湖北大学
HUBEI UNIVERSITY

人工智能技术与应用实验

课程简介

- **评分标准（暂定）**
  - ✓ 共6次实验，需提交实验报告，每次20分；
  - ✓ 选取5个最高分相加，作为最终成绩；
  - ✓ 6次实验报告均需要提交，不能只提交5次。缺少1次按不及格处理。
- **实验安排**
  - ✓ 本学期前2周和最后2周不布置作业；
  - ✓ 第3-14周，每2周完成一次实验，并提交实验报告。
- **出勤要求**
  - ✓ 不允许缺席。缺席1次扣5分，累计缺席3次按不及格处理。

课程简介

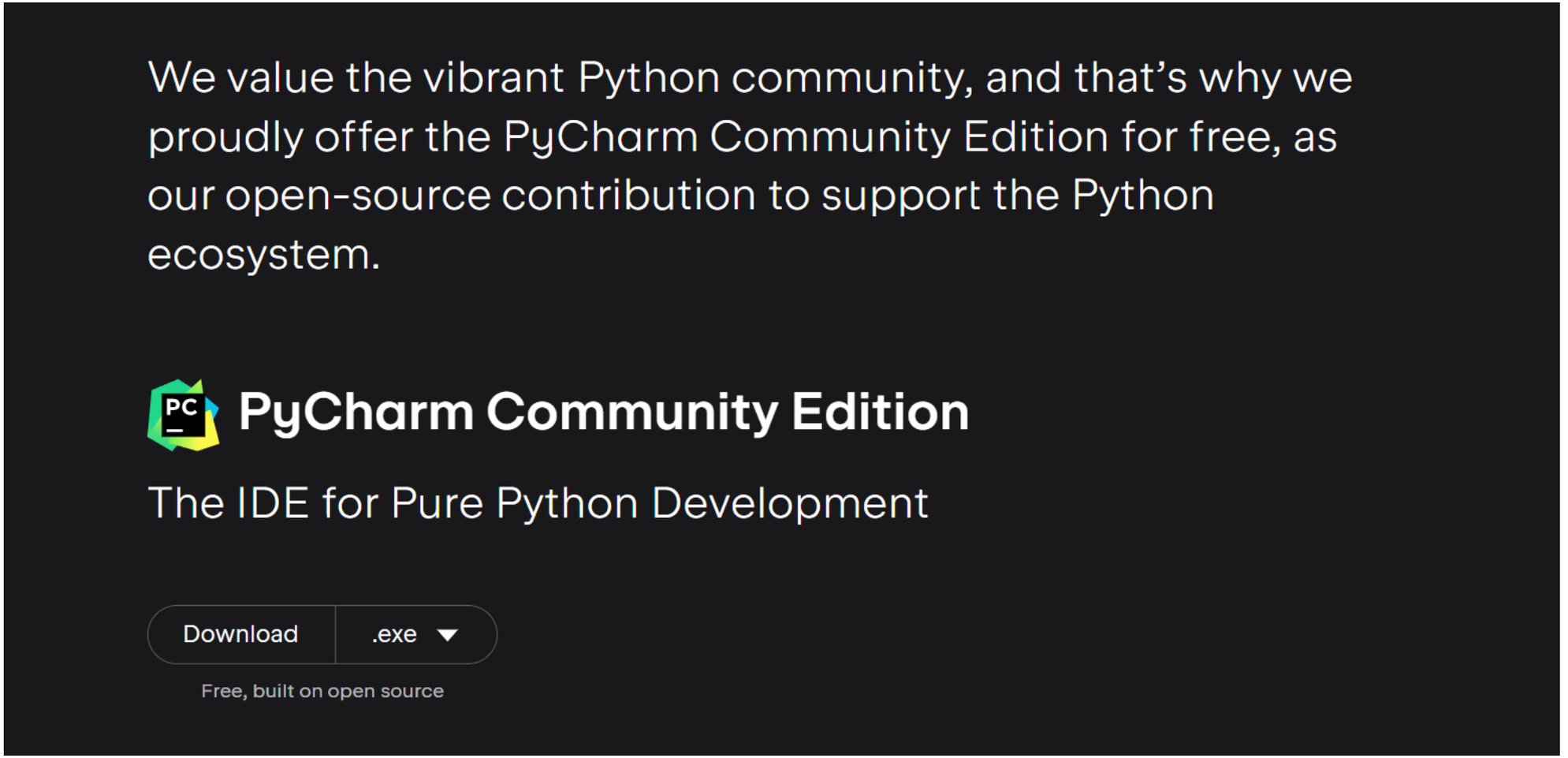
- **预备知识**
  - ✓ Python基础
  - ✓ 在本学期的前2周完成对Python基础语法的自学（或复习）
- **推荐书目：《A Byte of Python》**
  - ✓ 英文原版：http://python.swaroopch.com/
  - ✓ 中文版下载地址：https://liding320.github.io/

本周实验内容

- 安装Python的开发环境 PyCharm
- 安装Python的第三方库管理工具 Anaconda
- 在Anaconda中配置环境
- 在PyCharm中创建项目，并使用已配置的环境
- 绘图库Matplotlib入门

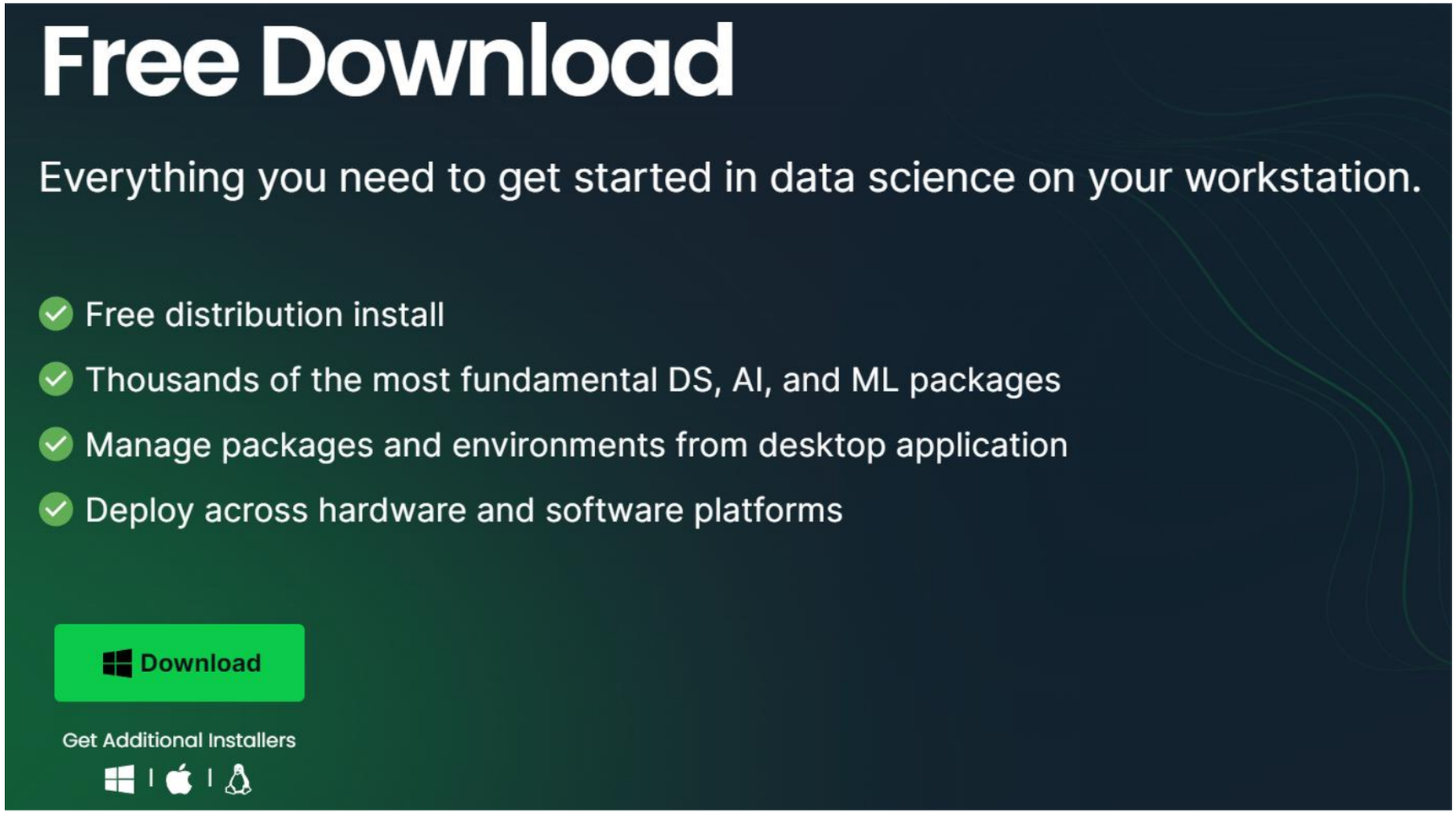
安装Python的开发环境

- **PyCharm Community Edition**
  - ✓ 下载地址： https://www.jetbrains.com/pycharm/download/

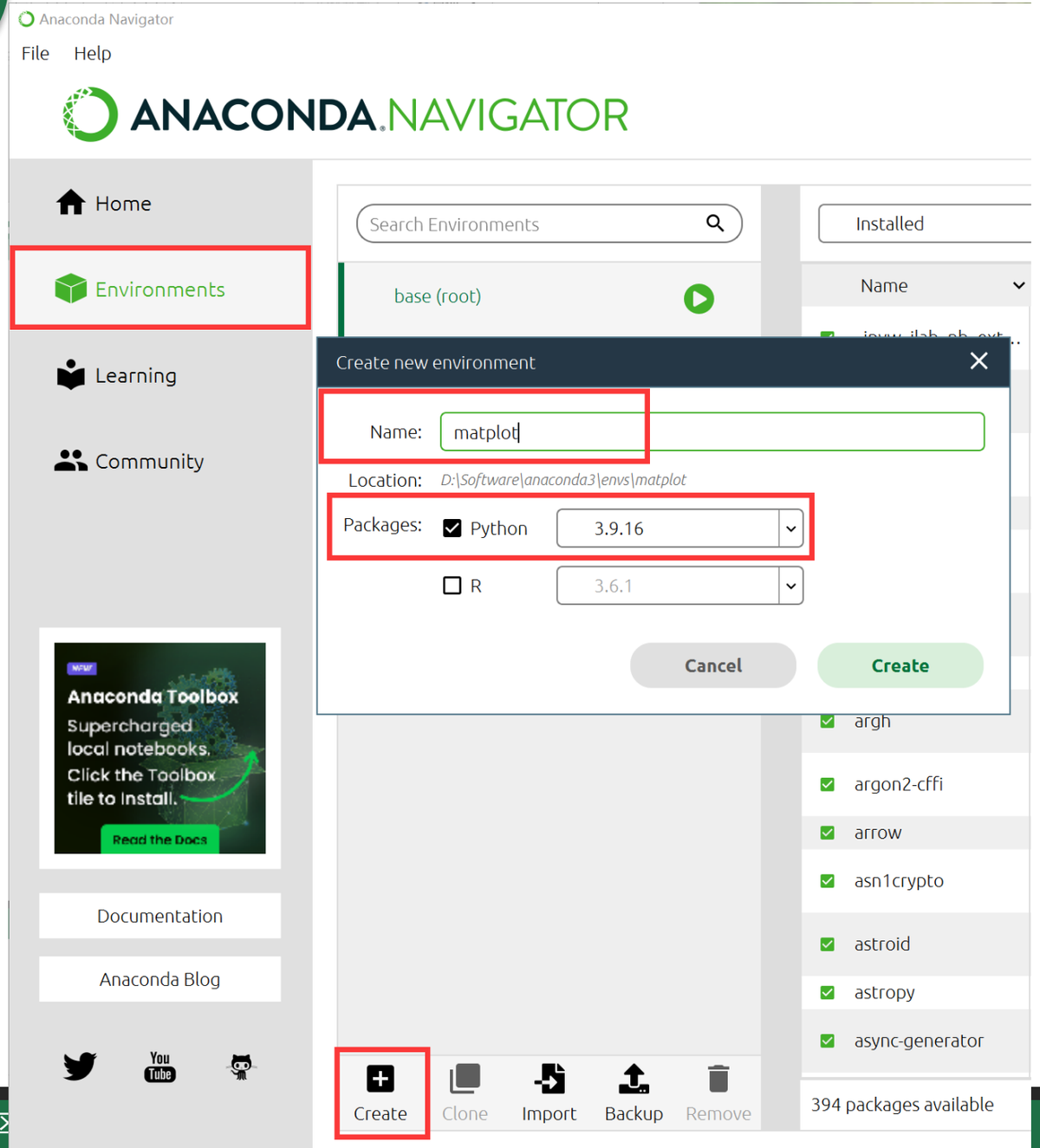


安装Python的第三方库管理工具

- **Anaconda**
  - ✓ 下载地址：https://www.anaconda.com/download/

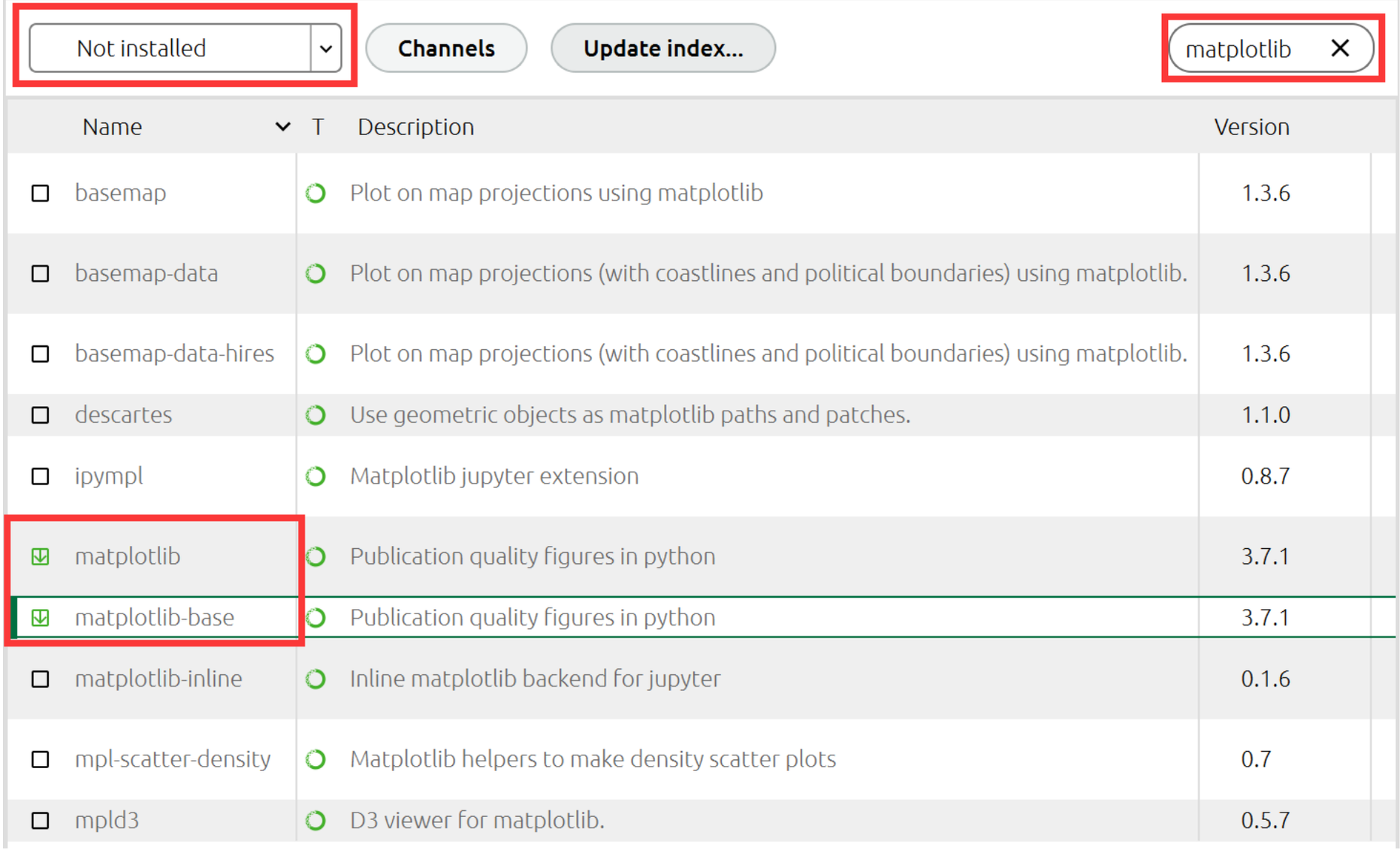


在Anaconda中配置一个新环境

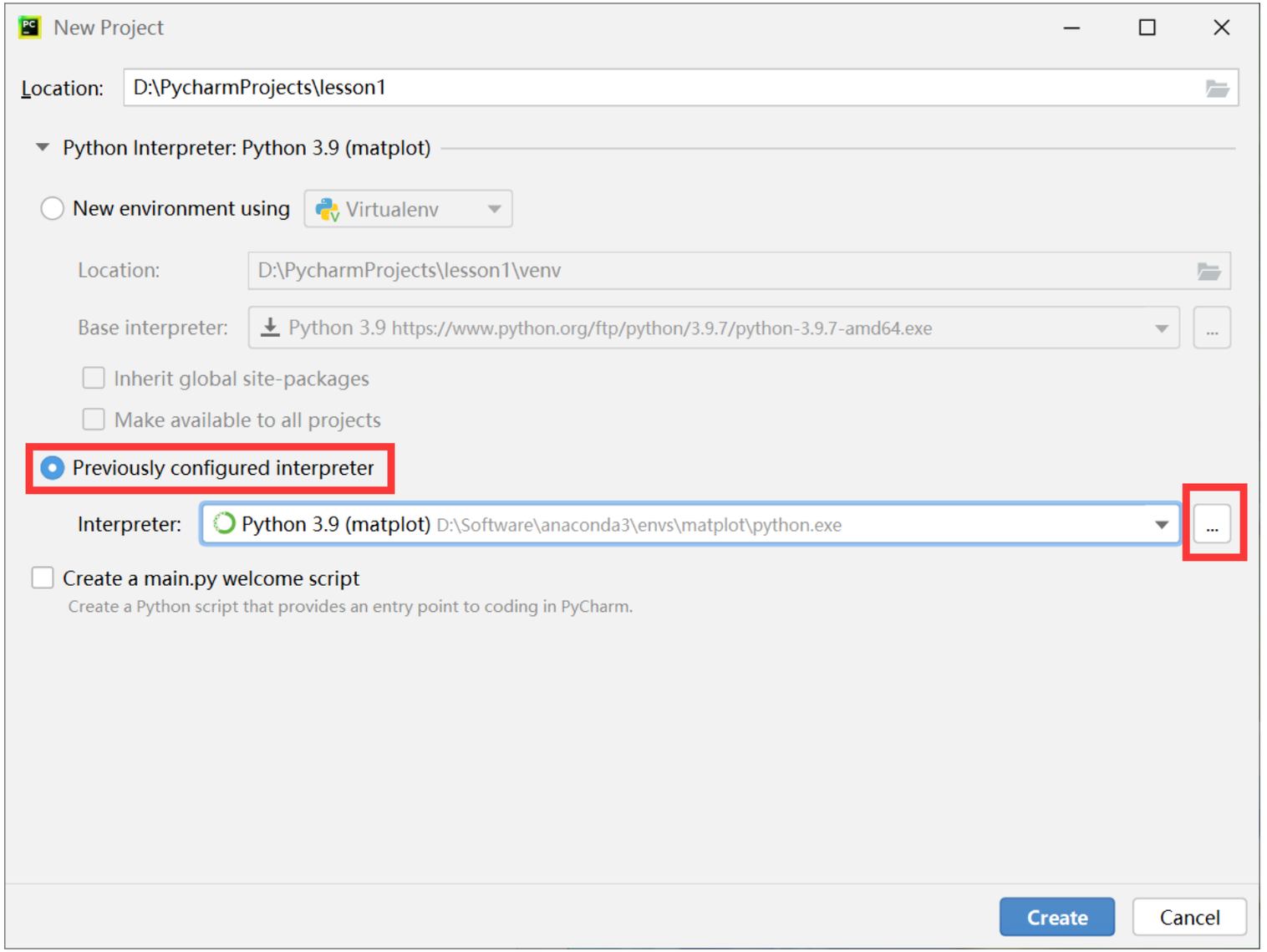


- 打开Anaconda Navigator
- 点击左侧的Environments
- 点击左下方的Create
- 填写Name，Packages勾选Python

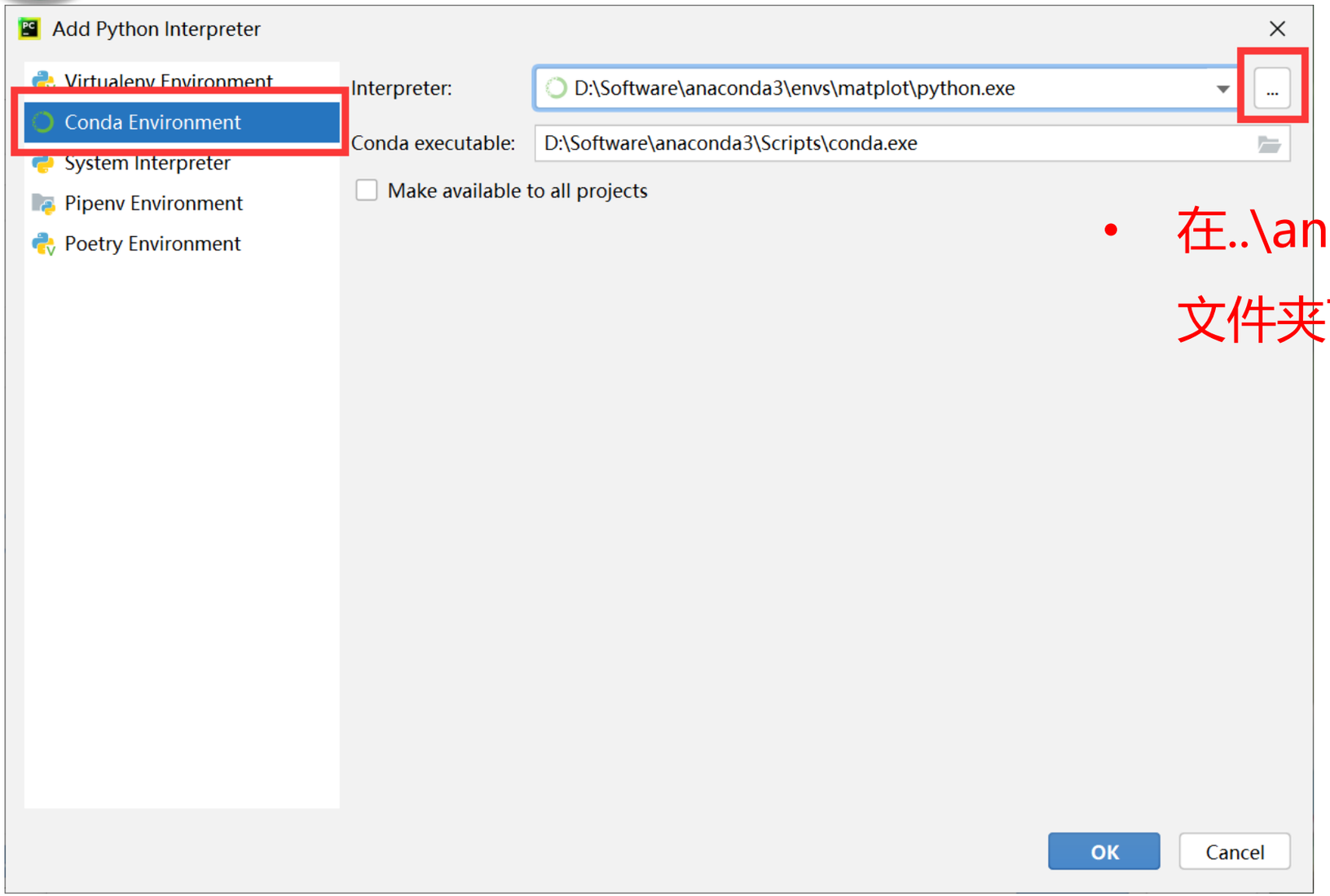
在Anaconda中配置一个新环境



创建一个Python项目

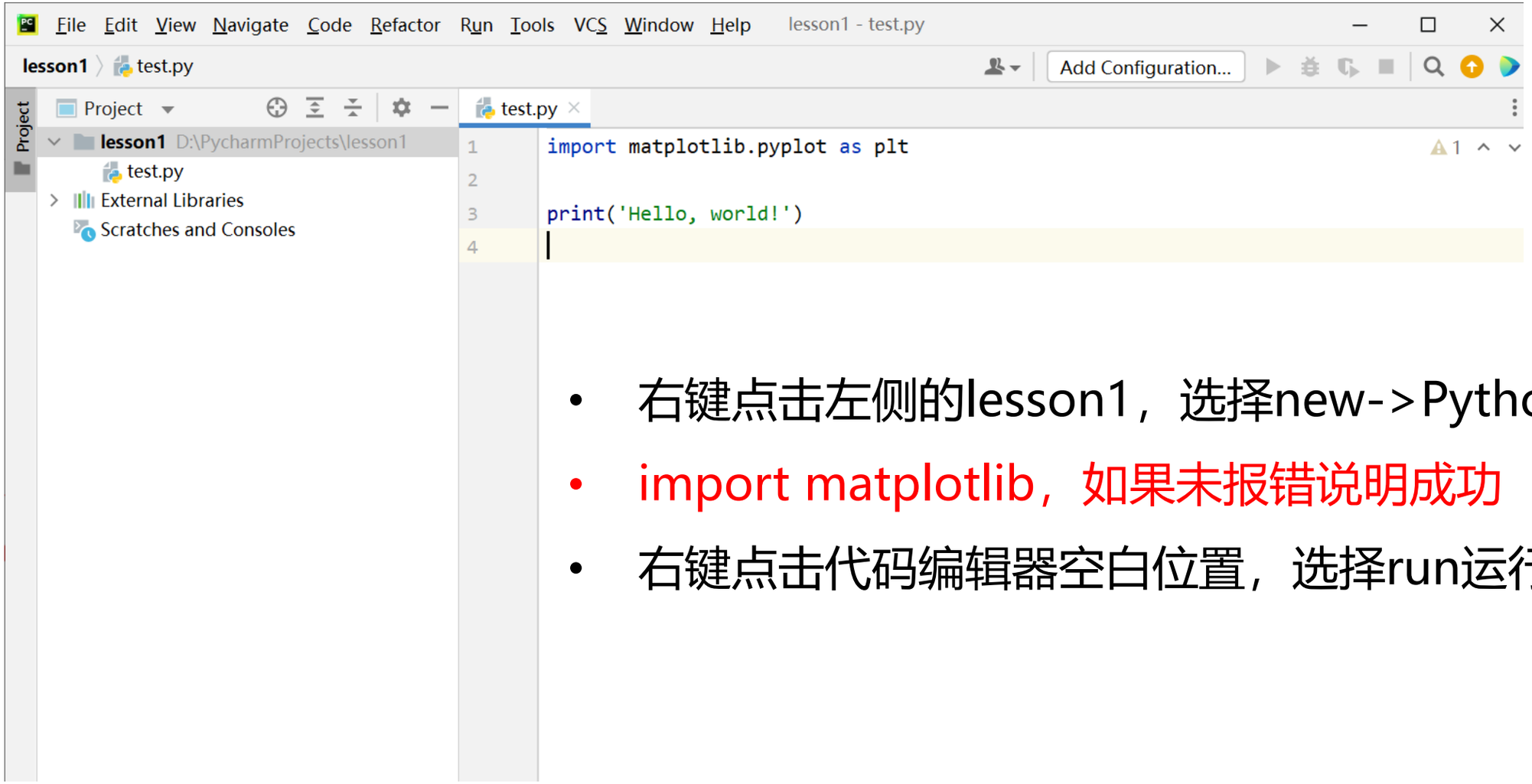


创建一个Python项目



- 在..\anaconda3\envs\matplot\文件夹下找到python.exe

创建一个Python项目

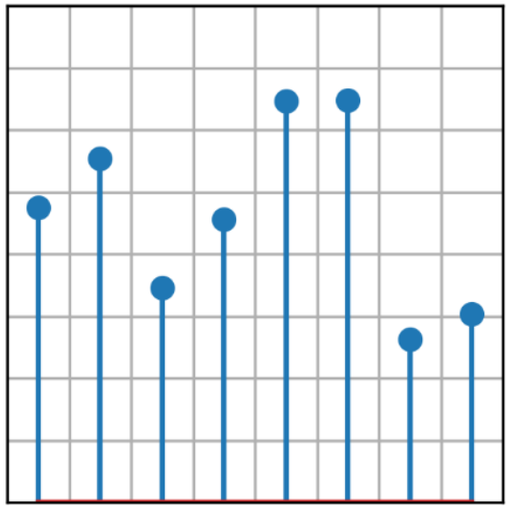


- 右键点击左侧的lesson1，选择new->Python File
- import matplotlib，如果未报错说明成功
- 右键点击代码编辑器空白位置，选择run运行程序

Matplotlib入门

官方网站：https://matplotlib.org/

matplotlib Plot types User guide Tutorials Examples Reference Contribute Releases



stem(x, y)

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 publication quality plots.
- Make interactive figures that can zoom, pan, update.
- Customize visual style and layout.
- Export to many file formats.
- Embed in JupyterLab and Graphical User Interfaces.
- Use a rich array of third-party packages built on Matplotlib.

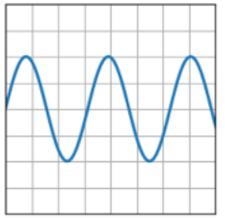
Try Matplotlib (on Binder) →

Matplotlib入门

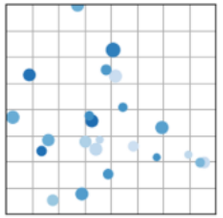
- **作用：**绘制论文中的插图，实现实验数据的可视化

Pairwise data

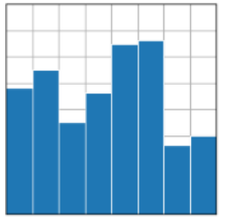
Plots of pairwise (x, y), tabular $(var\_0, \cdots, var\_n)$, and functional $f(x) = y$ data.



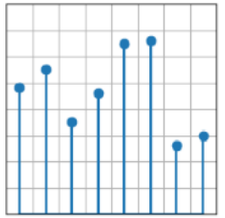
plot(x, y)



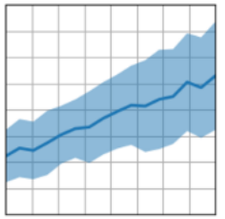
scatter(x, y)



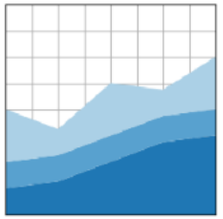
bar(x, height)



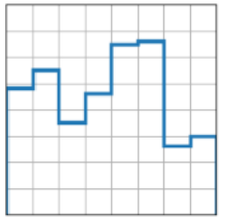
stem(x, y)



fill_between(x, y1, y2)



stackplot(x, y)

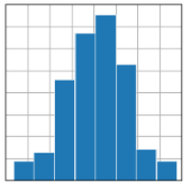


stairs(values)

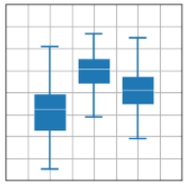
Matplotlib入门

Statistical distributions

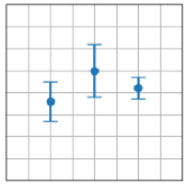
Plots of the distribution of at least one variable in a dataset. Some of these methods also compute the distributions.



hist(x)

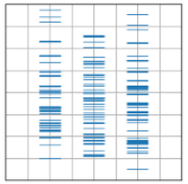


boxplot(X)

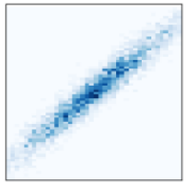


errorbar(x, y, yerr, xerr)

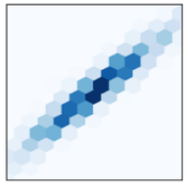
violinplot(D)



eventplot(D)

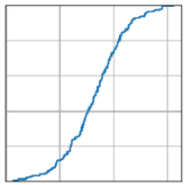


hist2d(x, y)



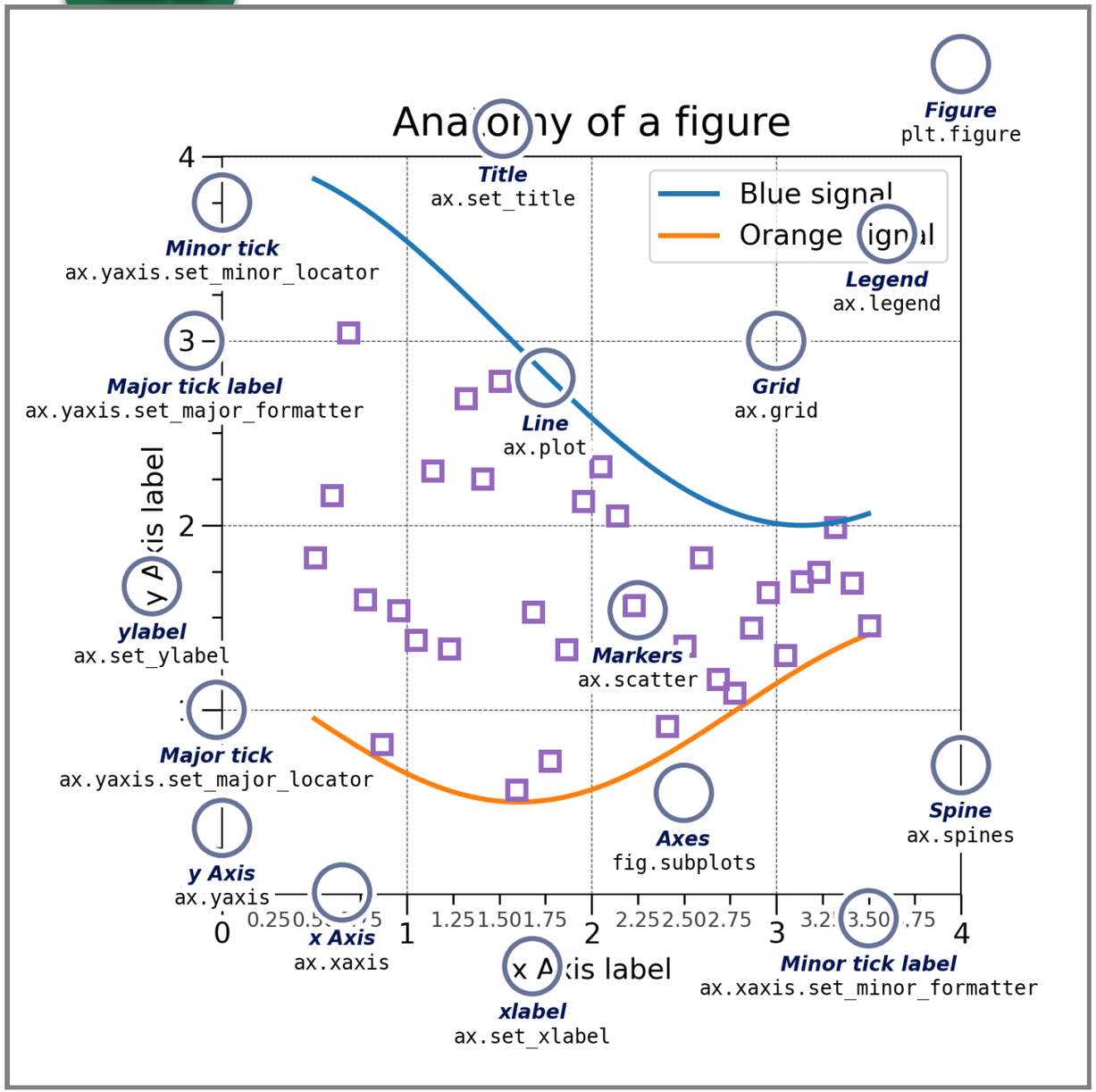
hexbin(x, y, C)

pie(x)



ecdf(x)

Matplotlib入门

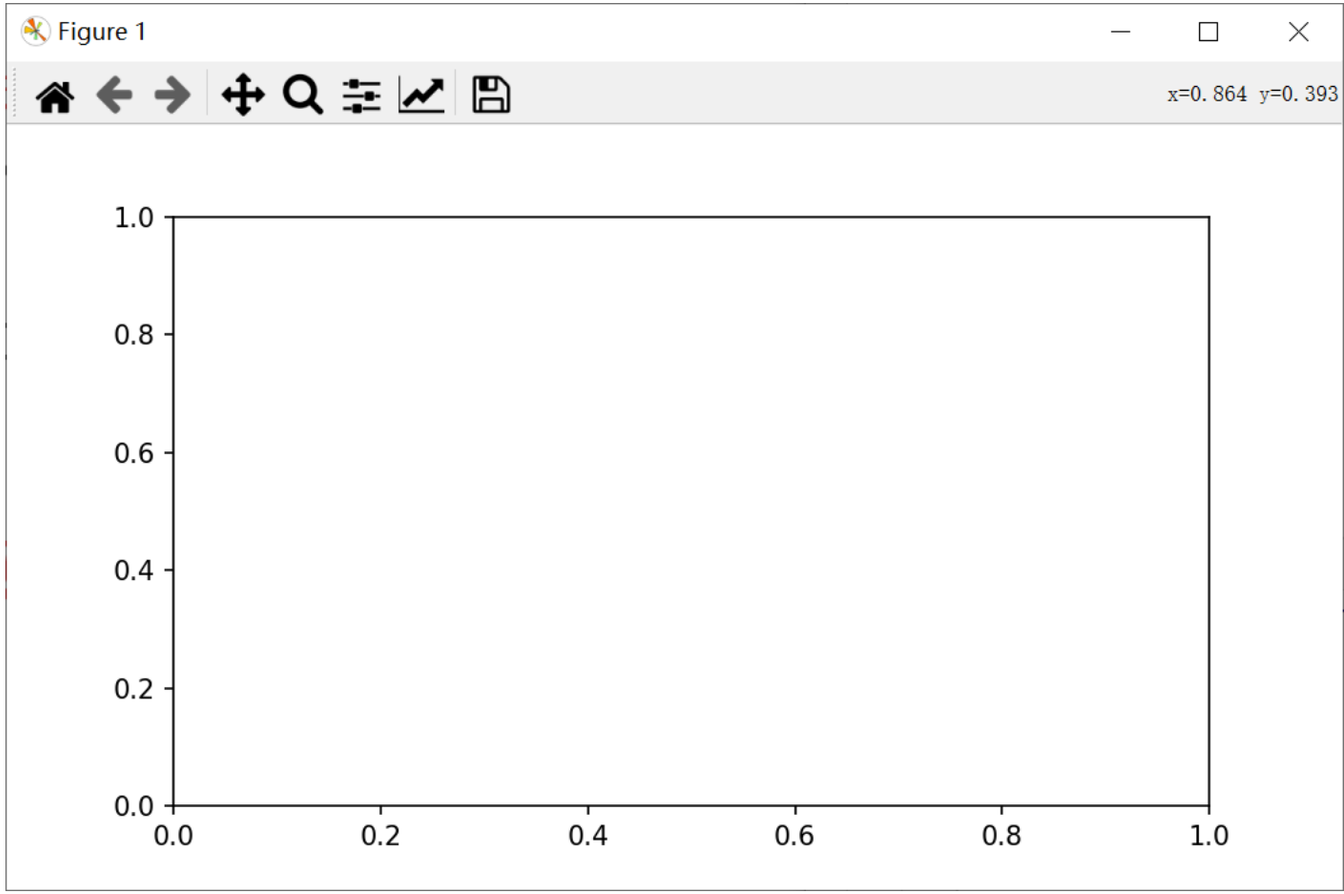


- **左图中的圆圈：**你可以绘制（修改）的部分
- **如何使用Matplotlib画图：**调用API绘制左图中的圆圈部分，如Title（标题），Legend（图例），Line（曲线样式），Spine（边框），xlabel，ylabel（x轴和y轴的含义）等
- **翻译问题：**Figure此处不是图，而是画布的意思；Axes此处不是坐标轴，而是图的意思；x Axis和y Axis才是坐标轴。

Matplotlib入门

- **第一步：使用plt.subplots()创建画布和图**

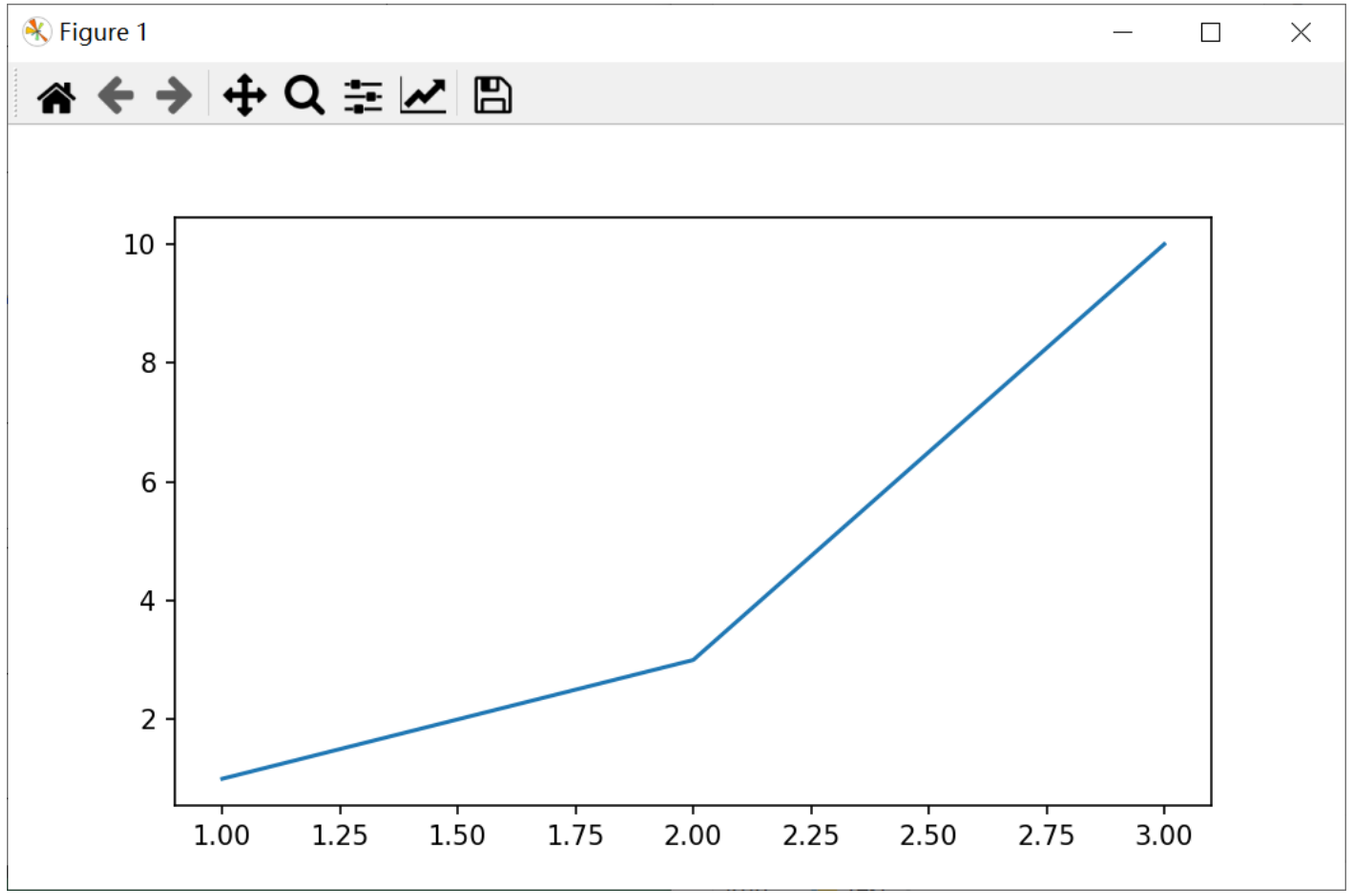
```
import matplotlib.pyplot as plt

# fig是画布，ax是图
# 参数figsize用于固定图的比例
fig, ax = plt.subplots(figsize=(7,4))

plt.show()
```



Matplotlib入门

- **第二步：绘制数据（以折线图为例）**

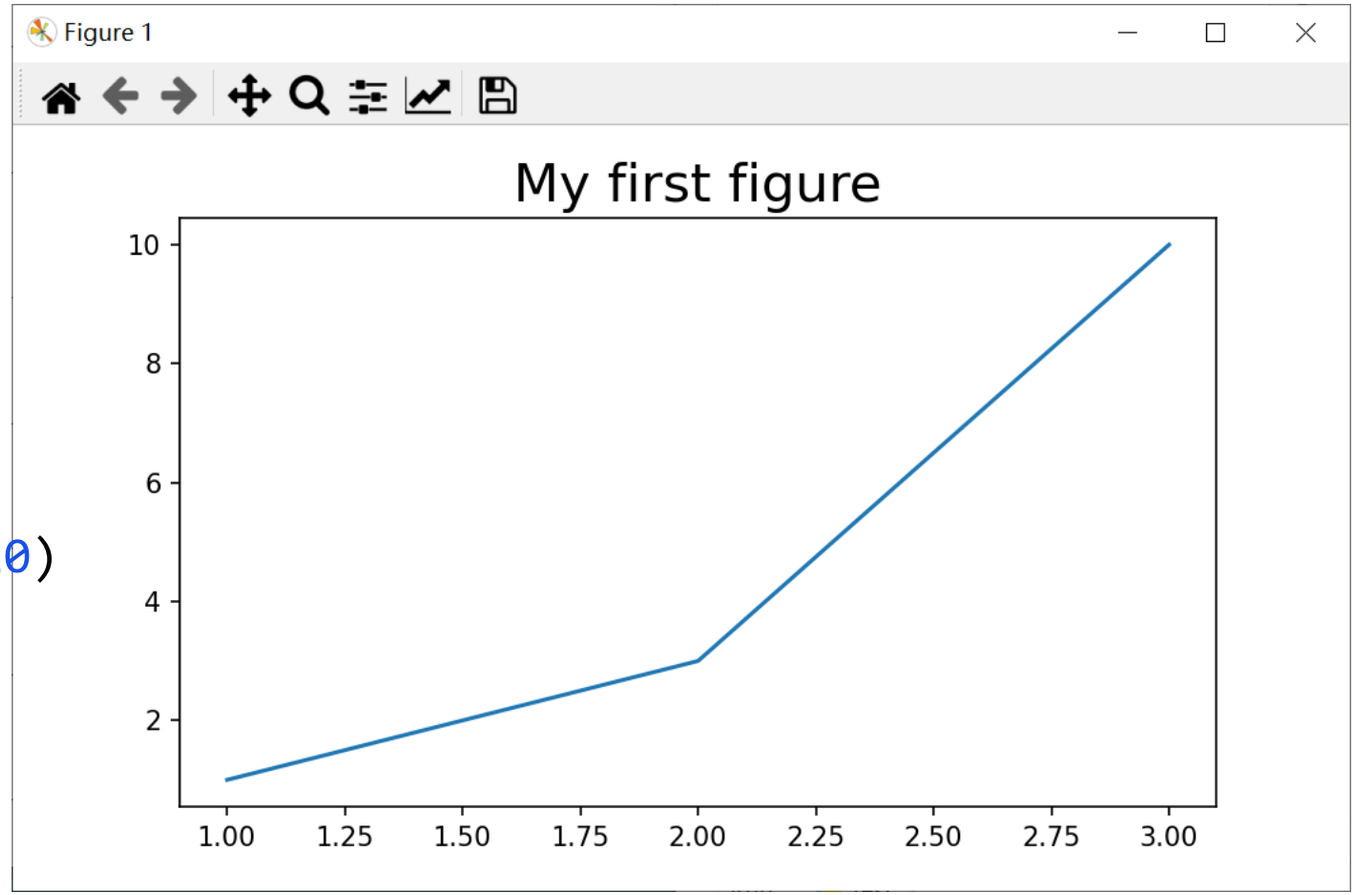
```
import matplotlib.pyplot as plt

# 数据(1,1), (2,3), (3,10)
x = [1, 2, 3]
y = [1, 3, 10]

fig, ax = plt.subplots(figsize=(7,4))

# 绘制折线图
ax.plot(x, y)

plt.show()
```



Matplotlib入门

- **第三步：添加亿点点细节（添加标题）**

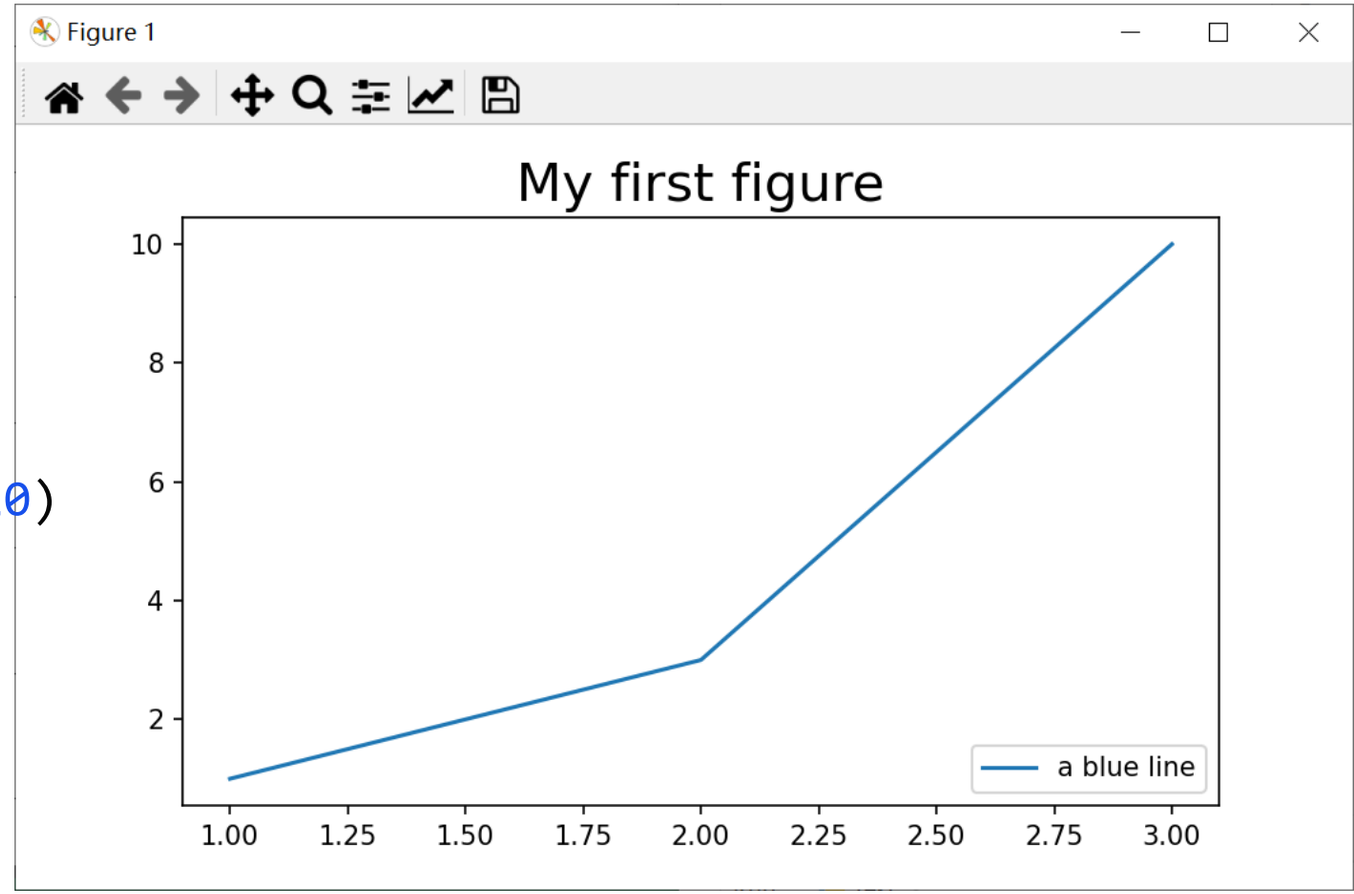
```
import matplotlib.pyplot as plt

x = [1, 2, 3]
y = [1, 3, 10]

fig, ax = plt.subplots(figsize=(7,4))
ax.plot(x, y)

# 添加标题，设置字体大小
ax.set_title('My first figure', fontsize=20)

plt.show()
```



Matplotlib入门

- **第三步：添加亿点点细节（添加图例）**

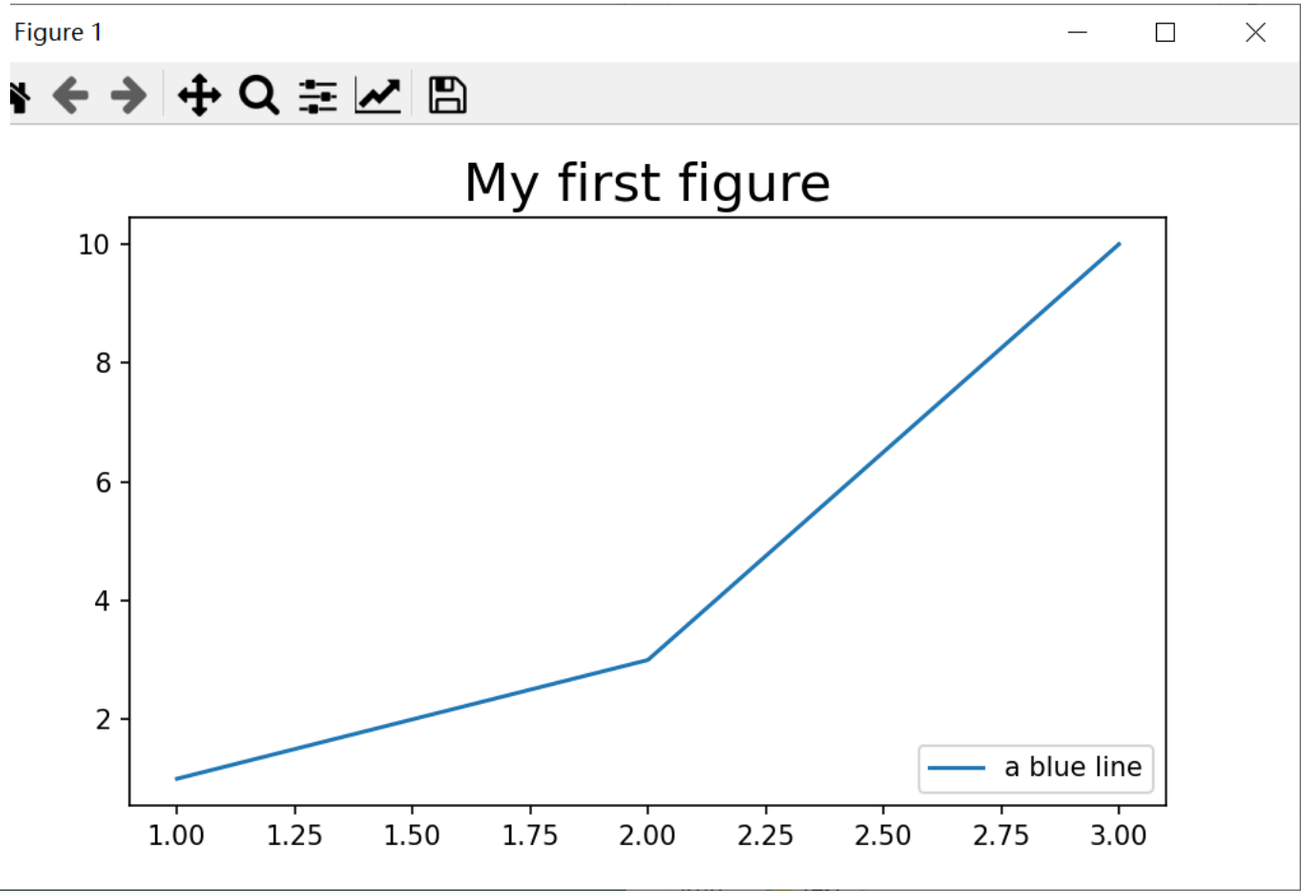
```
import matplotlib.pyplot as plt

x = [1, 2, 3]
y = [1, 3, 10]

fig, ax = plt.subplots(figsize=(7,4))

# 设置图例的label
ax.plot(x, y, label='a blue line')

ax.set_title('My first figure', fontsize=20)
# 显示图例，loc代表图例的位置
ax.legend(loc='lower right')

plt.show()
```



Matplotlib入门

- **第三步：添加亿点点细节（添加图例）**

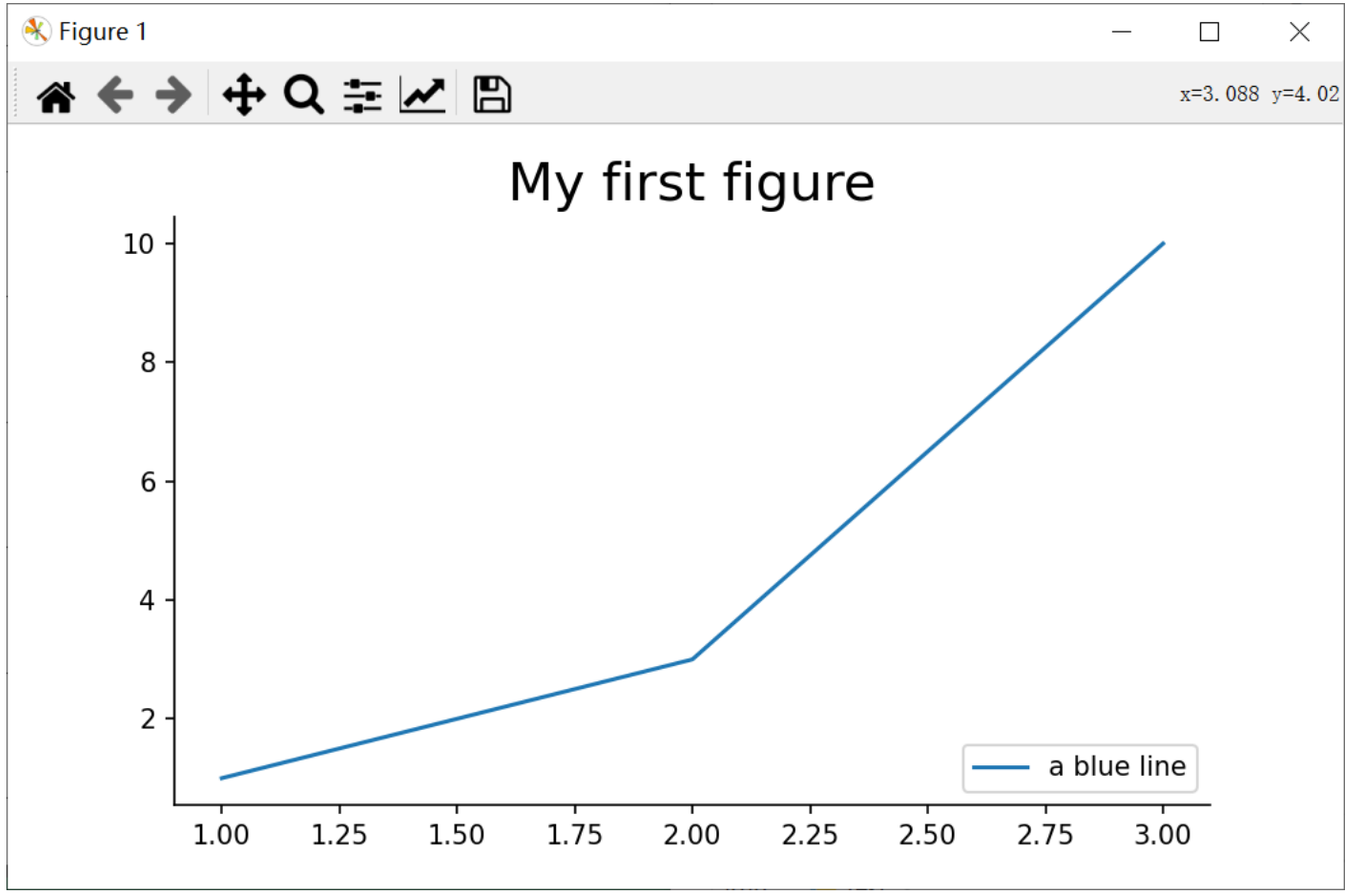
Location String	Location Code
'best' (Axes only)	0
'upper right'	1
'upper left'	2
'lower left'	3
'lower right'	4
'right'	5
'center left'	6
'center right'	7
'lower center'	8
'upper center'	9
'center'	10



Matplotlib入门

- **第三步：添加亿点点细节（去除边框）**

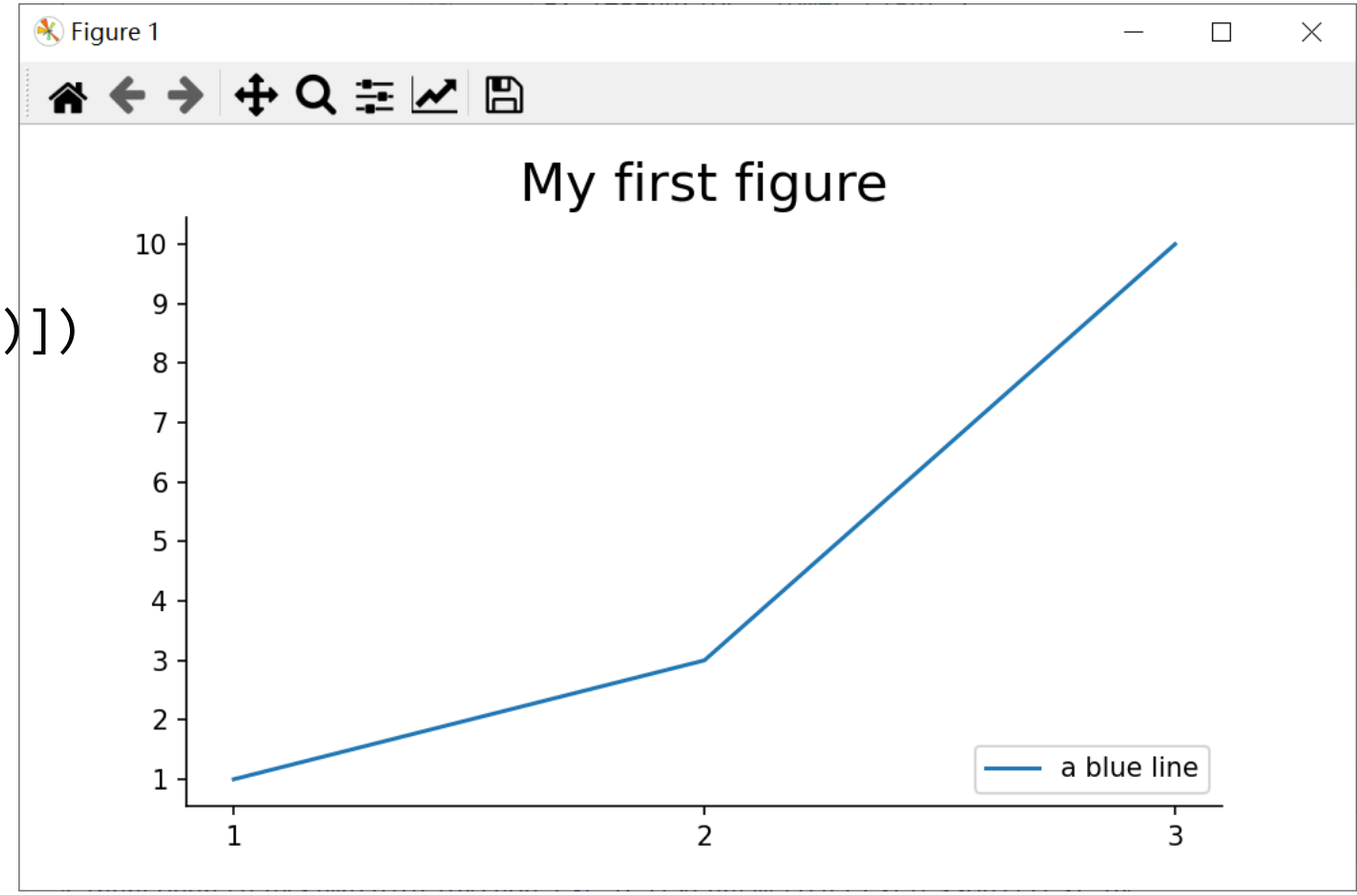
```
ax.set_title('My first figure', fontsize=20)
ax.legend(loc='lower right’ )

# 将上边框和右边框设置为不可见
ax.spines['top'].set_visible(False)
ax.spines['right'].set_visible(False)
```



Matplotlib入门

- **第三步：添加亿点点细节（设置x轴和y轴的刻度）**

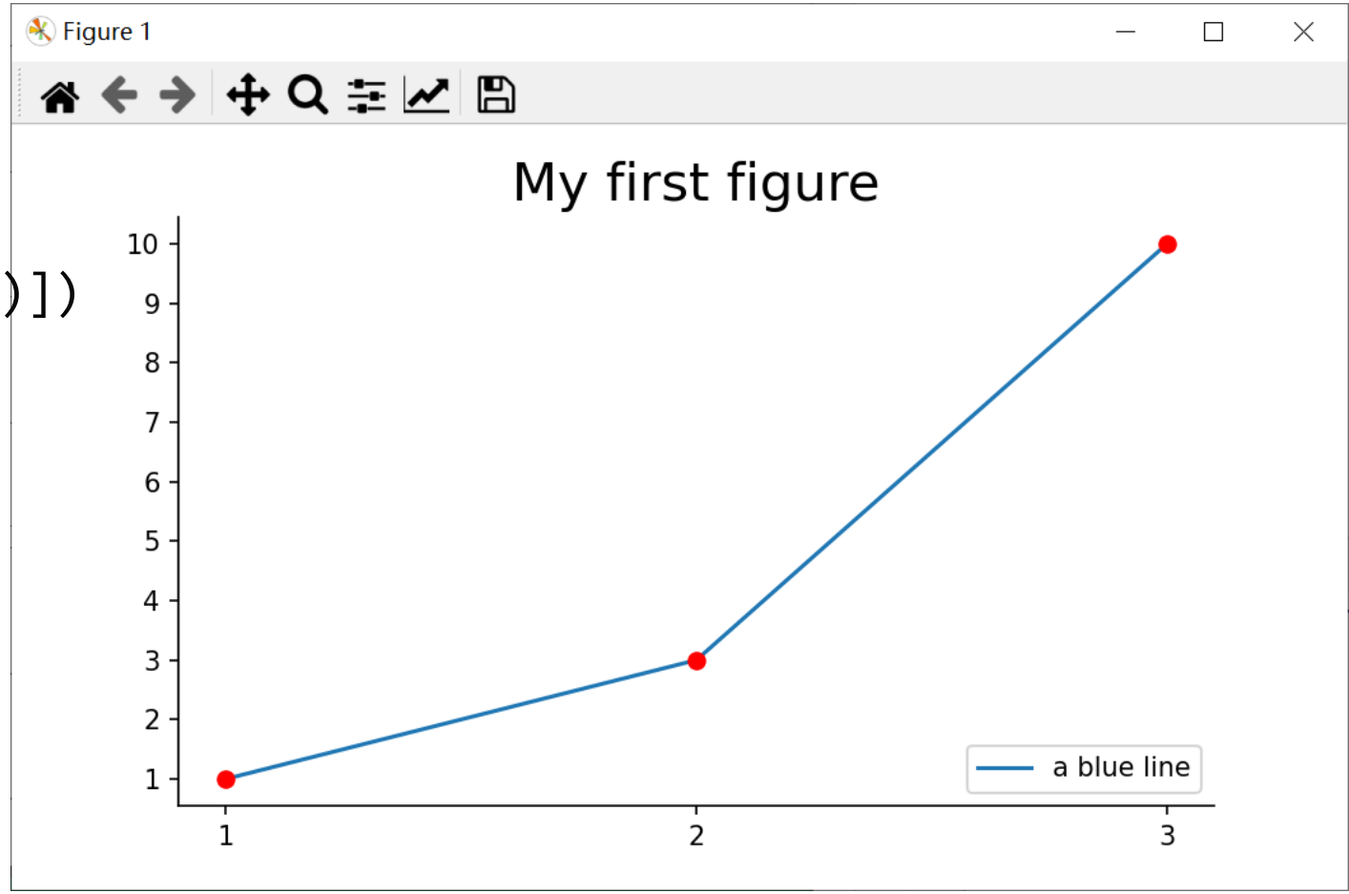
```
ax.set_title('My first figure', fontsize=20)
ax.legend(loc='lower right')
ax.spines['top'].set_visible(False)
ax.spines['right'].set_visible(False)

# 设置x轴和y轴的刻度
ax.xaxis.set_ticks([1, 2, 3])
ax.yaxis.set_ticks([y for y in range(1, 11)])
```



Matplotlib入门

- **第三步：添加亿点点细节（增强显示数据点）**

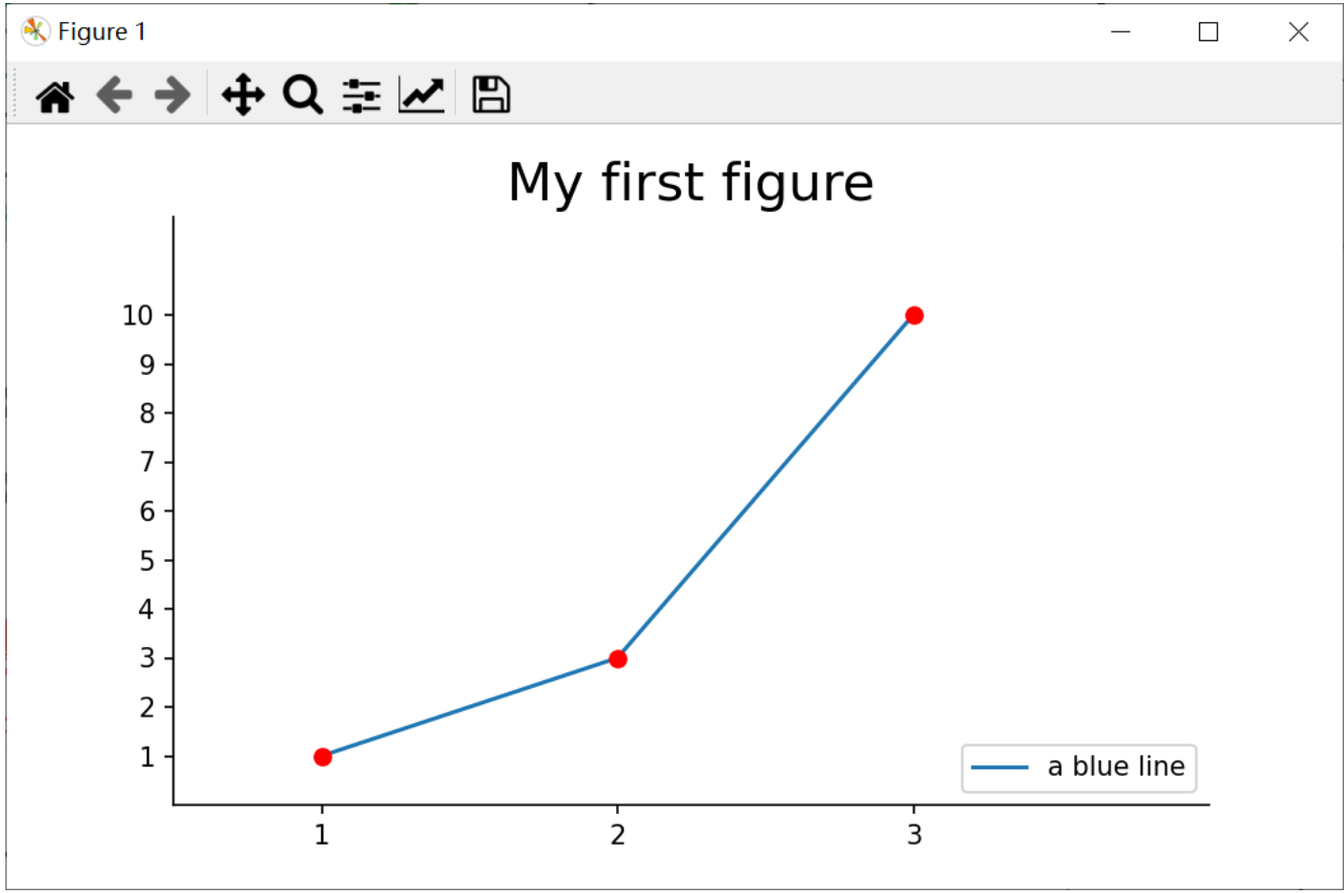
```
ax.set_title('My first figure', fontsize=20)
ax.legend(loc='lower right')
ax.spines['top'].set_visible(False)
ax.spines['right'].set_visible(False)

ax.xaxis.set_ticks([1, 2, 3])
ax.yaxis.set_ticks([y for y in range(1, 11)])

# 绘制散点图，将数据点的颜色设置为红色
# 将数据点的图层排列在折线图之上
ax.scatter(x, y, color='red', zorder=2)
```



Matplotlib入门

- **第三步：添加亿点点细节（设置x轴和y轴的显示范围）**

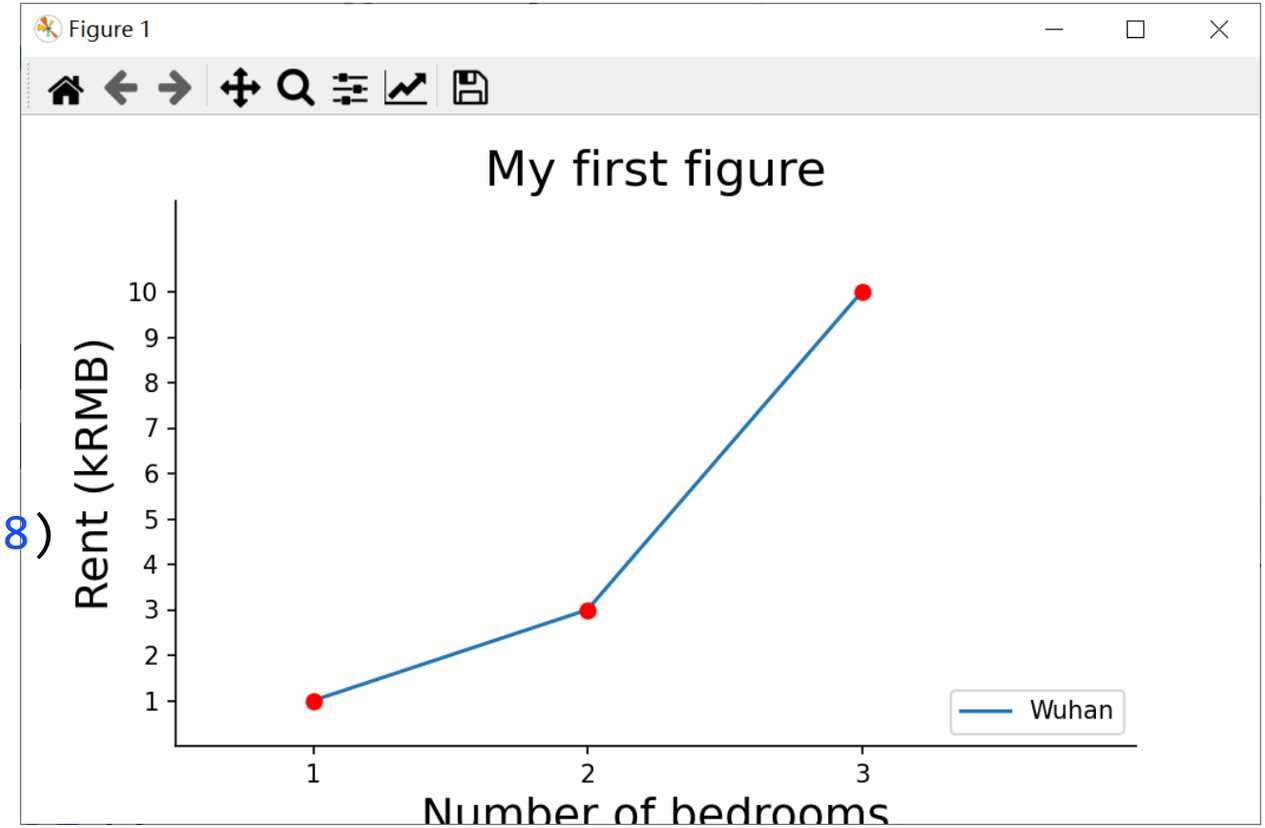
```
ax.set_title('My first figure', fontsize=20)
ax.legend(loc='lower right')
ax.spines['top'].set_visible(False)
ax.spines['right'].set_visible(False)
ax.xaxis.set_ticks([1, 2, 3])
ax.yaxis.set_ticks([y for y in range(1,
11)])
ax.scatter(x, y, color='red', zorder=2)

# 设置x轴和y轴的范围
ax.set_xlim([0.5, 4])
ax.set_ylim([0, 12])
```



Matplotlib入门

- **第三步：添加亿点点细节（设置x轴和y轴的含义）**

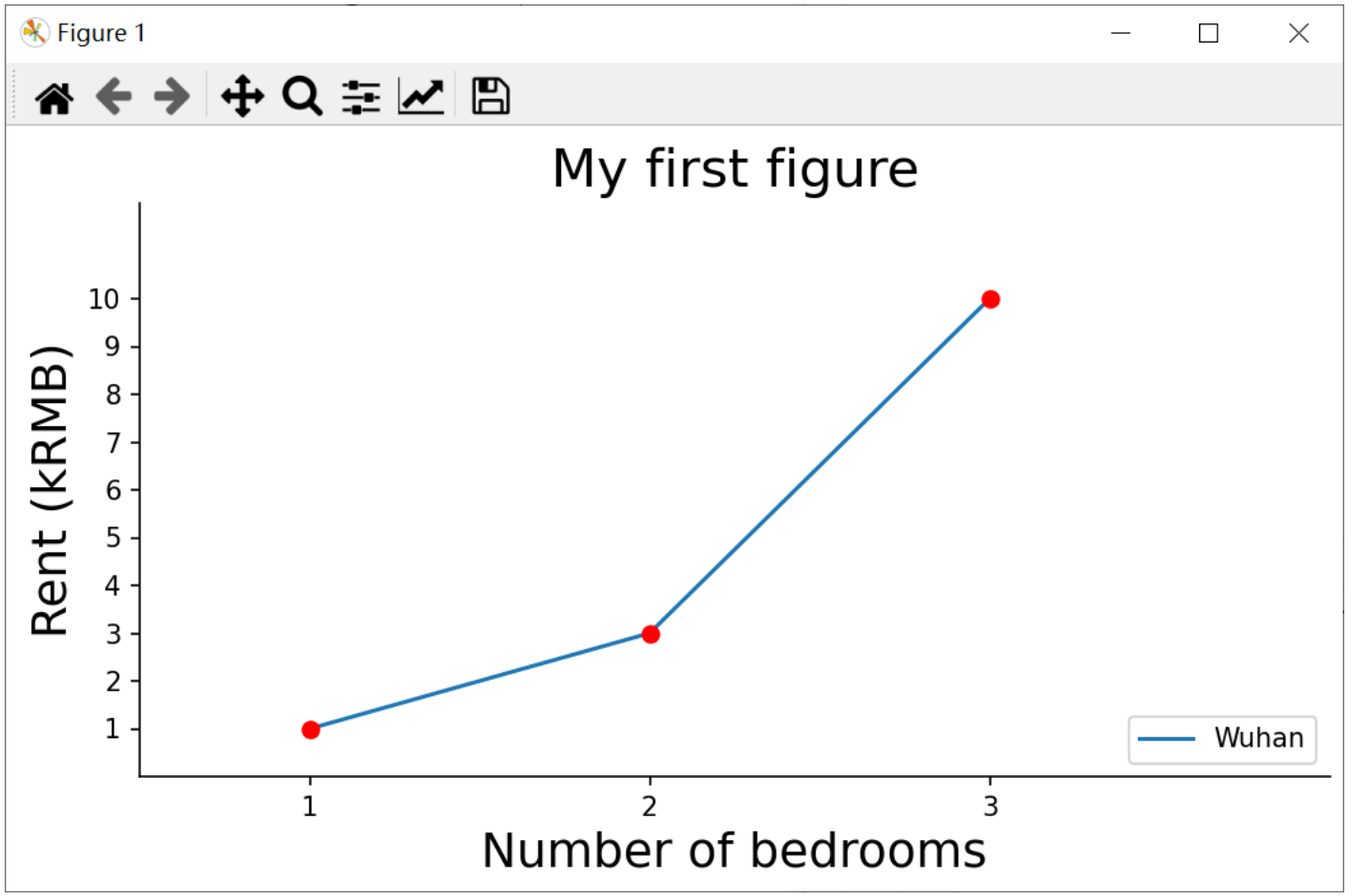
```
ax.set_title('My first figure', fontsize=20)
ax.legend(loc='lower right')
ax.spines['top'].set_visible(False)
ax.spines['right'].set_visible(False)
ax.xaxis.set_ticks([1, 2, 3])
ax.yaxis.set_ticks([y for y in range(1, 11)])
ax.scatter(x, y, color='red', zorder=2)
ax.set_xlim([0.5, 4])
ax.set_ylim([0, 12])

# 设置x轴和y轴的含义
ax.set_xlabel('Number of bedrooms', fontsize=18)
ax.set_ylabel('Rent (kRMB)', fontsize=18)
```



Matplotlib入门

- **第四步：调整图在画布上的位置，并另存为pdf**

```
fig.subplots_adjust(bottom=0.15, top=0.9, left=0.1, right=0.95)
```



Matplotlib入门

官方文档：https://matplotlib.org/stable/api/index.html

- **自由探索时间**
  - ✓ 如何把折线图画成虚线?
  - ✓ 如何使用red，blue...以外的其他颜色（查询16进制色）？
  - ✓ 如何排列多个图例？比如共有2个图例，可以显示在同一排，也显示在同一列。
  - ✓ 如何调整图例和坐标轴刻度的字体大小?
  - ✓ 如何显示网格（grid）？
  - ✓ ……

结束语

湖北大学
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谢 谢!