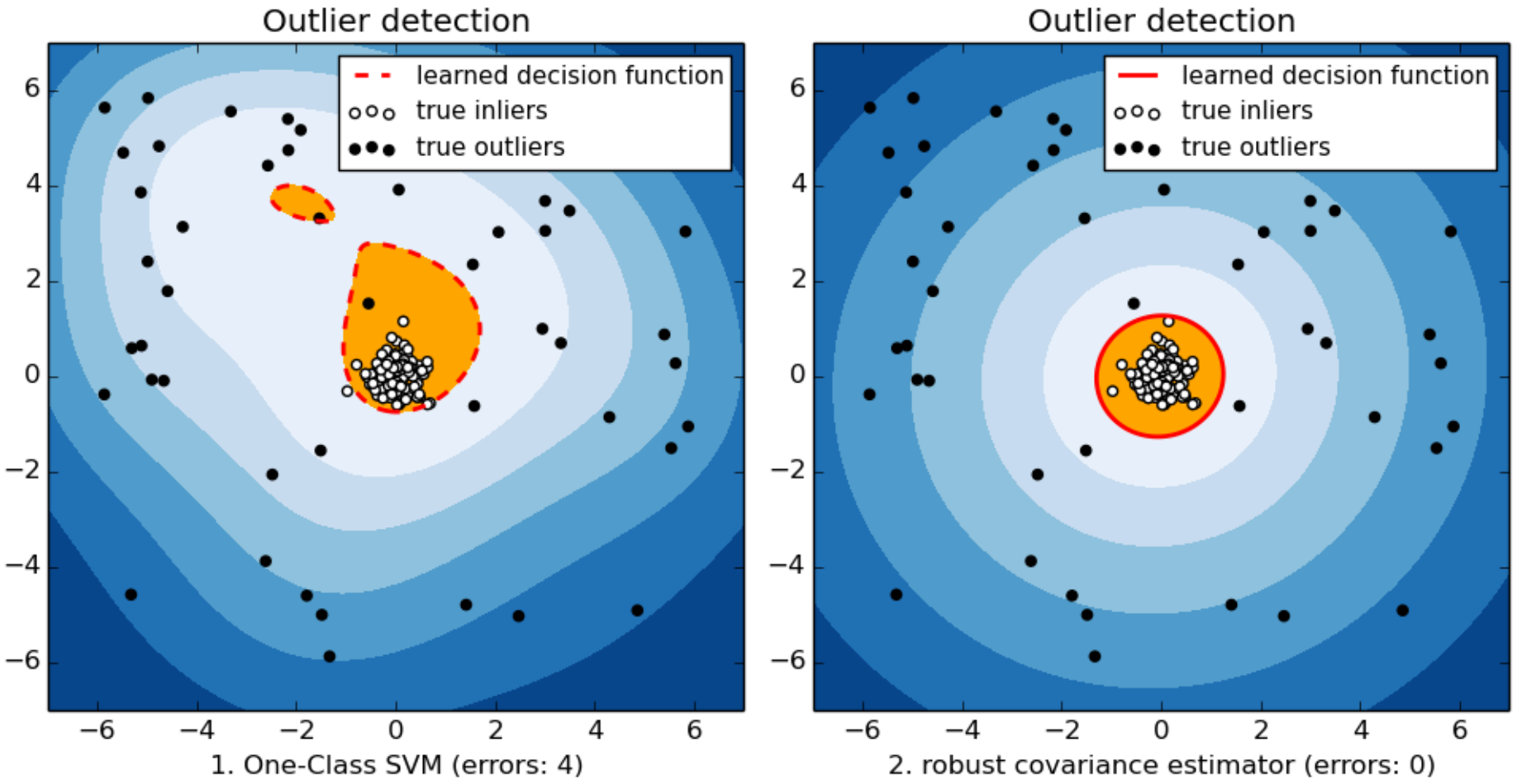
Image

Entropy

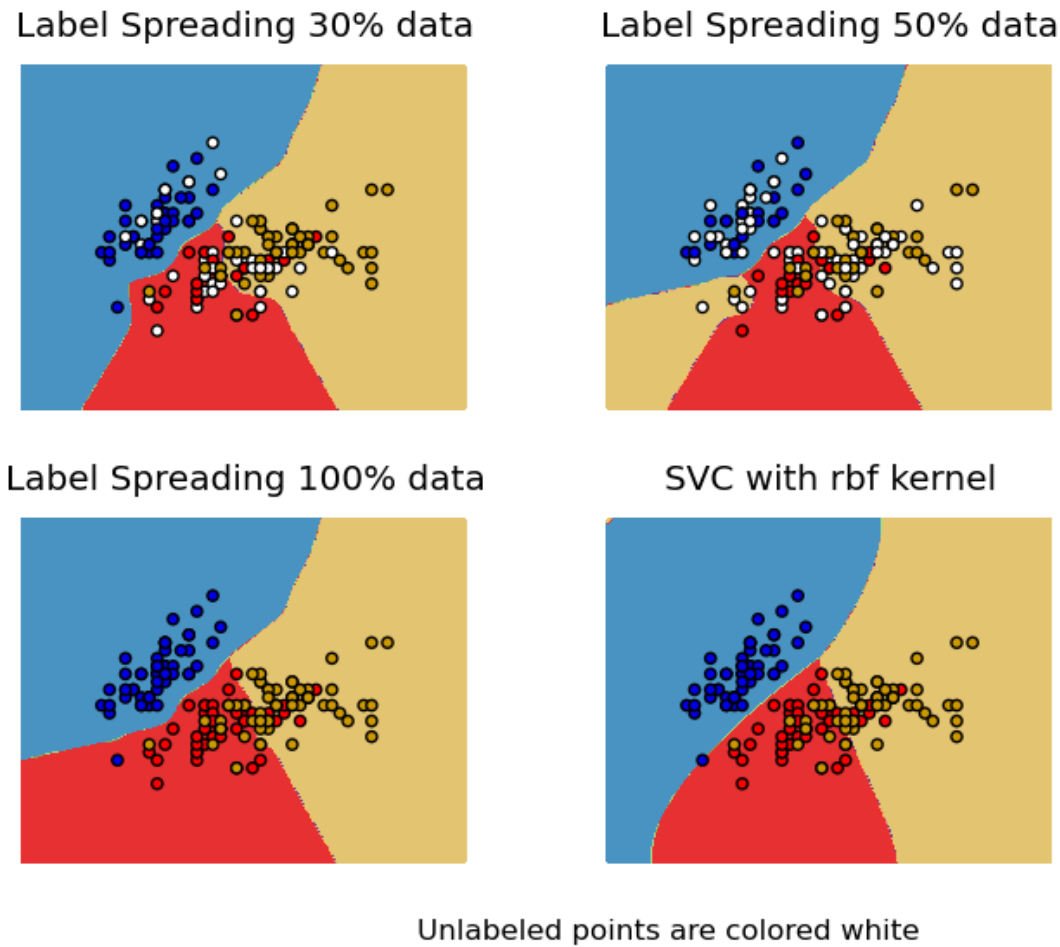


http://scikit-image.org/docs/dev/auto_examples/plot_entropy.html

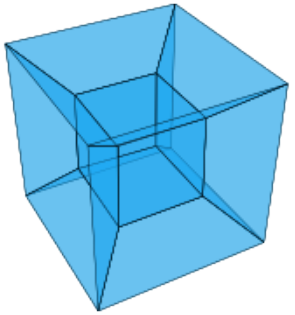
- **aprendizagem de máquina**



http://scikit-learn.org/stable/auto_examples/covariance/plot_outlier_detection.html



http://scikit-learn.org/stable/auto_examples/semi_supervised/plot_label_propagation_versus_svm_iris.html



e muitos outros!

https://pypi.python.org/pypi?:action=browse&c=385

Obrigado!

- **contato: www.programandociencia.com/sobre**