



湖北大学
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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1-2周为预备期，务必尽早在自己的笔记本上配置好python的开发环境



- **出勤要求与课堂纪律**

- ✓ 不允许缺席。缺席1次扣10分，**累计缺席3次按不及格处理。**
- ✓ **完成实验前，不允许做与实验无关的事，包括但不限于：**玩手机，看视频，睡觉等。



本周实验内容



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- 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



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- **PyCharm Community Edition**

✓ 下载地址: <https://www.jetbrains.com/pycharm/download/>

We value the vibrant Python community, and that's why we proudly offer the PyCharm Community Edition for free, as our open-source contribution to support the Python ecosystem.



PyCharm Community Edition

The IDE for Pure Python Development

Download

.exe ▼

Free, built on open source



安装Python的第三方库管理工具



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- **Anaconda**

✓ 下载地址: <https://www.anaconda.com/download/>

Free Download

Everything you need to get started in data science on your workstation.

- ✓ Free distribution install
- ✓ Thousands of the most fundamental DS, AI, and ML packages
- ✓ Manage packages and environments from desktop application
- ✓ Deploy across hardware and software platforms

 Download

Get Additional Installers

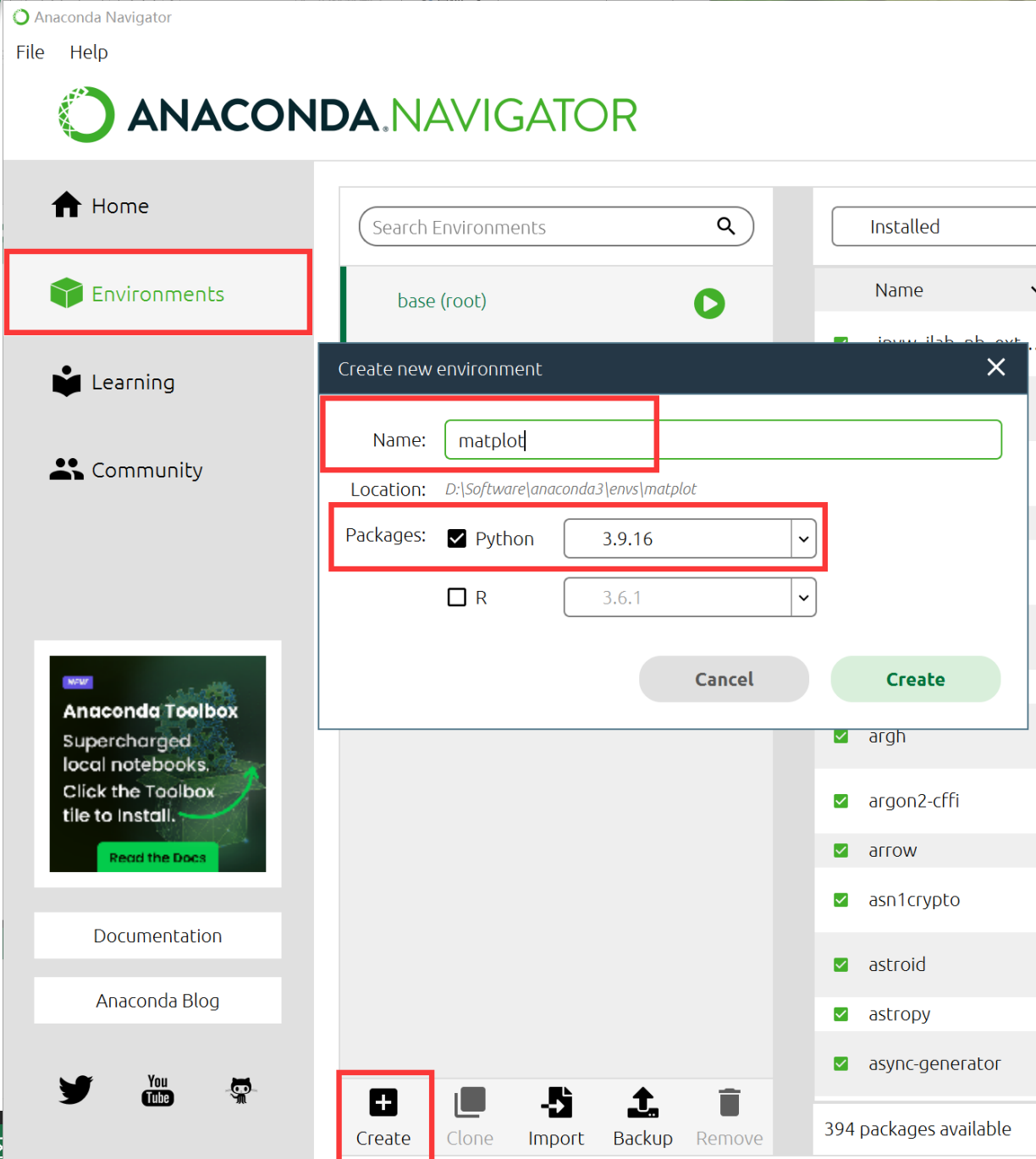




在Anaconda中配置一个新环境



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- 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



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Not installed		Channels	Update index...	matplotlib X
Name	T	Description	Version	
<input type="checkbox"/> basemap		Plot on map projections using matplotlib	1.3.6	
<input type="checkbox"/> basemap-data		Plot on map projections (with coastlines and political boundaries) using matplotlib.	1.3.6	
<input type="checkbox"/> basemap-data-hires		Plot on map projections (with coastlines and political boundaries) using matplotlib.	1.3.6	
<input type="checkbox"/> descartes		Use geometric objects as matplotlib paths and patches.	1.1.0	
<input type="checkbox"/> ipympl		Matplotlib jupyter extension	0.8.7	
<input checked="" type="checkbox"/> matplotlib		Publication quality figures in python	3.7.1	
<input checked="" type="checkbox"/> matplotlib-base		Publication quality figures in python	3.7.1	
<input type="checkbox"/> matplotlib-inline		Inline matplotlib backend for jupyter	0.1.6	
<input type="checkbox"/> mpl-scatter-density		Matplotlib helpers to make density scatter plots	0.7	
<input type="checkbox"/> mpld3		D3 viewer for matplotlib.	0.5.7	



创建一个Python项目



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New Project

Location: D:\PycharmProjects\lesson1

Python Interpreter: Python 3.9 (matplotlib)

☐ New environment using Virtualenv

Location: D:\PycharmProjects\lesson1\venv

Base interpreter: Python 3.9 https://www.python.org/ftp/python/3.9.7/python-3.9.7-amd64.exe

☐ Inherit global site-packages

☐ Make available to all projects

☒ Previously configured interpreter

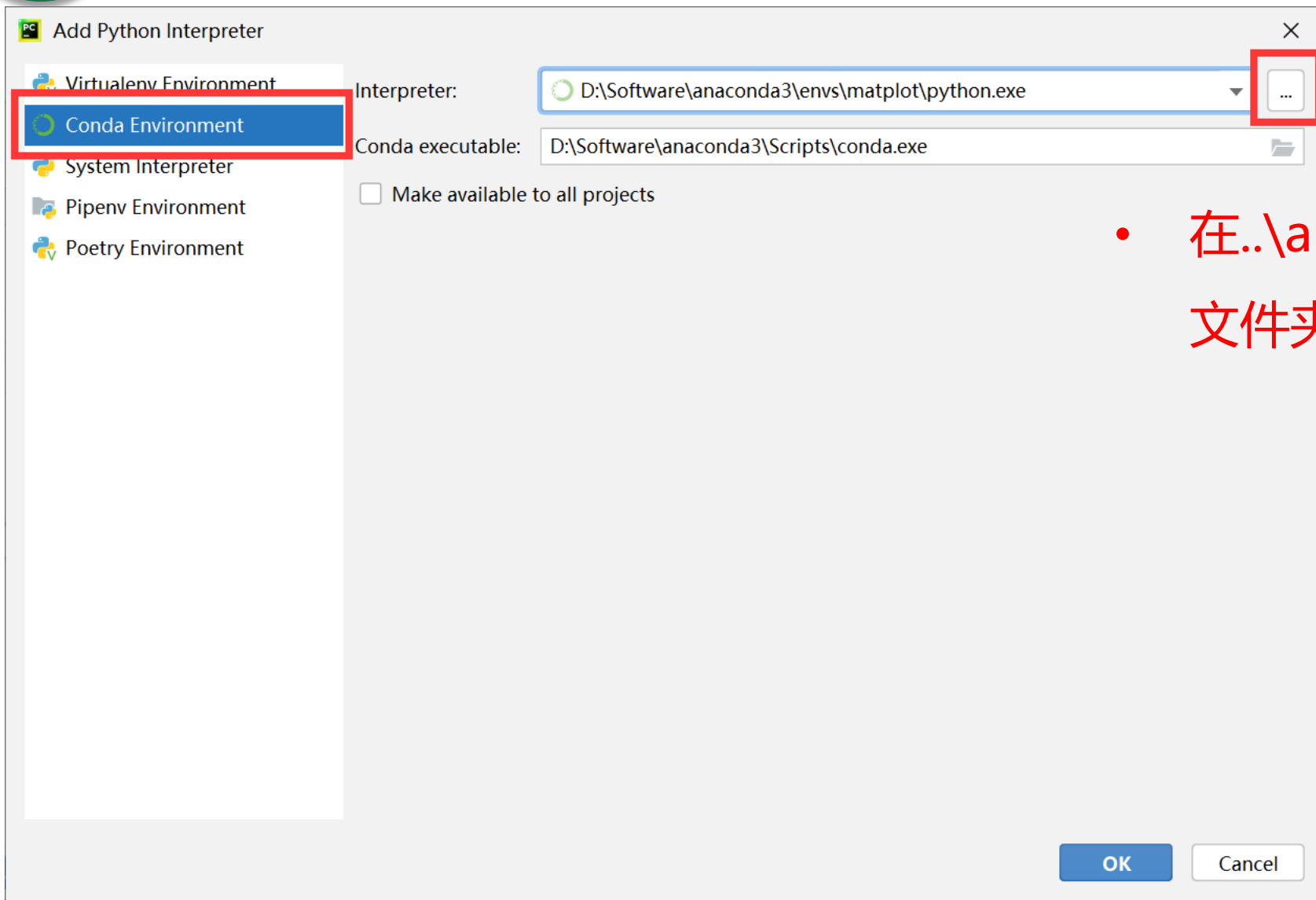
Interpreter: Python 3.9 (matplotlib) D:\Software\anaconda3\envs\matplotlib\python.exe

☐ Create a main.py welcome script
Create a Python script that provides an entry point to coding in PyCharm.

Create Cancel



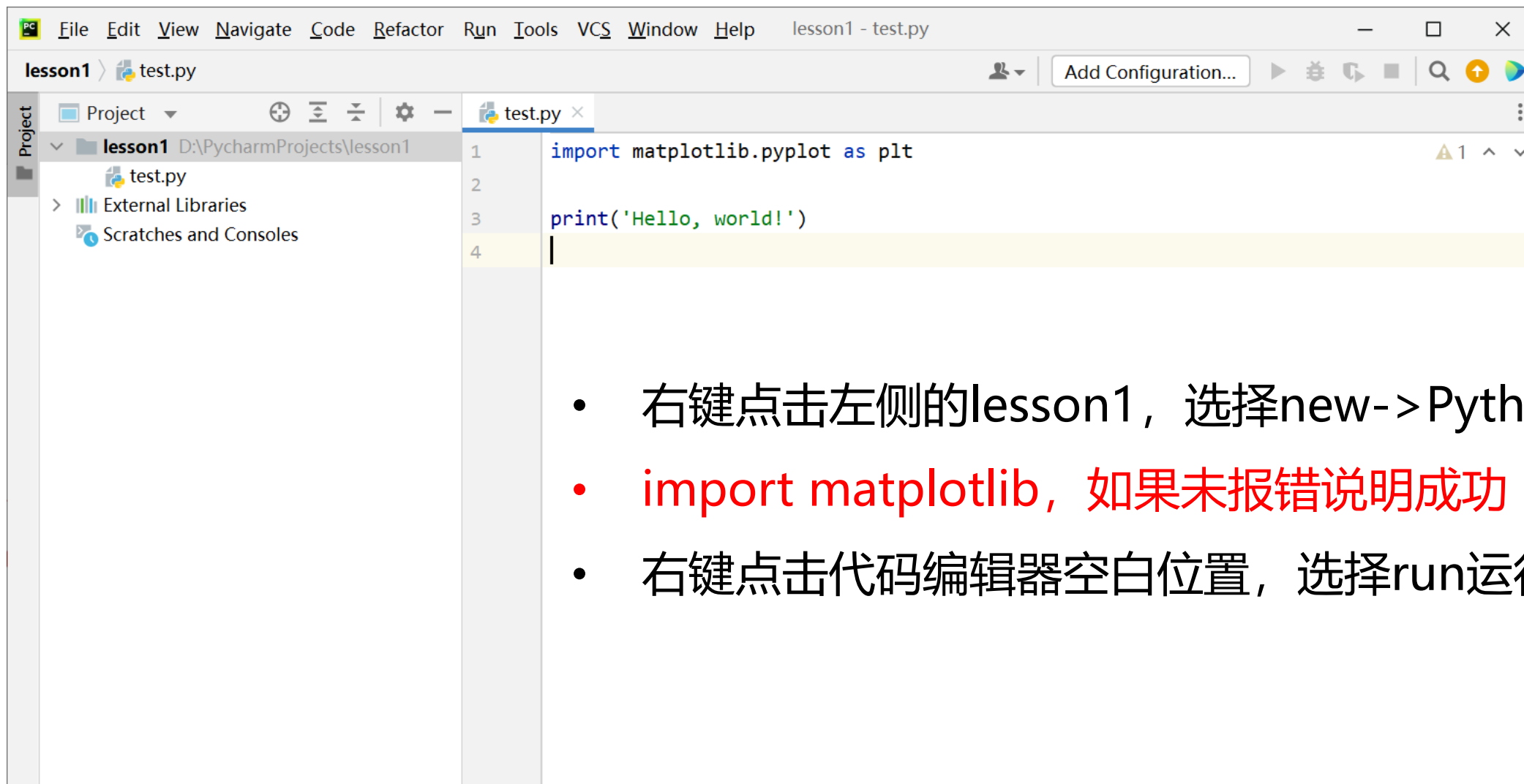
创建一个Python项目



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



创建一个Python项目



```
File Edit View Navigate Code Refactor Run Tools VCS Window Help lesson1 - test.py
lesson1 > test.py
Project
  lesson1 D:\PycharmProjects\lesson1
    test.py
  External Libraries
  Scratches and Consoles
1 import matplotlib.pyplot as plt
2
3 print('Hello, world!')
4
```

- 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

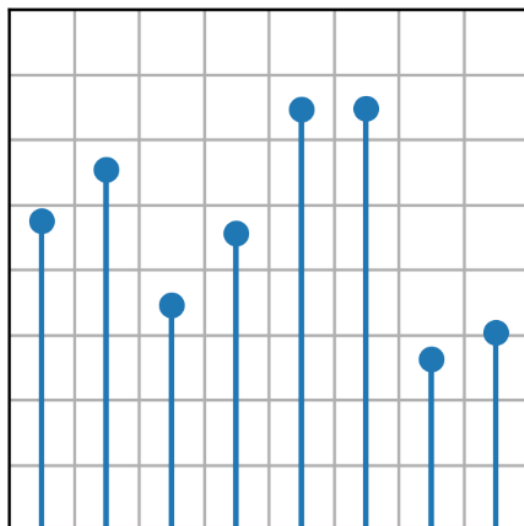
官方网站: <https://matplotlib.org/>



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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

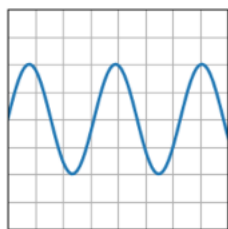


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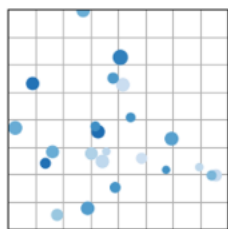
- **作用：**绘制论文中的插图，实现实验数据的可视化

Pairwise data

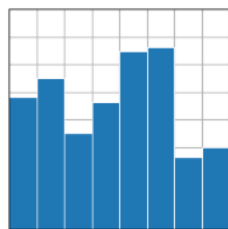
Plots of pairwise (x, y) , tabular (var_0, \dots, var_n) , and functional $f(x) = y$ data.



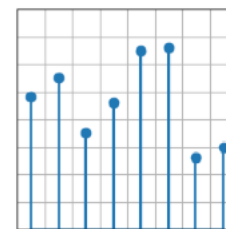
plot(x, y)



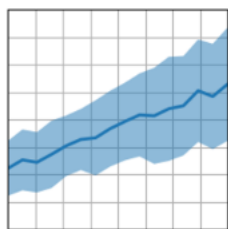
scatter(x, y)



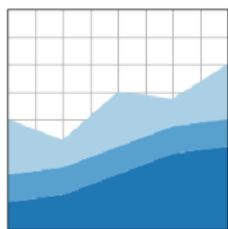
bar(x, height)



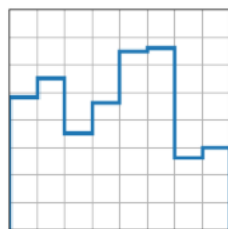
stem(x, y)



fill_between(x, y1,
y2)



stackplot(x, y)



stairs(values)



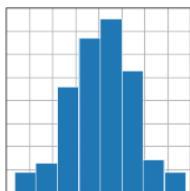
Matplotlib入门



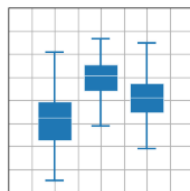
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Statistical distributions

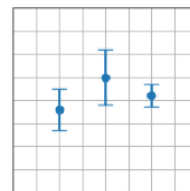
Plots of the distribution of at least one variable in a dataset. Some of these methods also compute the distributions.



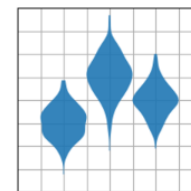
hist(x)



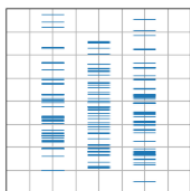
boxplot(X)



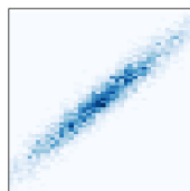
errorbar(x, y, yerr,
xerr)



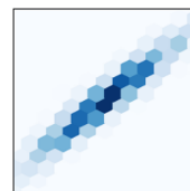
violinplot(D)



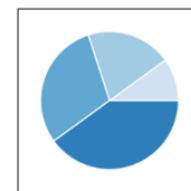
eventplot(D)



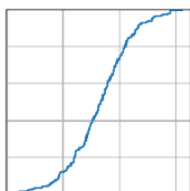
hist2d(x, y)



hexbin(x, y, C)



pie(x)



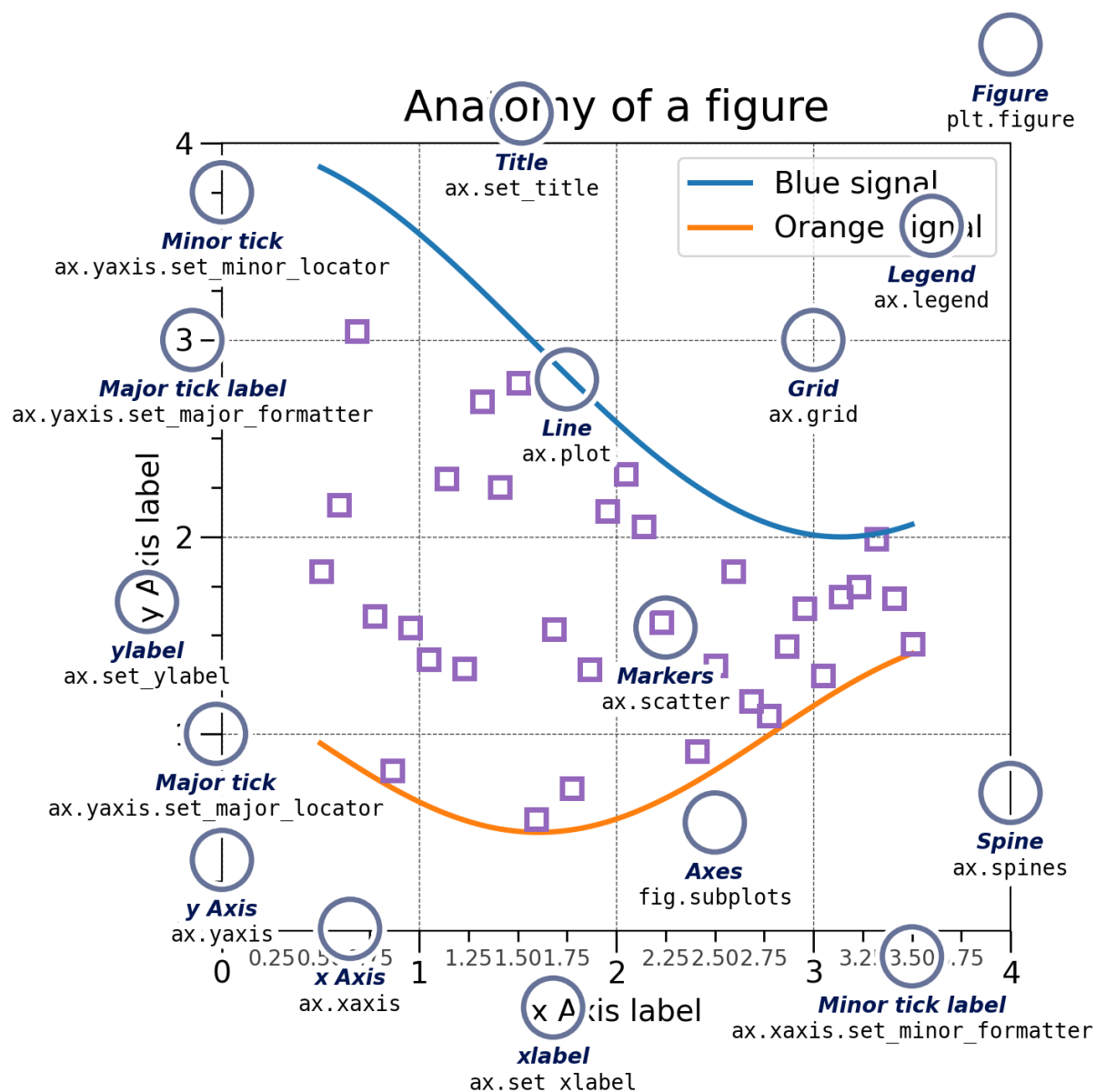
ecdf(x)



Matplotlib入门



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- **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



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- 第一步：使用`plt.subplots()`创建画布和图

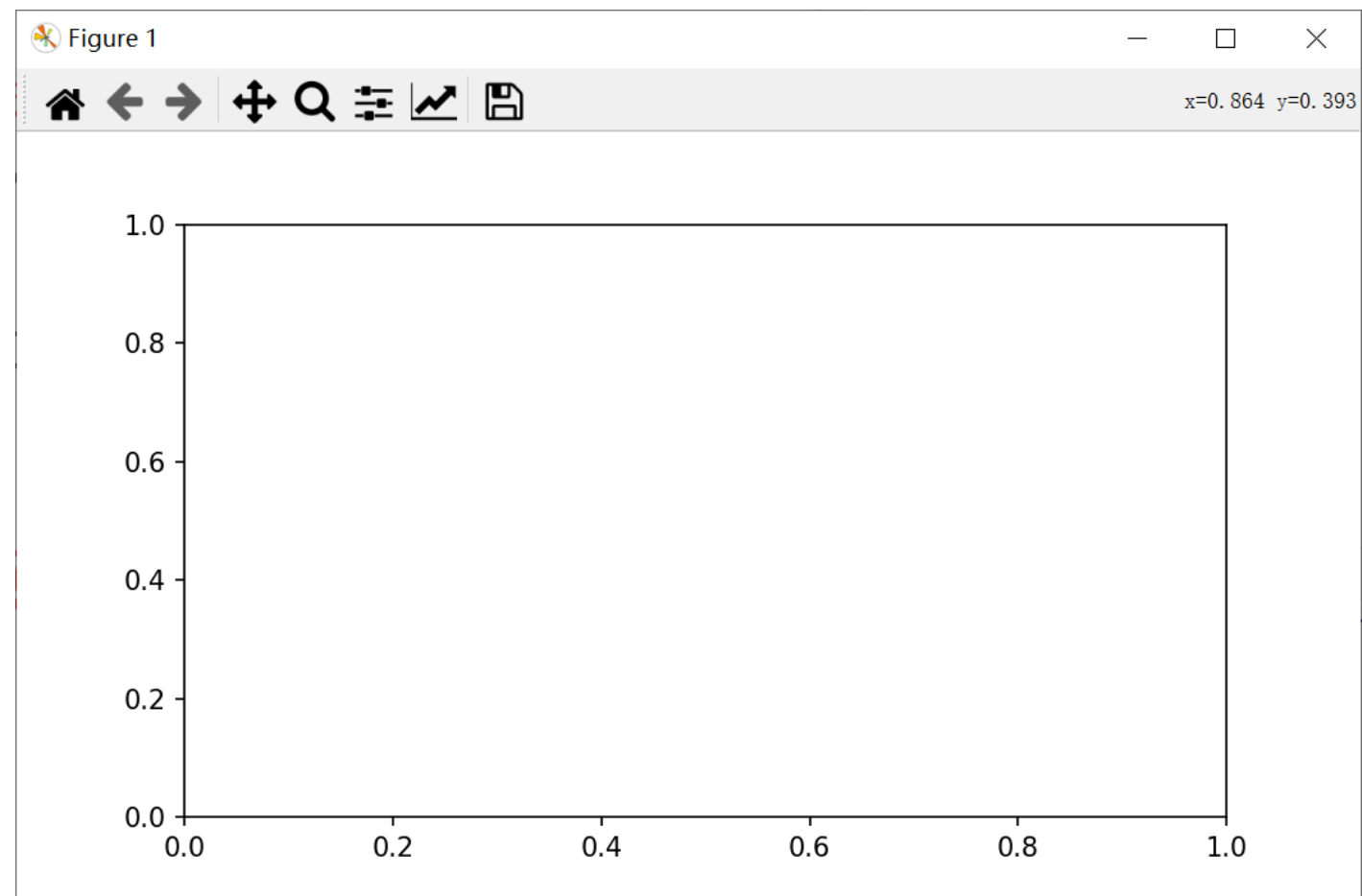
```
import matplotlib.pyplot as plt
```

```
# 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



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- 第二步：绘制数据（以折线图为例）

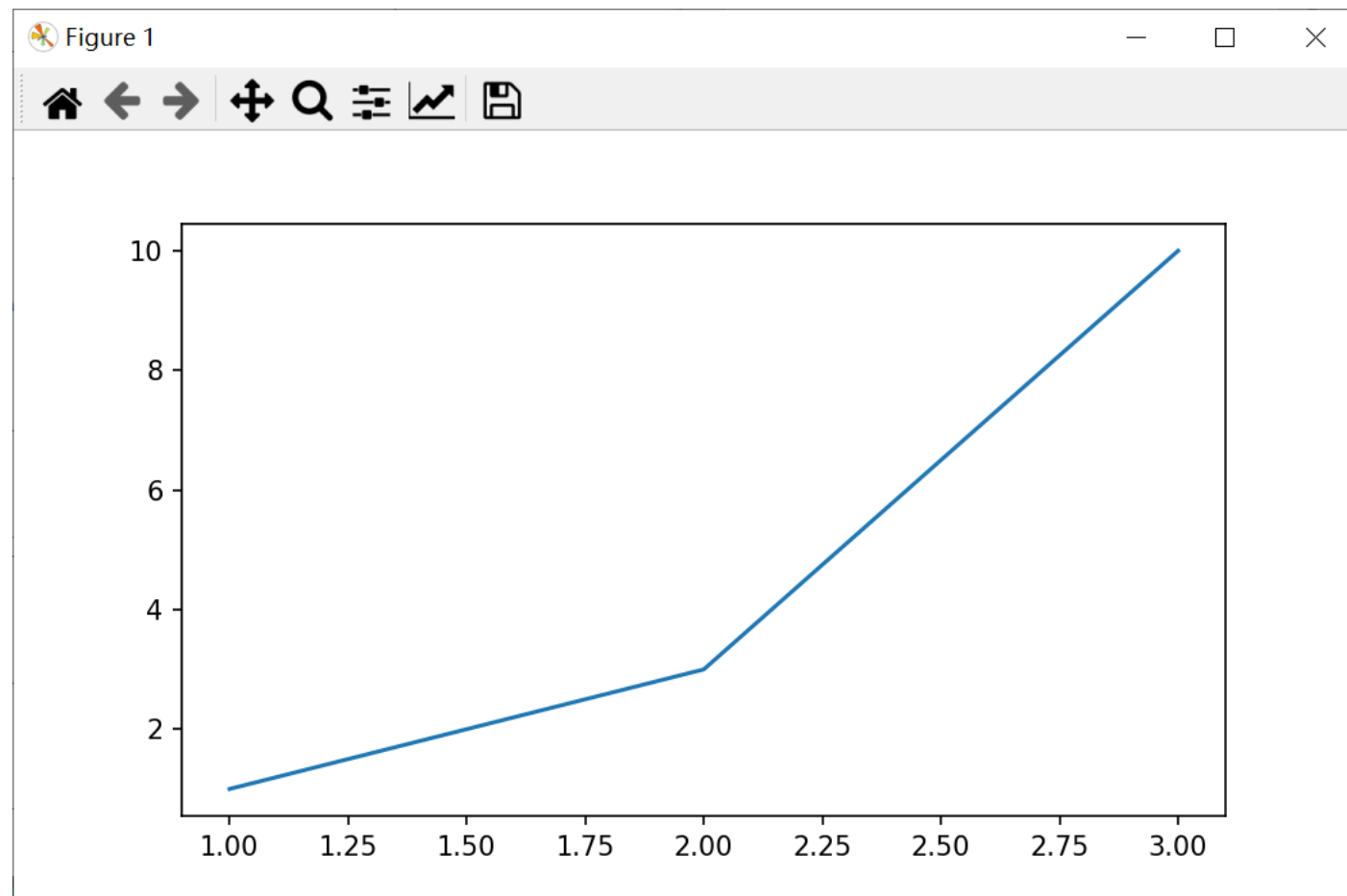
```
import matplotlib.pyplot as plt

# 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



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- 第三步：添加亿点点细节（添加标题）

```
import matplotlib.pyplot as plt
```

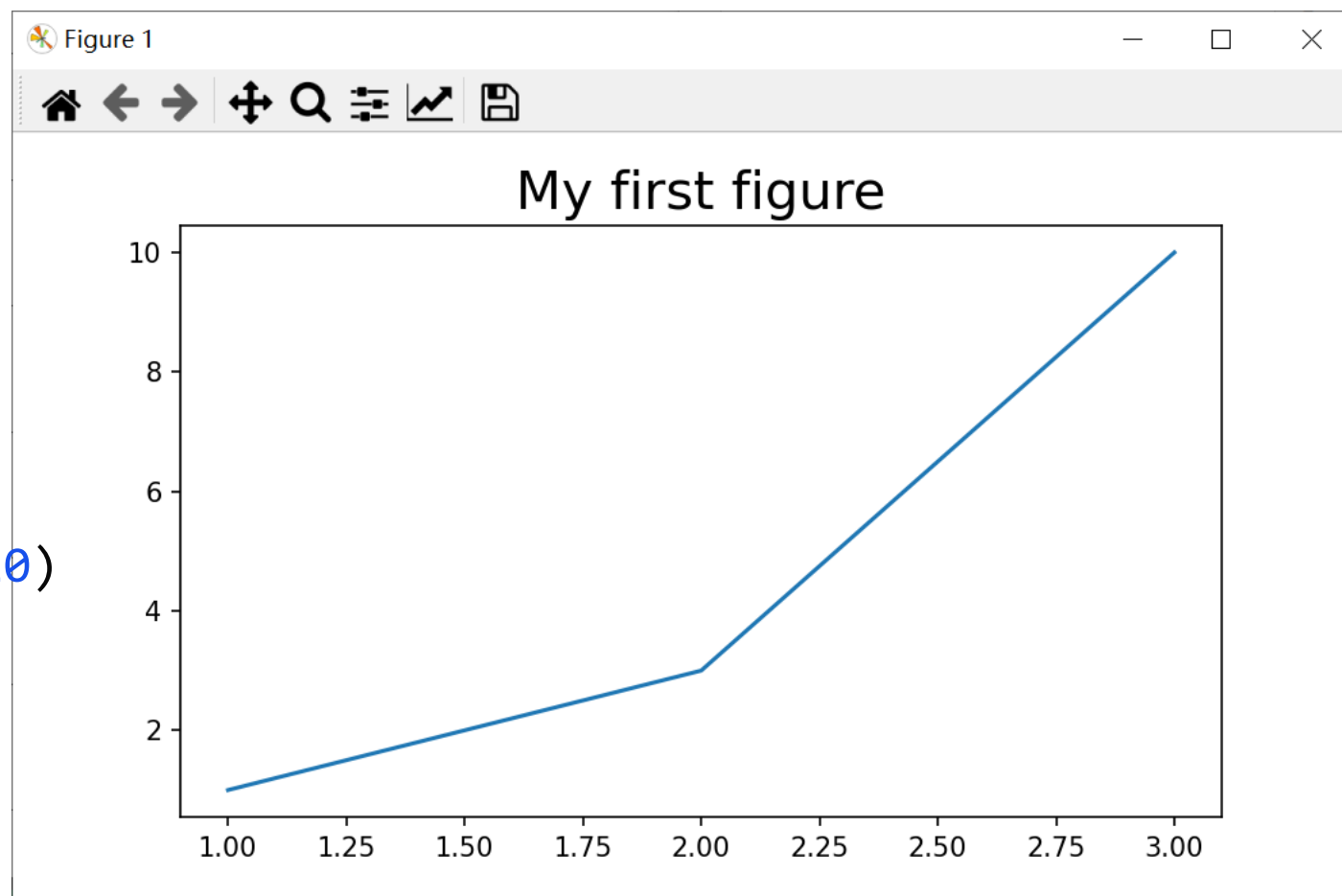
```
x = [1, 2, 3]  
y = [1, 3, 10]
```

```
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



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• 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
```

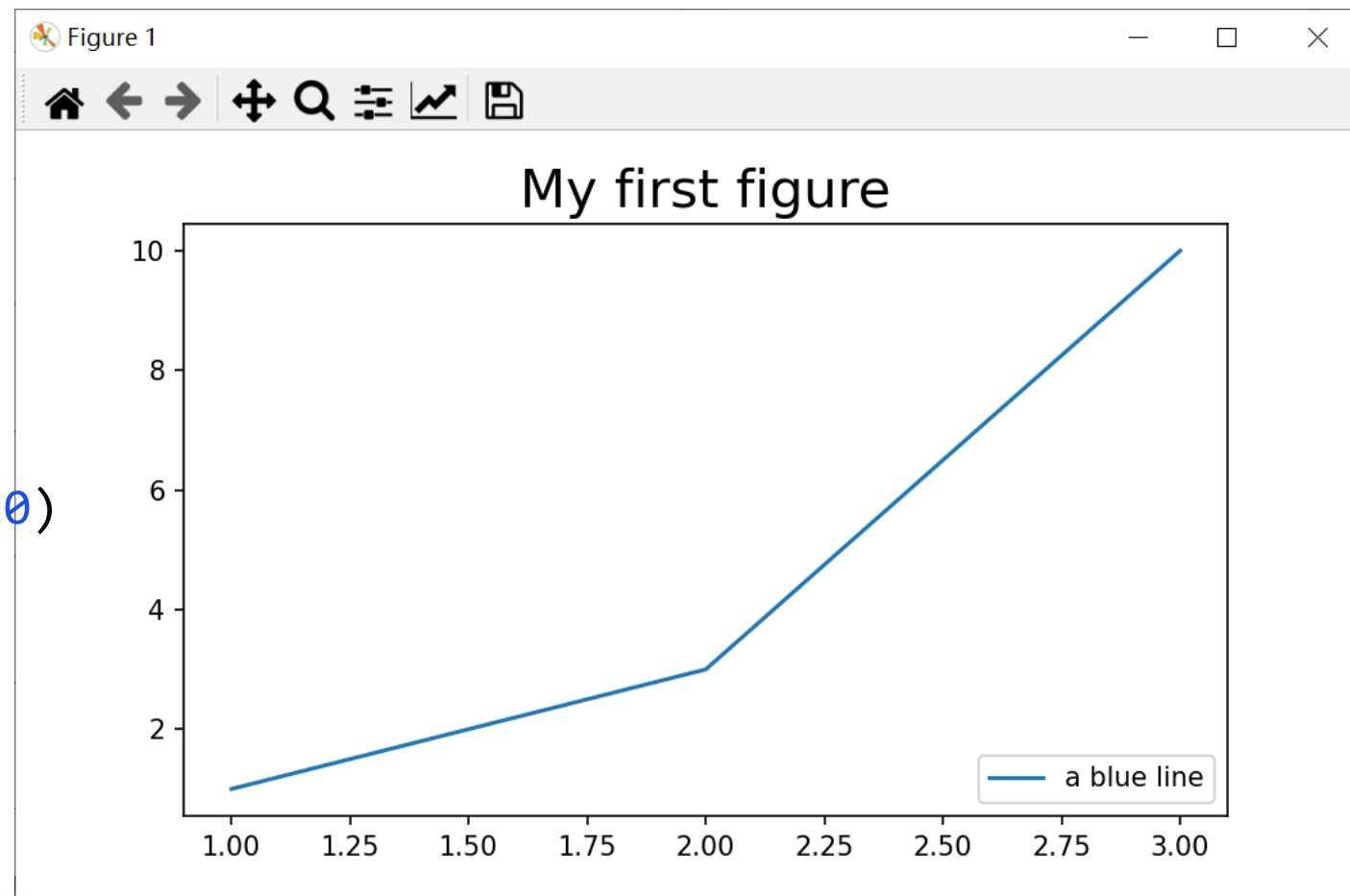
```
ax.plot(x, y, label='a blue line')
```

```
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



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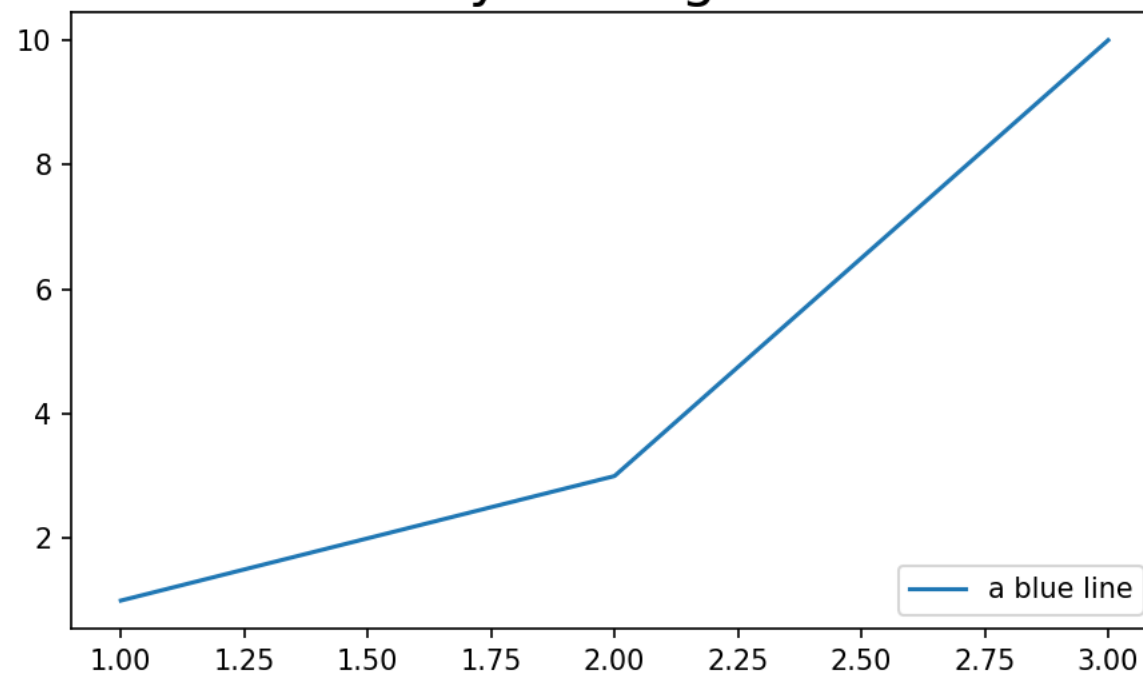
• 第三步：添加亿点点细节（添加图例）

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

Figure 1



My first figure





Matplotlib入门



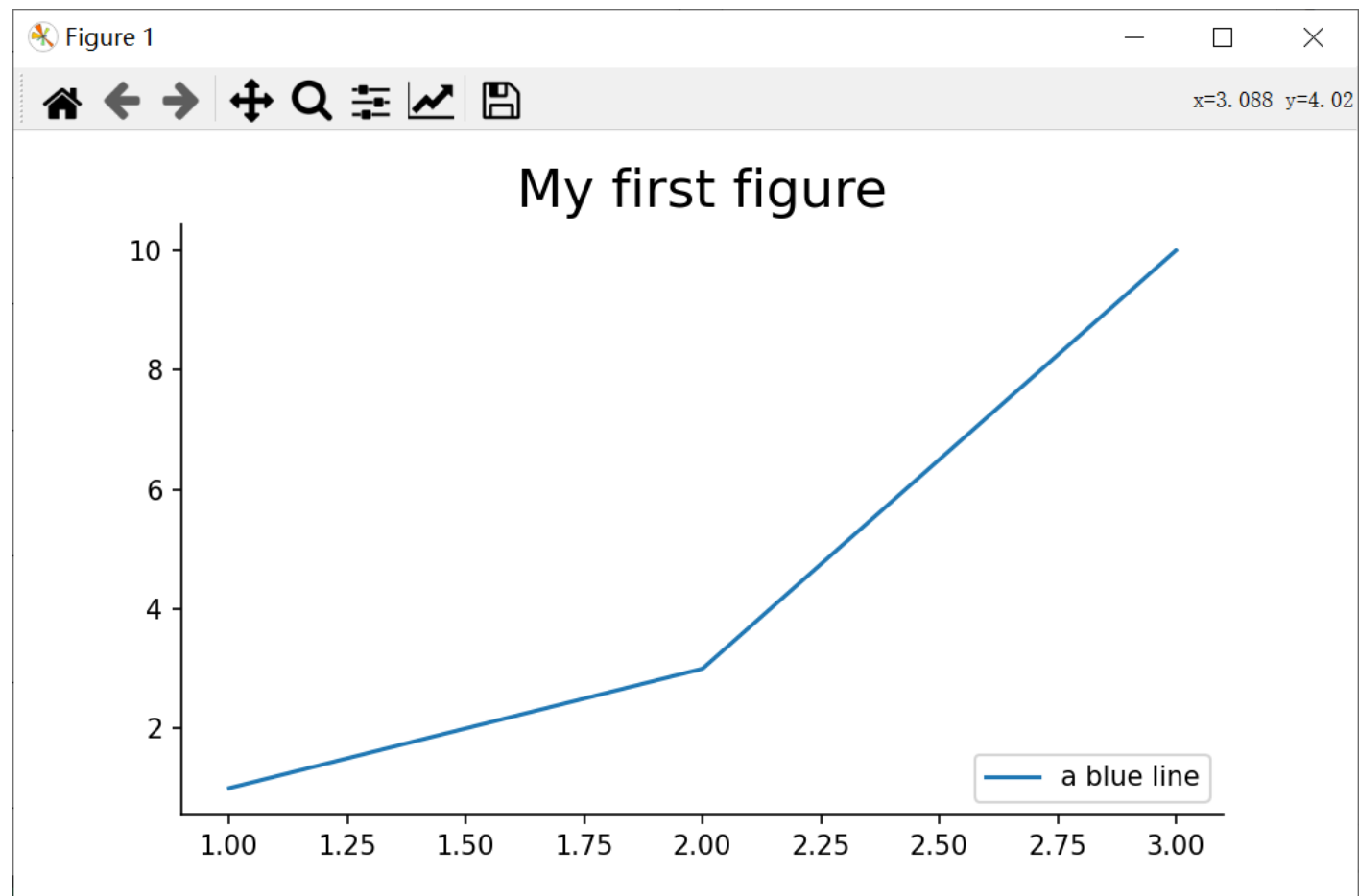
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- 第三步：添加亿点点细节（去除边框）

```
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

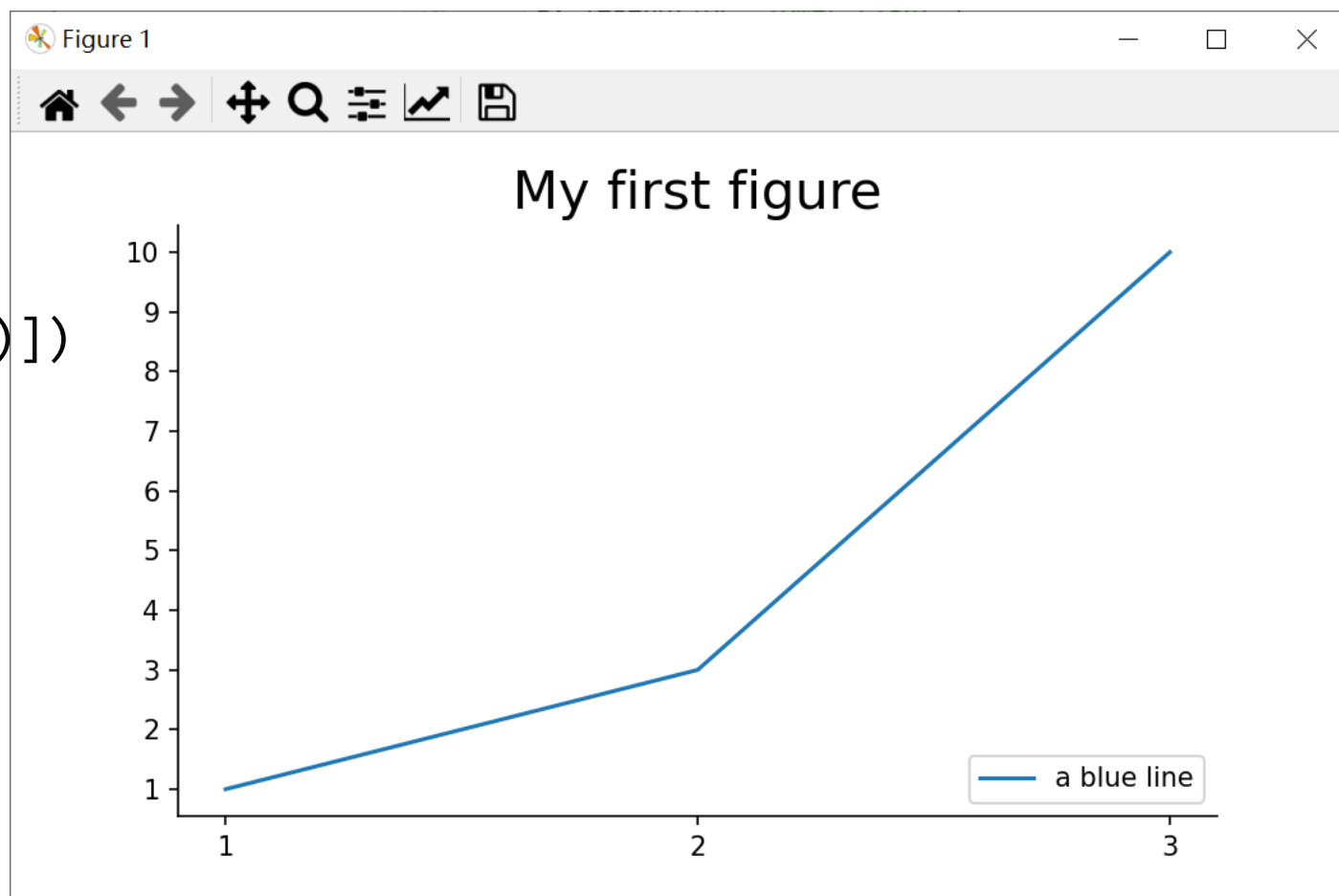


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- 第三步：添加亿点点细节（设置x轴和y轴的刻度）

```
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



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• 第三步：添加亿点点细节（增强显示数据点）

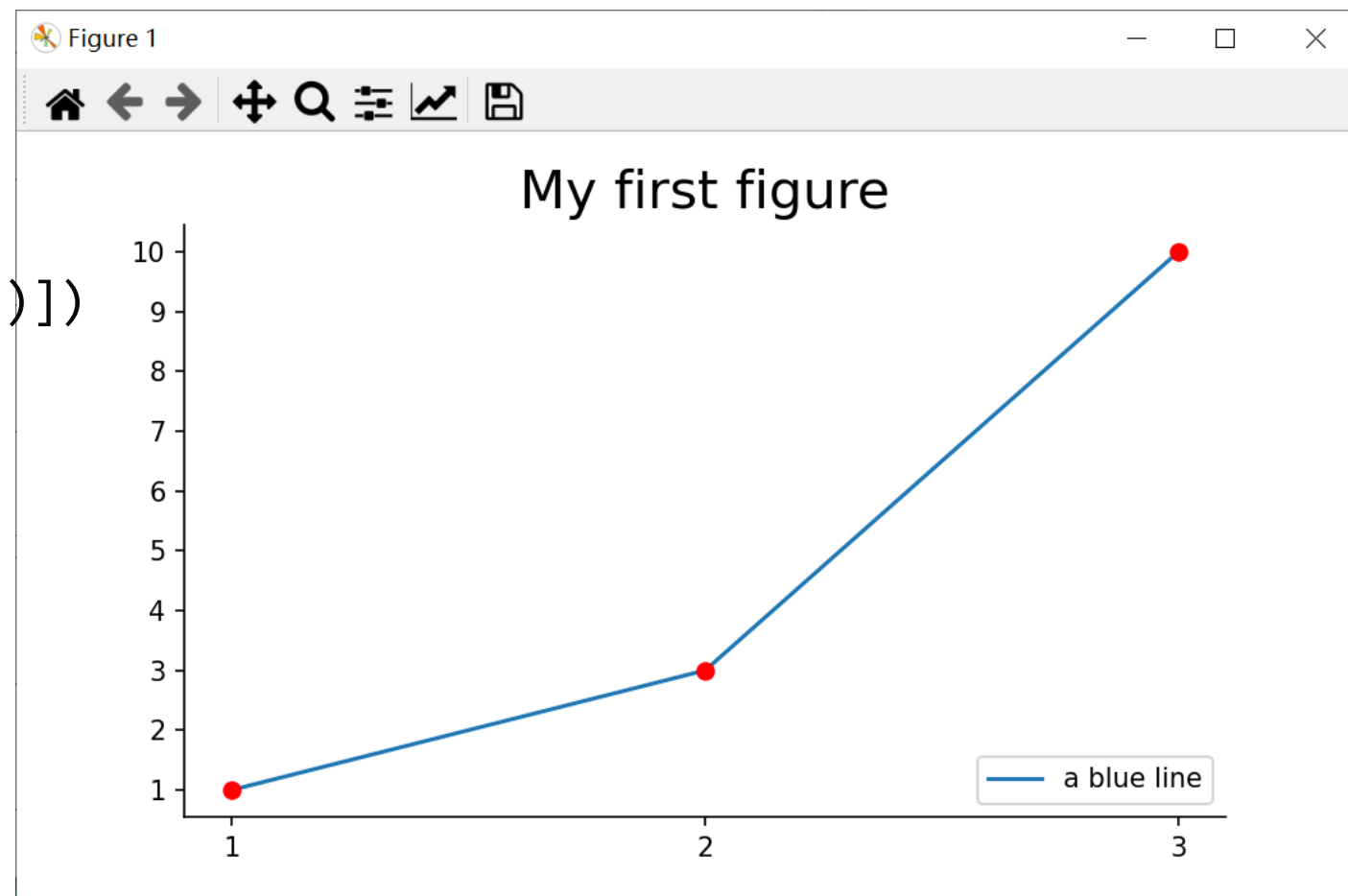
```
ax.set_title('My first figure', fontsize=20)
ax.legend(loc='lower right')
ax.spines['top'].set_visible(False)
ax.spines['right'].set_visible(False)
```

```
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



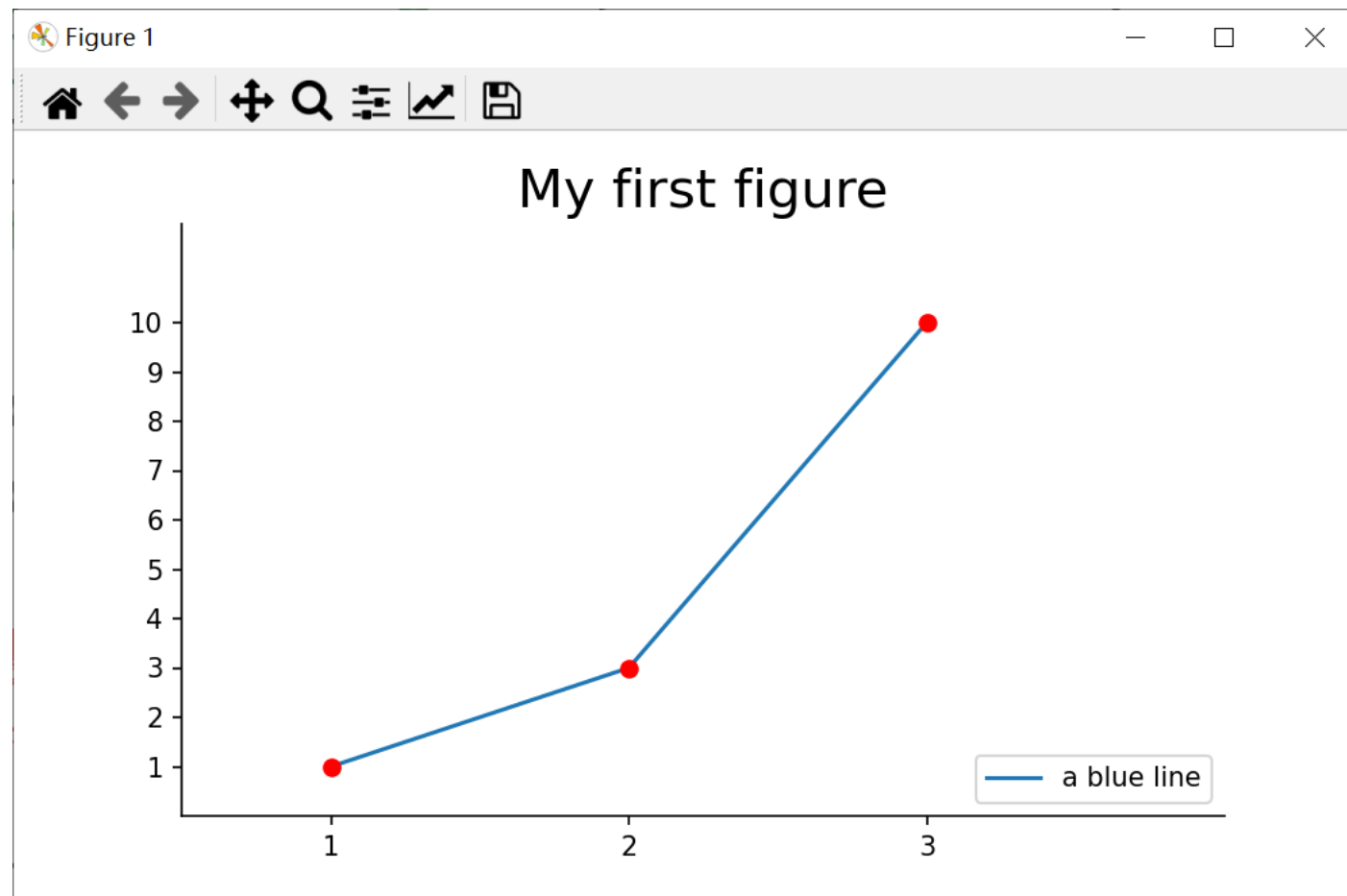
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- 第三步：添加亿点点细节（设置x轴和y轴的显示范围）

```
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



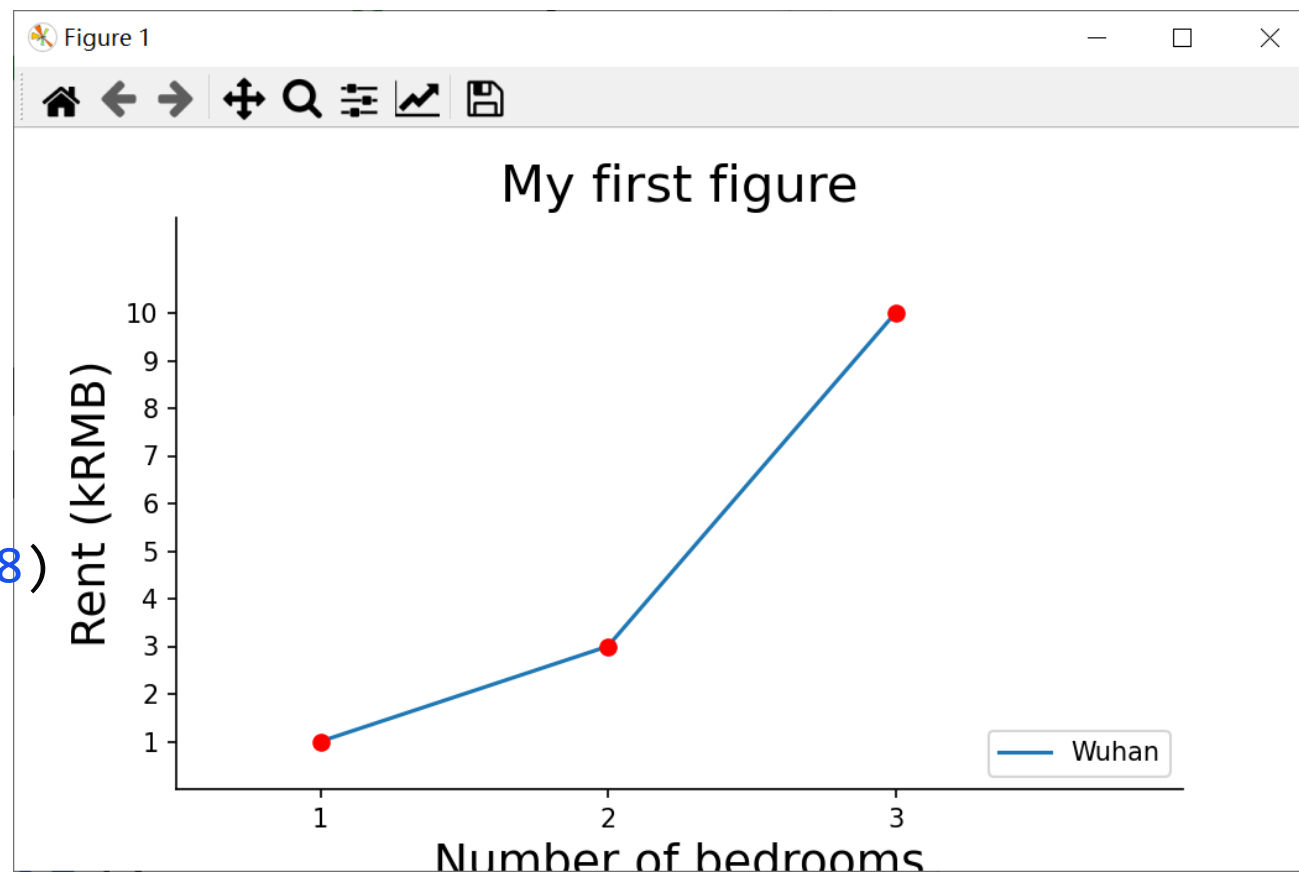
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- 第三步：添加亿点点细节（设置x轴和y轴的含义）

```
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)
```





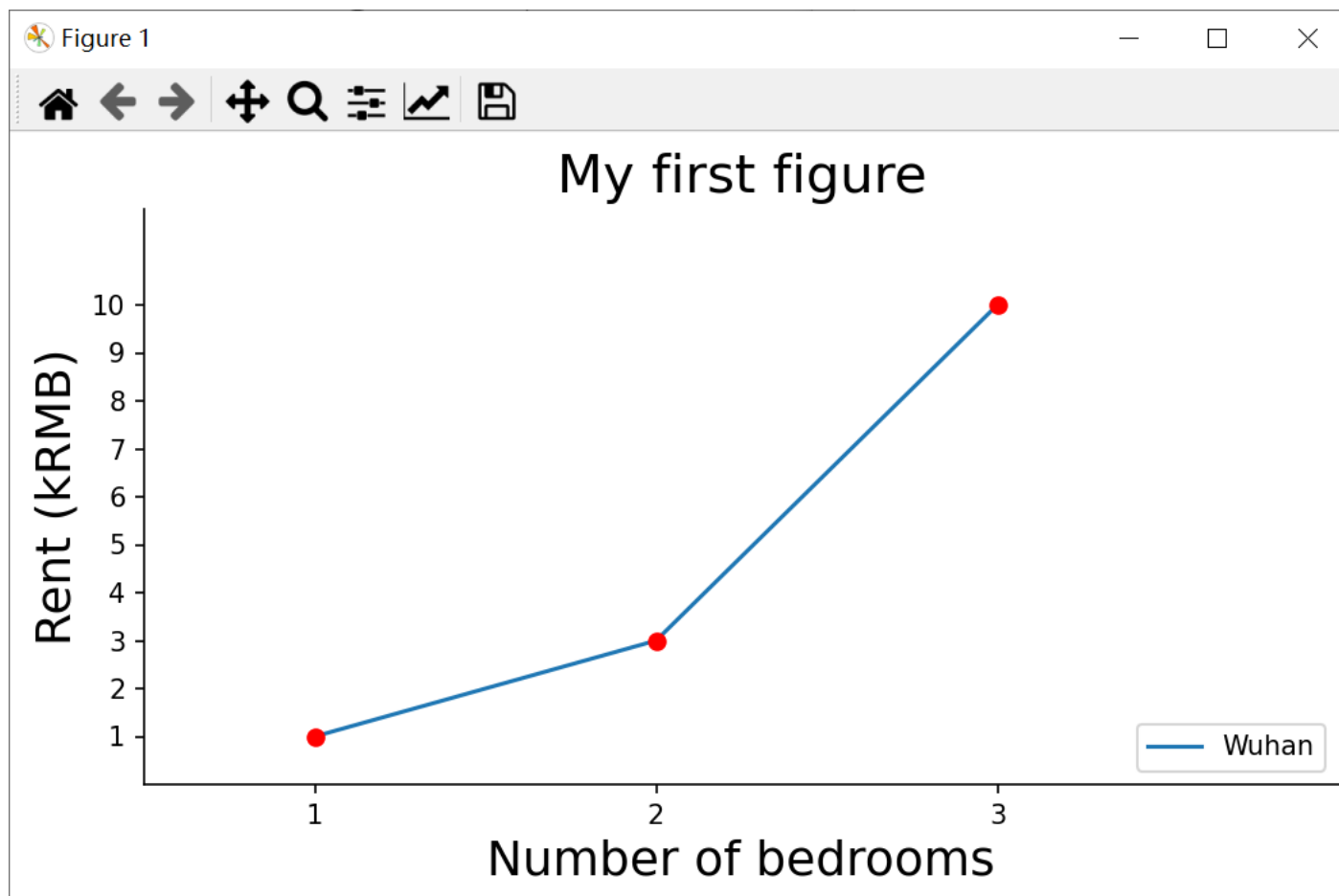
Matplotlib入门



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- 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 (搜索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



谢谢!