

Procesamiento de señales, fundamentos

Maestría en sistemas embebidos

Universidad de Buenos Aires

MSE 5Co2020

Introducción a Python y NumPy

Ing. Pablo Slavkin

slavkin.pablo@gmail.com

wapp:011-62433453



Applications on

base (root)

Channels

Refresh



JupyterLab

0.35.3

An extensible environment for interactive and reproducible computing, based on the Jupyter Notebook and Architecture.

Launch



Notebook

5.7.4

Web-based, interactive computing notebook environment. Edit and run human-readable docs while describing the data analysis.

Launch



Qt Console

4.4.3

PyQt GUI that supports inline figures, proper multiline editing with syntax highlighting, graphical calltips, and more.

Launch



Spyder

3.3.2

Scientific Python Development Environment. Powerful Python IDE with advanced editing, interactive testing, debugging and introspection features

Launch



Glueviz

0.13.3

Multidimensional data visualization across files. Explore relationships within and among related datasets.

Launch



Orange 3

3.19.0

Component based data mining framework. Data visualization and data analysis for novice and expert. Interactive workflows with a large toolbox.

Launch



RStudio

1.1.456

A set of integrated tools designed to help you be more productive with R. Includes R essentials and notebooks.

Launch



VS Code

1.44.2

Streamlined code editor with support for development operations like debugging, task running and version control.

Launch

Engineered Arts Cha x (1) WhatsApp x Home x Untitled x +

localhost:8889/notebooks/Untitled.ipynb?kernel_name=python3# 110% ... ☆

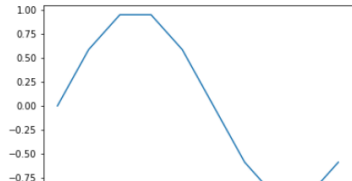
jupyter Untitled Last Checkpoint: 5 minutes ago (unsaved changes) Logout

File Edit View Insert Cell Kernel Widgets Help Trusted Python 3

Save + Undo Copy Paste Up Down Run Stop Restart Markdown

Esto es un notebook

```
In [9]: 1 import numpy as np
2 import matplotlib.pyplot as plt
3
4 t=np.arange(0,1,0.1)
5 signal=np.sin(2*np.pi*t)
6
7 plt.plot(t,signal)
8 plt.show()
9
```



Anaconda

Snvder

The screenshot displays the Anaconda Snvder IDE interface. The main editor window shows a Python script for plotting two signals. The right sidebar contains a 'Usage' help panel and a 'Python console' showing the IPython prompt.

Editor - /home/pslavkin/untitled0.py

```
1 import numpy as np
2 import matplotlib.pyplot as plt
3 from matplotlib.animation import FuncAnimation
4
5 fs=1000
6 N=300
7 circleFrec=0
8 signalFrec=10
9
10 fig=plt.figure()
11 circleAxe=fig.add_subplot(2,2,1)
12 circleLn, =plt.plot([],[],"r-")
13 circleAxe.set_xlim(-2,2)
14 circleAxe.set_ylim(-2,2)
15 circleData=[]
16
17 signalAxe=fig.add_subplot(2,2,2)
18 signalLn, =plt.plot([],[],"b-o")
19 signalAxe.set_xlim(0,N/fs)
20 signalAxe.set_ylim(-2,2)
21 signalData=[]
22
23 def circle(c,f,t):
24     return c*np.exp(-1j*2*np.pi*f*t)
25
```

Usage

Here you can get help of any object by pressing **Ctrl+I** in front of it, either on the Editor or the Console.

Help can also be shown automatically after writing

Variable explorer **File explorer** **Find in files** **Help**

Python console

Console 1/A

Python 3.7.1 (default, Dec 14 2018, 19:28:38)
Type "copyright", "credits" or "license" for more information.

IPython 7.2.0 -- An enhanced Interactive Python.

In [1]:

Anaconda









ipython

```
pslavkin@work1:/h/p/m/clases$ ipython3
/usr/local/lib/python3.7/site-packages/IPython/core/history.py:226: UserWarning: IPython History requires SQLite, your history will not be saved
  warn("IPython History requires SQLite, your history will not be saved")
Python 3.7.3 (default, Nov  5 2019, 00:08:28)
Type 'copyright', 'credits' or 'license' for more information
IPython 7.9.0 -- An enhanced Interactive Python. Type '?' for help.
```

```
In [1]: a=[1,2,3]
```

```
In [2]: print(a)
[1, 2, 3]
```

```
In [3]:
```

 JupyterLab 0.35.1 The JupyterLab environment for interactive and reproducible computing, based on the Jupyter Notebook and Architecture. Launch	 Notebook 5.7.0 Web-based, interactive computing notebook environment. Edit and run human-readable docs while describing the data analysis. Launch	 Qt Console 4.4.1 PyQt GUI that supports inline figures, proper multiline editing with syntax highlighting, graphical calltips, and more. Launch	 Spyder 3.3.2 Scientific Python Development Environment. Powerful Python IDE with advanced editing, interactive testing, debugging and introspection features. Launch
 Glueviz 0.13.3 Multidimensional data visualization across files. Explore relationships within and among related datasets. Launch	 Orange 3 3.19.0 Component based data mining framework. Data visualization and data analysis for novice and expert. Interactive workflows with a large toolbox. Launch	 RStudio 1.1.456 A set of integrated tools designed to help you be more productive with R. Includes R essentials and notebooks. Launch	 VS Code 1.44.2 Streamlined code editor with support for development operations like debugging, task running and version control. Launch

python

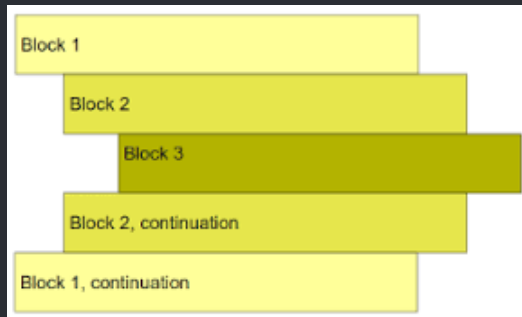
python

```
pslavkin@work1:/h/pslavkin$ python3
Python 3.7.3 (default, Dec 20 2019, 18:57:59)
[GCC 8.3.0] on linux
Type "help", "copyright", "credits" or "license" for more information.
>>> a="soy python"
>>> print(a)
soy python
>>>
In [1]: a=[1,2,3]
In [2]: print(a)
[1, 2, 3]
In [3]:
```

Introducción

- Lenguaje Interpretado
- Tipado dinámico: El tipo se define en tiempo de ejecución
- Fuertemente tipado: Durante las operaciones se chequea el tipo

Indentación



```
mi_variable = 27
mi_flag     = True

if mi_flag:
    while mi_variable > 0:
        print(mi_variable)
        mi_variable-=1
```


Números

- Enteros: Con signo, sin límite
- Punto flotante
- Complejos
- Booleanos

```
nint      = 27
nfloat    = 3.14
ncomplex  = 1+2j

print(type(nint))
print(type(nfloat))
print(type(ncomplex))
-----
>> <class 'int'>
>> <class 'float'>
>> <class 'complex'>

flag1 = True
flag2 = False

print(type(flag1))
print(flag2)

if flag1:
    print("verdadero!")
-----
>> <class 'bool'>
>> False
>> verdadero!
```

Cadenas

- Strings: se guardan codificadas. Ej. UTF8 y son inmutables
- Byte array: sin codificar, raw, son mutables

```
msg = "Hola mundo"
msg = 'Hola mundo'

print(msg)
print(msg[2])
print(msg[5:10])
-----
>> Hola mundo
>> l
>> mundo

b = bytearray()
b.append(0x02)
b.append(0x10)
b.append(0x05)
b.append(0x10)
b.append(0x03)
print(b)
print(b[3])
print(len(b))
-----
>> bytearray(b'\x02\x10\x05\x10\x03')
>> 16
>> 5
```

Listas

```
l = [1, 2, 3, 4, 5 ];
print(l)
for i in l:
    print(i)
-----
>>
[1, 2, 3, 4, 5]
1
2
3
4
l = [1, 2, 3, "casa", 5.2 ];
print(l[2])
print(l[-1])
print(l[1:4])
```

```
-----
>> 3
>> 5.2
>> [2, 3, "casa"]
l.append(6)
l.remove(2) #por valor
print(l)
-----
>> [1, 3, "casa" , 5.2, 6]

lista = [1, 2, 3, 4, 5 ];
cantidad_elementos = len(lista)
print(cantidad_elementos)
-----
>> 5
```

funciones

```
def miFuncion(arg1,arg2,arg3=1):  
    print(arg1)  
    print(arg2)  
    print(arg3)  
    return 5,6,7  
  
cinco,seis,siete = miFuncion(1,2)  
miFuncion("hola",arg2=2+1j,arg3=3)
```

NumPy

arrays

```
a=np.array([1,2,3])  
print(type(a))  
print(a)  
print(a+1)
```

```
>>numpy.ndarray  
>>[1 2 3]  
>>[2 3 4]
```

NumPy

linspace, arange

```
import numpy as np
a=np.linspace(0,1,10)
print(a)
b=np.linspace(0,1,10,endpoint=False)
print(b)
c=np.arange(0,1,0.1)
print(c)
print(c[:2])
print(c[2:])
print(c[2:2])
print(c[:2])
print(c[:-1])
print(c[2])
print(c[-2])
for i in c:
    print(i)
-----
```

```
>>[0. 0.11111111 0.22222222 0.33333333 0.44444444
      0.55555556 0.66666667 0.77777778 0.88888889 1.]
>>[0.  0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9]
>>[0.  0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9]
>>[0.  0.1]
>>[0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9]
>>[]
>>[0.  0.2 0.4 0.6 0.8]
>>[0.9 0.8 0.7 0.6 0.5 0.4 0.3 0.2 0.1 0. ]
>>0.2
>>0.8
>>0.0
>>0.1
>>0.2
>>0.30000000000000004
>>0.4
>>0.5
>>0.6000000000000001
>>0.7000000000000001
>>0.8
>>0.9
```

matplotlib

pyplot

```
import matplotlib.pyplot as plt

fig = plt.figure()

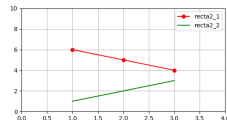
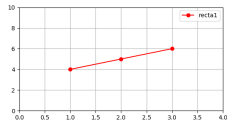
graph1Axe = fig.add_subplot(2,2,1)
graph1Ln1, = plt.plot([1,2,3],[4,5,6], 'r-o')

graph1Axe.grid ( True )
graph1Axe.set_xlim ( 0,4 )
graph1Axe.set_ylim ( 0,10 )
graph1Ln1.set_label ( "recta1" )
graph1legendLn = graph1Axe.legend ( )

data2_1=[6,5,4]
data2_2=[1,2,3]
t=[1,2,3]
graph2Axe = fig.add_subplot(2,2,4)
graph2Ln1,graph2Ln2 = plt.plot(t,data2_1,'r-o', t,data2_2,'g-',)

graph2Axe.grid ( True )
graph2Axe.set_xlim ( 0,4 )
graph2Axe.set_ylim ( 0,10 )
graph2Ln1.set_label ( "recta2_1" )
graph2Ln2.set_label ( "recta2_2" )
graph2legendLn = graph2Axe.legend ( )

plt.show ( )
```



FuncAnimation

Animation

```
import numpy as np
import matplotlib.pyplot as plt
from matplotlib.animation import FuncAnimation

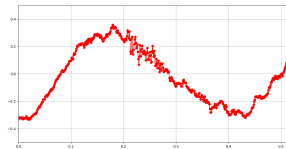
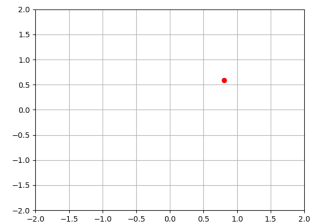
fig = plt.figure ( )
fs = 10
N = 10

circleAxe = fig.add_subplot(1,1,1)
circleLn, = plt.plot([],[],'ro')
circleAxe.grid(True)
circleAxe.set_xlim(-2,2)
circleAxe.set_ylim(-2,2)
circleFreq = 1

circle = lambda c,f,n: c*np.exp(-1j*2*np.pi*f*n*1/fs)

def update(n):
    circleLn.set_data(np.real(circle(1 ,circleFreq ,n)) ,np.
        imag(circle(1 ,circleFreq ,n)))
    return circleLn,

ani=FuncAnimation(fig,update,N,interval=1000 ,blit=False,
    repeat=True)
plt.show()
```



Módulos y paquetes

Módulos:

defino un archivo:

```
mi_modulo.py
# en minúscula
def func1():
    print("f1")
def func2():
    print("f2")
-----
import mi_modulo
mi_modulo.func1()
-----
>>f1
```

Paquetes:

```
| -- paquete
|   |-- __init__.py
|   |-- mi_modulo1
|       |-- mod1_file1.py
|   |-- mi_modulo2
|       |-- __init__.py
|-----
lo invoco como:-----
from paquete.mi_modulo1 import mod1_file1
    as m1
m1.mod1_file1_func1()
```