Python与机器学习

——Python库的使用

华算科技 黄老师

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华算科技
HUASUAN TECHNOLOGY

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库

库是完成一定功能的代码的集合

tkinter

SciPy

库的优势

提高开发效率

例如：前面的求list平均

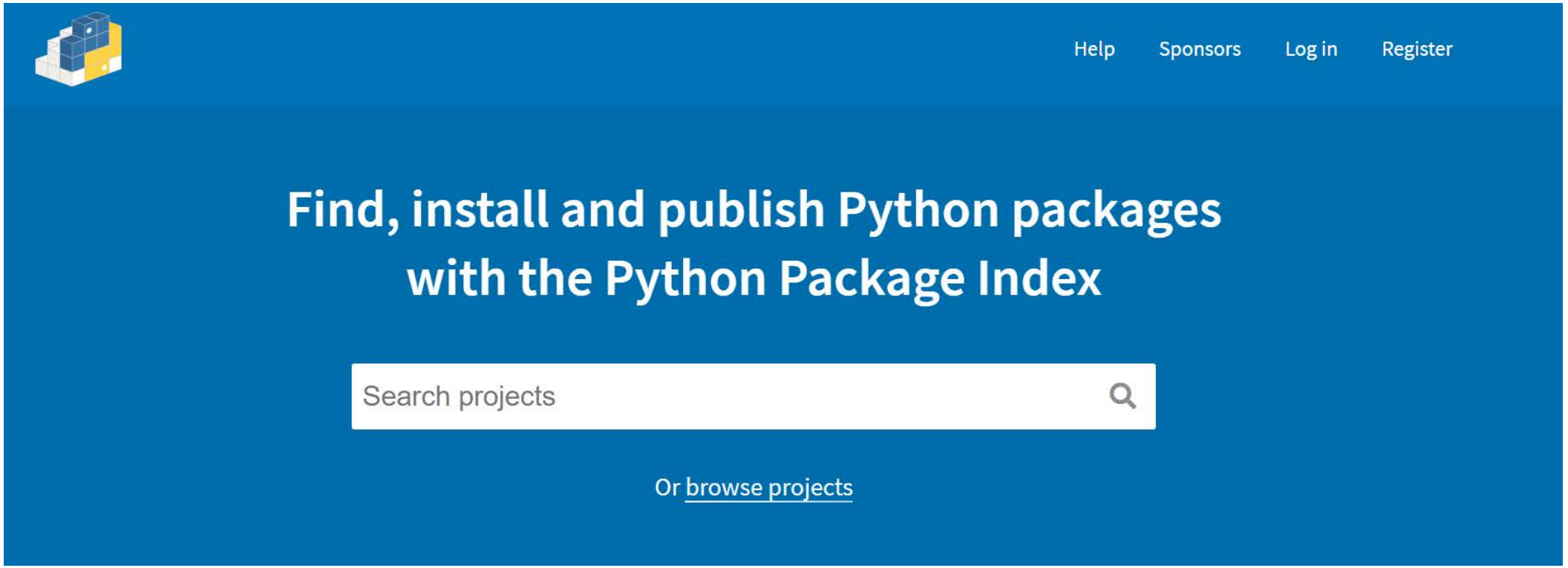
In [14]:
```
I_max = map(float, I_max)
I_max = list(I_max)
print(I_max)
I_min = list(map(float, I_min))

import numpy as np
I1 = np.mean(I_max)
I2 = np.mean(I_min)

print(I1, I2)
```

```
[2.27e-12, 2.24e-12, 2.3e-12, 2.25e-12, 2.22e-12, 2.25e-12, 2.24e-12]
2.2528571428571432e-12 2.5471428571428572e-12
```

库的安装

pip install xxx命令

Python库官方索引网站：PyPI(Python Package Index)　https://pypi.org



镜像源

清华：https://pypi.tuna.tsinghua.edu.cn/simple

阿里云：http://mirrors.aliyun.com/pypi/simple

中国科技大学 https://pypi.mirrors.ustc.edu.cn/simple

豆瓣：http://pypi.douban.com/simple

库的导入

1. import 语句

使用方法：import A　　（导入A模块，例如导入numpy模块，import numpy）

可添加别名，例如 import numpy as np，程序中则可使用np代表numpy

2. from … import … 语句

使用方法：from A import a1　　（在内存中创建并加载A模块中a1工具的副本，例如导入numpy模块中的zeros函数，from numpy import zeros）

与import A.a1的区别，前者可直接调用，后者只能使用全名

查看帮助文件

help 语句

使用方法：help(A) （查看A模块下的所有函数，help(numpy)）

help(A.a1) （查看A模块中的a函数，help(numpy.zero)）

```
In [4]: help(numpy)
```

```
Help on package numpy:

NAME
    numpy

DESCRIPTION
    NumPy
    =====

    Provides
      1. An array object of arbitrary homogeneous items
      2. Fast mathematical operations over arrays
      3. Linear Algebra, Fourier Transforms, Random Number Generation

    How to use the documentation
    ----------------------------
    Documentation is available in two forms: docstrings provided
    with the code, and a loose standing reference guide, available from
    `the NumPy homepage <https://www.scipy.org>`_.

    We recommend exploring the docstrings using
    `IPython <https://ipython.org>`_, an advanced Python shell with
    TAB-completion and introspection capabilities.  See below for further
    instructions.

    The docstring examples assume that `numpy` has been imported as `np`::

      >>> import numpy as np

    Code snippets are indicated by three greater-than signs::
```

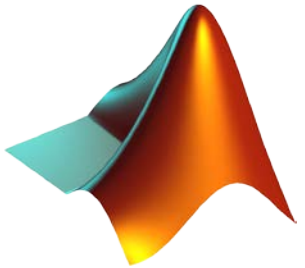
```
In [5]: help(numpy.zeros)
```

```
Help on built-in function zeros in module numpy:

zeros(...)
    zeros(shape, dtype=float, order='C', *, like=None)

    Return a new array of given shape and type, filled with zeros.

    Parameters
    ----------
    shape : int or tuple of ints
        Shape of the new array, e.g., ``(2, 3)`` or ``2``.
    dtype : data-type, optional
        The desired data-type for the array, e.g., `numpy.int8`.  Default is
        `numpy.float64`.
    order : {'C', 'F'}, optional, default: 'C'
        Whether to store multi-dimensional data in row-major
        (C-style) or column-major (Fortran-style) order in
        memory.
    like : array_like
        Reference object to allow the creation of arrays which are not
        NumPy arrays. If an array-like passed in as ``like`` supports
        the ``__array_function__`` protocol, the result will be defined
        by it. In this case, it ensures the creation of an array object
        compatible with that passed in via this argument.

        .. versionadded:: 1.20.0
```

科学计算库

NumPy，SciPy，matplotlib的组合，广泛用于替代MATLAB

最优化、线性代数等科学计算



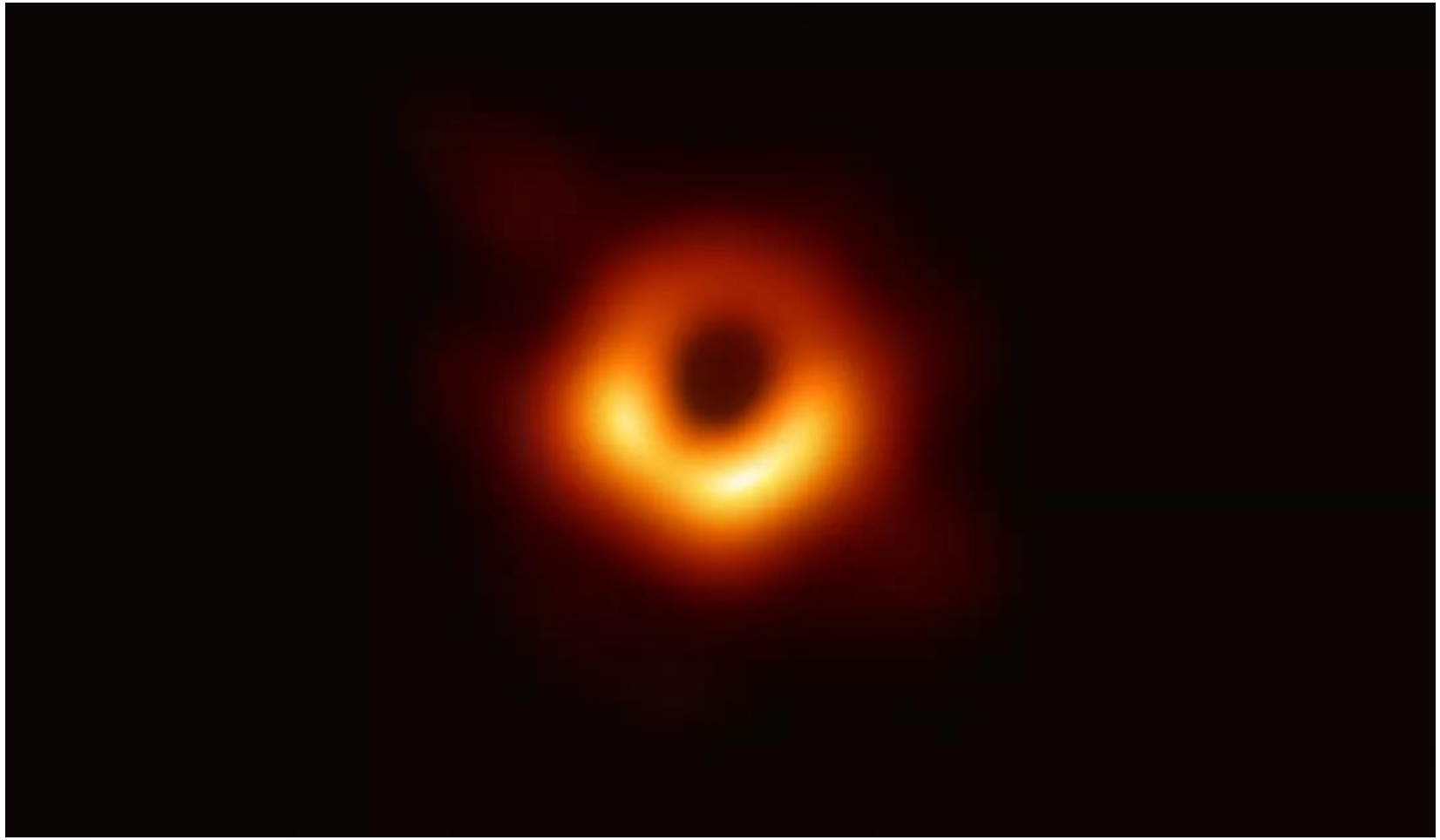
MATLAB

可视化，图像输出

黑洞照片

2019年，人类首次拍到了黑洞的照片

https://github.com/achael/eht-imaging



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NumPy库的使用

NumPy中封装有array（数组），其结构与Python中自带的list相似，但在科学计算中更为方便与强大。

list = [3.3, 2.2, 2.5, 3.1, 3.0, 'eV']

a = np.array([3.3, 2.2, 2.5, 3.1, 3.0])

array中存放的数据类型相同

```
In [1]: import numpy as np

In [2]: a = np.array([1, 2, 3, 4, 5, 6])
        b = np.array([[1, 2, 3], [4, 5, 6]])
        c = np.zeros(5)

        print(a)
        print(b)
        print(c)
```

```
[1 2 3 4 5 6]
[[1 2 3]
 [4 5 6]]
[0. 0. 0. 0. 0.]
```

NumPy库的使用

数组属性

```
In [3]: print(a.ndim)
        print(a.shape)
        print(b.ndim)
        print(b.shape)
        print(b.size)
        print(b.dtype)
```

```
1
(6,)
2
(2, 3)
6
int32
```

ndim：数组维度

shape：n行m列

size：总元素个数

dtype：数据类型

NumPy库的使用

维度与形状调整

In [4]:
```
b.reshape(3,2)
print(b.shape)
b = b.reshape(3,2)
print(b.shape)
b = b.reshape(-1,1)
print(b)
```

```
(2, 3)
(3, 2)
[[1]
 [2]
 [3]
 [4]
 [5]
 [6]]
```

In [5]:
```
c = np.zeros(24)
print(c.ndim)
c = c.reshape(2, 4, 3)
print(c.ndim)
print(c)
```

```
1
3
[[[0. 0. 0.]
  [0. 0. 0.]
  [0. 0. 0.]
  [0. 0. 0.]]

 [[0. 0. 0.]
  [0. 0. 0.]
  [0. 0. 0.]
  [0. 0. 0.]]]
```

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pandas数据结构

Series

Series:　　由一组数据以及一组与之相关的标签构成

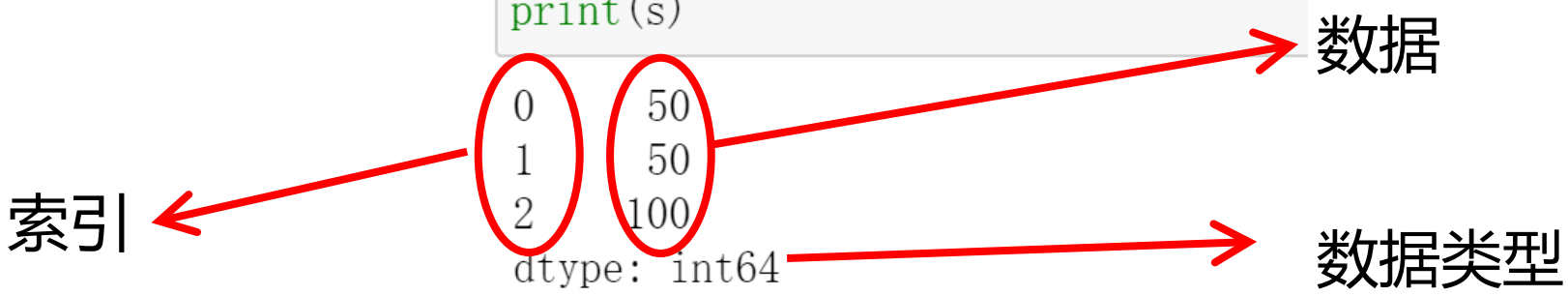
```
In [1]: import pandas as pd

In [2]: s = pd.Series([50, 50, 100])
        print(s)

0     50
1     50
2    100
dtype: int64

In [3]: s.index=['Red', 'Purple', 'Blue']
        print(s)

Red       50
Purple    50
Blue     100
dtype: int64
```



DataFrame

DataFrame:　　由若干个共用一个索引的Series组成

In [34]:
```
data = [['Red', 50, 60], ['Purple', 60, 50], ['Blue', 100, 100]]
df = pd.DataFrame(data, columns = ['name', 'score1', 'score2'])
df
```

Out[34]:

	name	score1	score2
0	Red	50	60
1	Purple	60	50
2	Blue	100	100

pandas读取csv

read_csv()函数　　把csv文件读入DataFrame中

In [9]:
```
df = pd.read_csv('didz.csv', header = None)
df
```

Out[9]:

	0	1	2	3	4	5	6	7
0	3.000000e-10	2.270000e-12	2.240000e-12	2.300000e-12	2.250000e-12	2.220000e-12	2.250000e-12	2.240000e-12
1	2.900000e-10	2.810000e-12	1.840000e-12	2.990000e-12	2.580000e-12	2.310000e-12	2.800000e-12	2.500000e-12
2	3.000000e-10	2.270000e-12	2.240000e-12	2.300000e-12	2.250000e-12	2.220000e-12	2.250000e-12	2.240000e-12
3	2.900000e-10	2.810000e-12	1.840000e-12	2.990000e-12	2.580000e-12	2.310000e-12	2.800000e-12	2.500000e-12

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实操：谱图平滑

In [1]:
```
1 import pandas as pd
```

In [2]:
```
1 df = pd.read_csv('UV_noise.csv', header = None)
2 df
```

Out[2]:

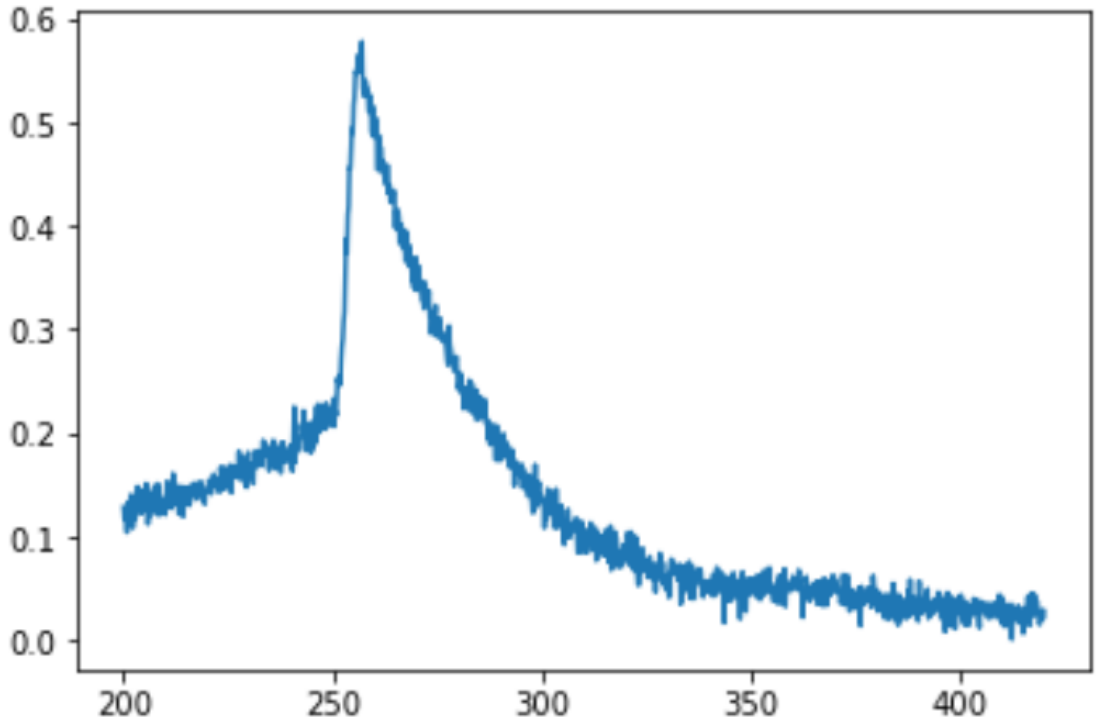
	0	1
0	200.0	0.128823
1	200.2	0.117582
2	200.4	0.125130
3	200.6	0.121738
4	200.8	0.104534
...	...	...
1096	419.2	0.022818
1097	419.4	0.025858
1098	419.6	0.029388
1099	419.8	0.021187
1100	420.0	0.028926

1101 rows × 2 columns

实操：谱图平滑

In [4]:
```
1  import numpy as np
2
3  wl = np.array(df[0])
4  Abs = np.array(df[1])
```

In [5]:
```
1  import matplotlib.pyplot as plt
2  plt.plot(wl, Abs)
3  plt.show()
```

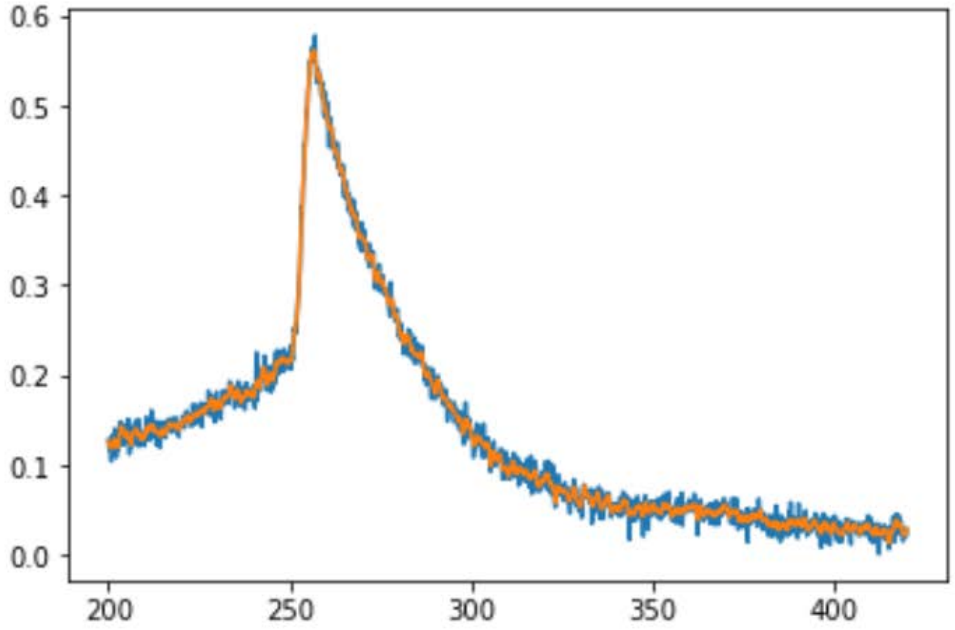


实操：谱图平滑

Savitzky-Golay平滑法

In [6]:
```
from scipy.signal import savgol_filter
Abs_smooth = savgol_filter(Abs, 9, 2)
```

In [9]:
```
plt.plot(wl, Abs)
plt.plot(wl, Abs_smooth)
plt.show()
```



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可视化

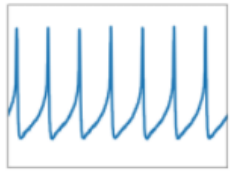
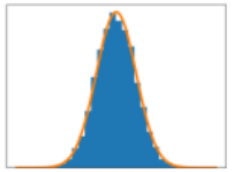
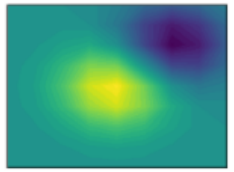
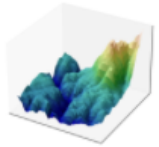
matplotlib Version 3.4.3

matplotlib库

https://matplotlib.org

Matplotlib: Visualization with Python

Matplotlib is a comprehensive library for creating static, animated, and interactive visualizations in Python.

Matplotlib makes easy things easy and hard things possible.

Create

- Develop publication quality plots with just a few lines of code
- Use interactive figures that can zoom, pan, update...

Customize

- Take full control of line styles, font properties, axes properties...
- Export and embed to a number of file formats and interactive environments

Extend

- Explore tailored functionality provided by third party packages
- Learn more about Matplotlib through the many external learning resources

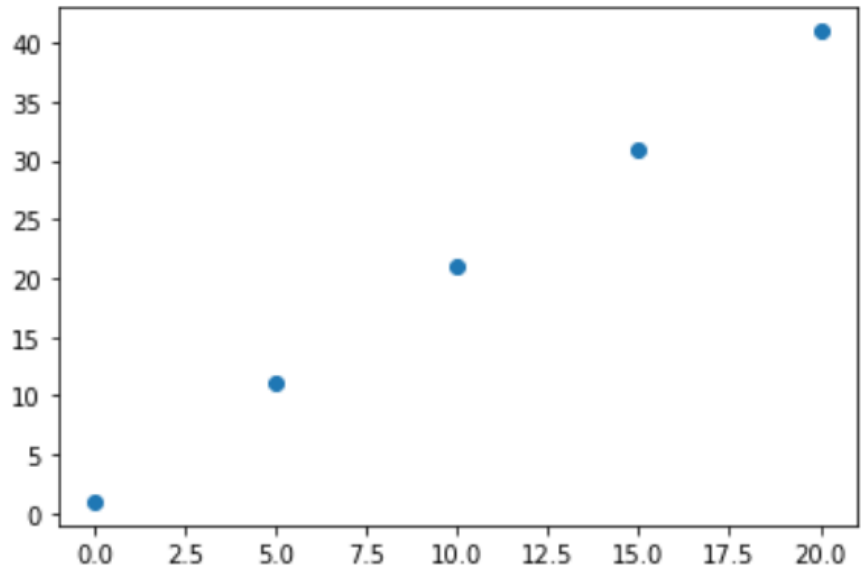
实操：散点图的绘制

```
In [1]: import numpy as np
        import matplotlib.pyplot as plt

In [2]: x = np.linspace(0, 20, 5)
        y = 2 * x + 1

In [3]: plt.scatter(x, y)

Out[3]: <matplotlib.collections.PathCollection at 0x248c8f8f550>
```



linspace()
在指定的间隔内返回均匀间隔的数字

x = [0, 5, 10, 15, 20]

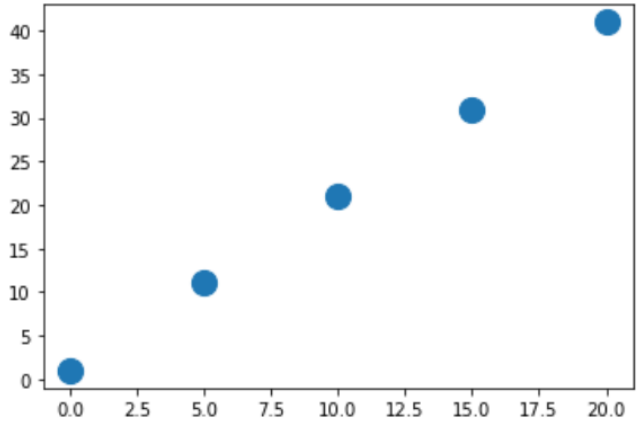
y = [1, 11, 21, 31, 41]

图像点调整

调整点的大小

s=200

```
In [4]: plt.scatter(x, y, s=200)
Out[4]: <matplotlib.collections.PathCollection at 0x2bfad90aaf0>
```

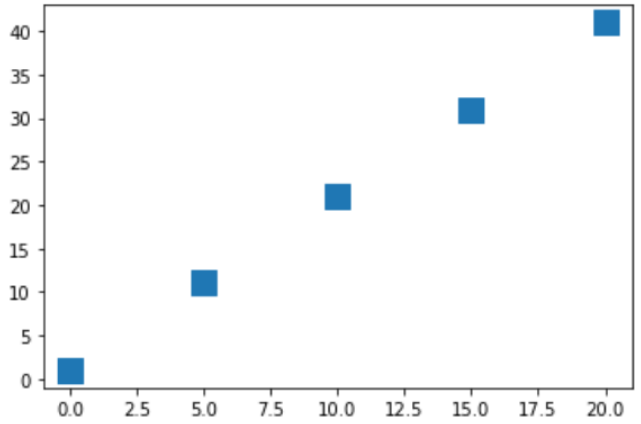


调整点的形状

marker=','

marker='v'

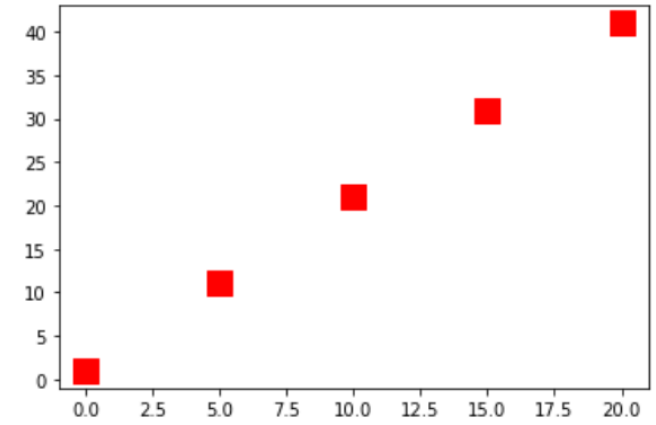
```
In [5]: plt.scatter(x, y, s=200, marker=',')
Out[5]: <matplotlib.collections.PathCollection at 0x2bfad985d60>
```



调整点的颜色

c='red'

```
In [6]: plt.scatter(x, y, s=200, marker=',', c='red')
Out[6]: <matplotlib.collections.PathCollection at 0x2bfad9ff670>
```



常用颜色

color = 或c =	颜色	样例
None	靛青色	
‘b’或’blue’	蓝色	
‘g’或’green’	绿色	
‘r’或’red’	红色	
‘c’	青色(cyan)	
‘m’	品红色(magenta)	
‘y’	黄色(yellow)	
‘k’或’black’	黑色	
‘w’或’white’	白色	

坐标调整

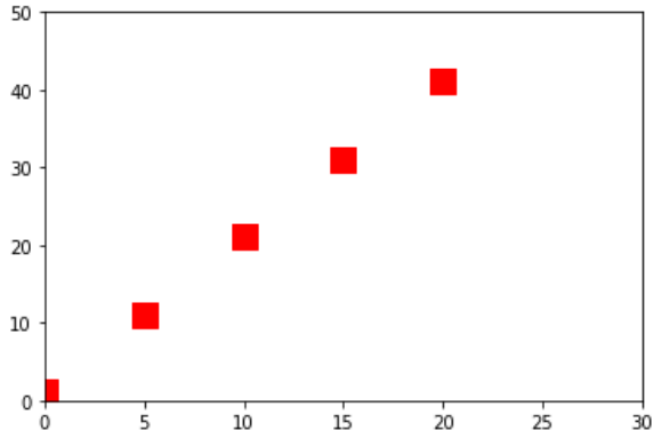
调整坐标轴大小

plt.xlim((0, 30))

```
In [7]: plt.xlim((0, 30))
        plt.ylim((0, 50))

        plt.scatter(x, y, s=200, marker=',', c='red')
```

```
Out[7]: <matplotlib.collections.PathCollection at 0x269cc785cd0>
```



调整坐标轴刻度

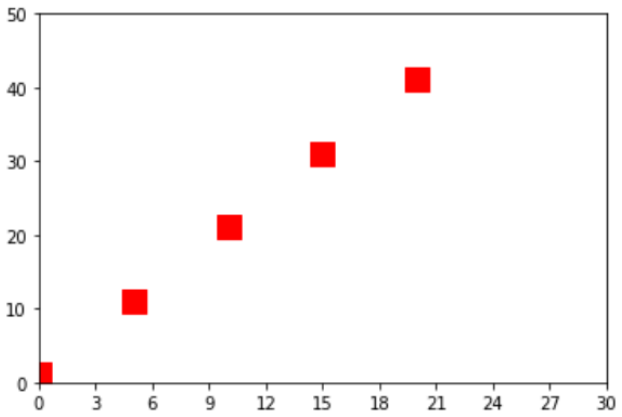
plt.xticks()

```
In [8]: plt.xlim((0, 30))
        plt.ylim((0, 50))

        x_ticks = np.linspace(0, 30, 11)
        plt.xticks(x_ticks)

        plt.scatter(x, y, s=200, marker=',', c='red')
```

```
Out[8]: <matplotlib.collections.PathCollection at 0x269cc7eb4f0>
```



调整坐标轴标签

plt.xlabel()

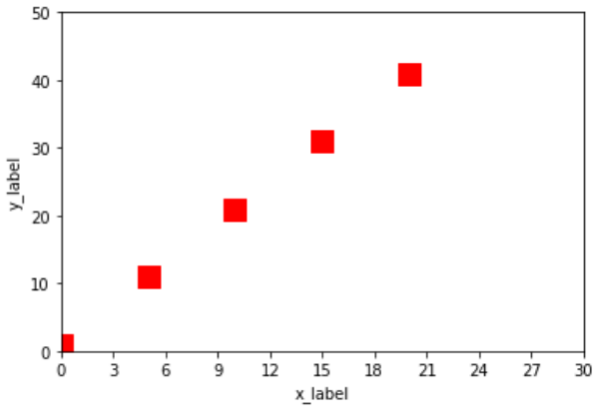
```
In [9]: plt.xlim((0, 30))
        plt.ylim((0, 50))

        x_ticks = np.linspace(0, 30, 11)
        plt.xticks(x_ticks)

        plt.xlabel('x_label')
        plt.ylabel('y_label')

        plt.scatter(x, y, s=200, marker=',', c='red')
```

```
Out[9]: <matplotlib.collections.PathCollection at 0x269cc86ff40>
```

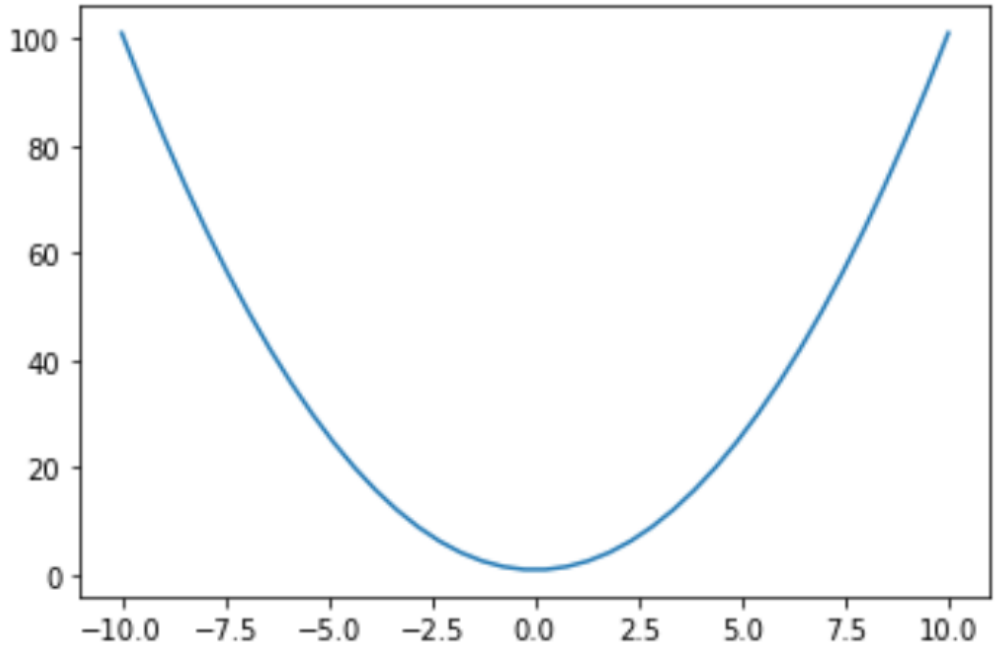


实操：简单函数绘图

y = x^2 + 1

```
In [10]: x = np.linspace(-10, 10, 40)
         y = x * x + 1
         plt.plot(x, y)
```

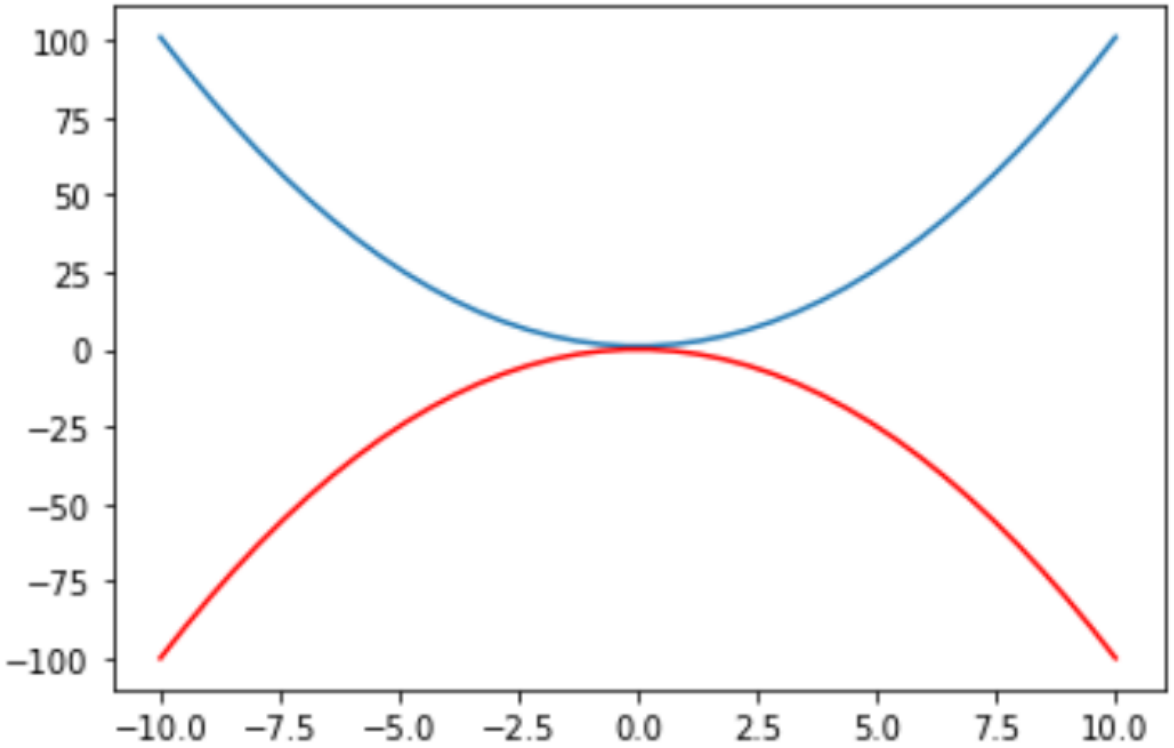
```
Out[10]: [<matplotlib.lines.Line2D at 0x264d5962460>]
```



同一个图绘制多个函数

In [11]:
```
x = np.linspace(-10, 10, 40)
y = x * x + 1
y0 = -x * x
plt.plot(x, y)
plt.plot(x, y0, c='red')
```

Out[11]: [<matplotlib.lines.Line2D at 0x14b9dbf9130>]

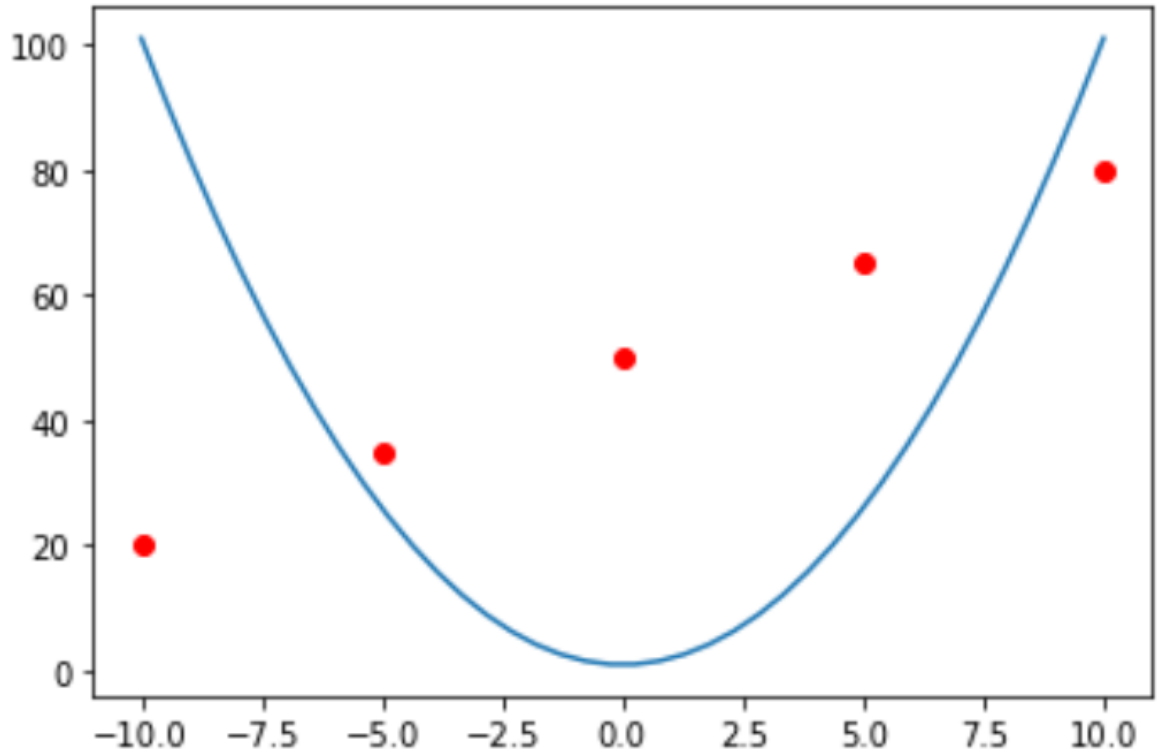


同时绘制散点与线

In [12]:
```
x2 = np.linspace(-10, 10, 5)
y2 = 3 * x2 + 50

plt.scatter(x2, y2, c='red')
plt.plot(x, y)
```

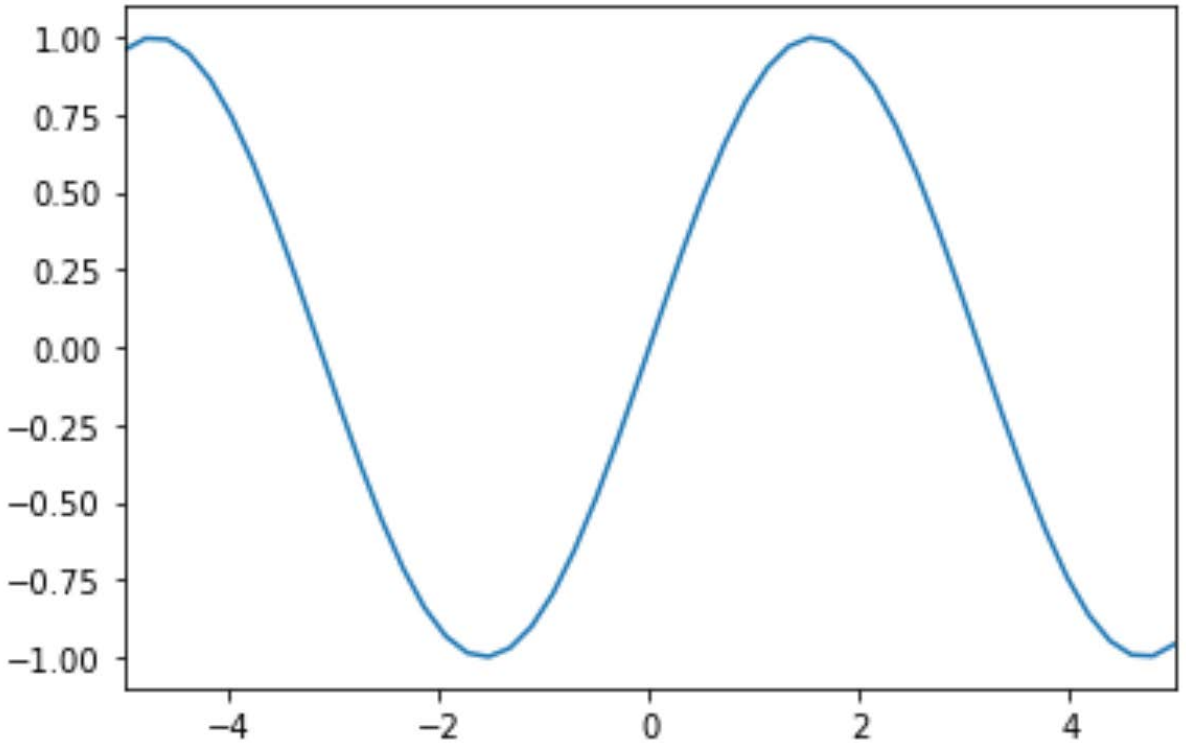
Out[12]:
```
[<matplotlib.lines.Line2D at 0x14b9dc63d30>]
```



练习：绘制正弦函数图像

绘制x在(-5,5)范围内正弦函数 y = sin(x) 的图像

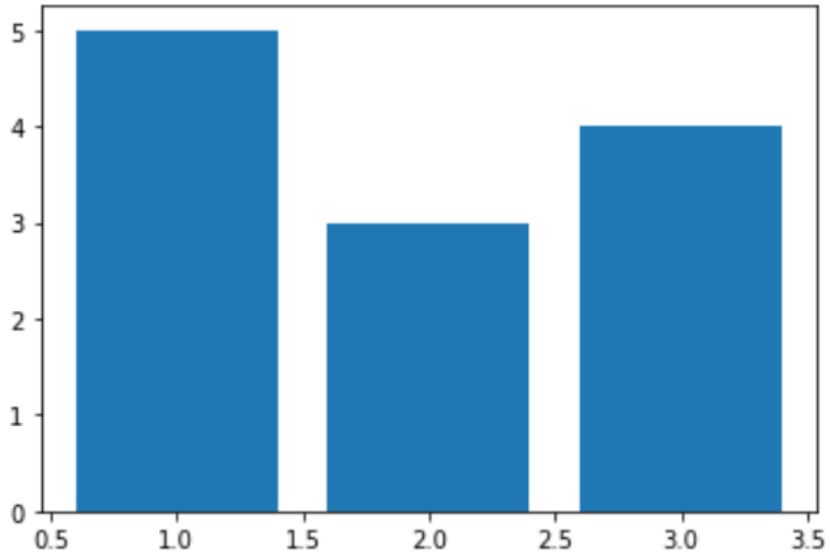
提示：sin函数调用方法为np.sin()



柱状图

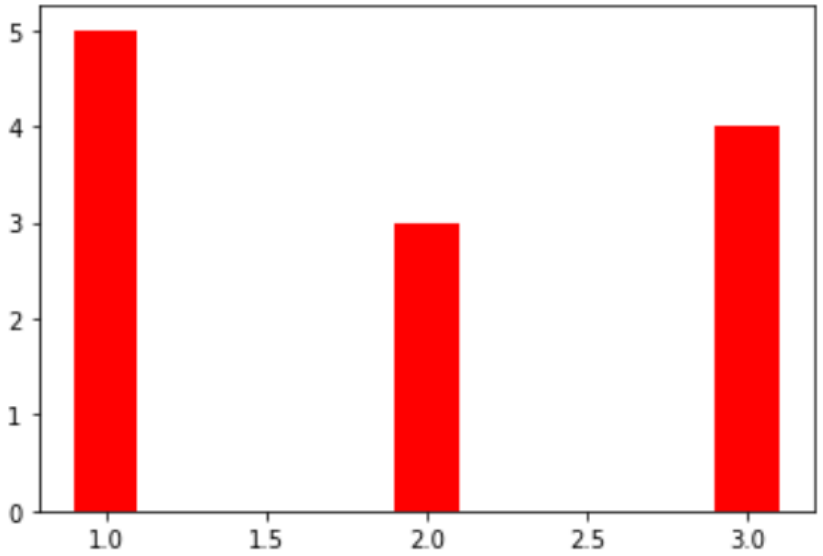
In [5]:
```
x = [1, 2, 3]
y = [5, 3, 4]
plt.bar(x, y)
```

Out[5]: <BarContainer object of 3 artists>



In [6]:
```
plt.bar(x, y, width = 0.2, color = 'r')
```

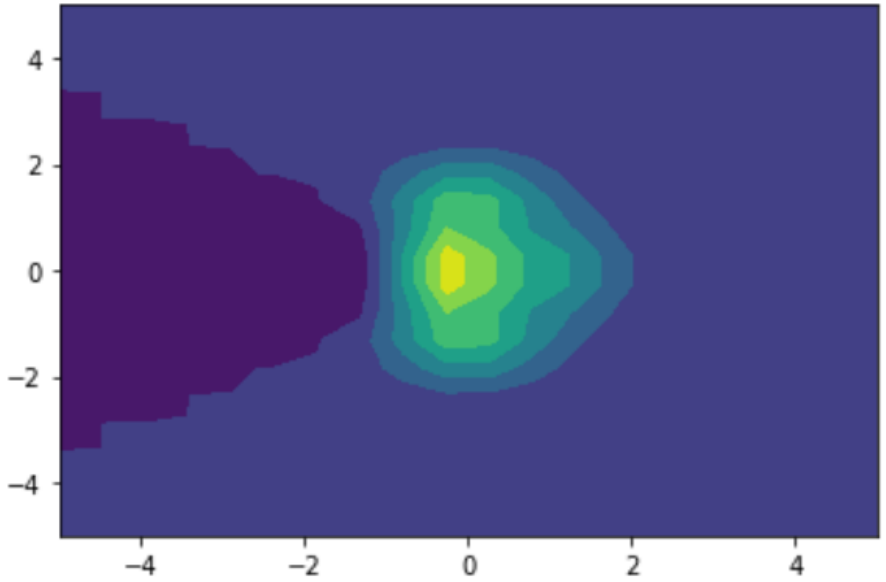
Out[6]: <BarContainer object of 3 artists>



阅读材料：二维图

In [7]:
```
x = np.linspace(-5, 5, 20)
y = np.linspace(-5, 5, 20)
X, Y = np.meshgrid(x, y)
Z = (1-X/2 + X**3 + Y**4)*np.exp(-X**2-Y**2)
plt.contourf(X, Y, Z)
```

Out[7]: <matplotlib.contour.QuadContourSet at 0x28fd484bd00>



In [8]:
```
x = np.linspace(-5, 5, 20)
y = np.linspace(-5, 5, 20)
X, Y = np.meshgrid(x, y)
Z = (1-X/2 + X**3 + Y**4)*np.exp(-X**2-Y**2)
plt.pcolormesh(X, Y, Z)
```

```
C:\Users\26093\AppData\Local\Temp/ipykernel_30172/2048871572.py:5: Mat
imensions as C is deprecated since 3.3.  Either specify the corners of
'gouraud', or set rcParams['pcolor.shading'].  This will become an err
  plt.pcolormesh(X, Y, Z)
```

Out[8]: <matplotlib.collections.QuadMesh at 0x28fd47fbb20>