



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。**



- **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



湖北大学
HUBEI UNIVERSITY

- **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



湖北大学
HUBEI UNIVERSITY

- **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



湖北大学
HUBEI UNIVERSITY

Anaconda Navigator

File Help

ANACONDA.NAVIGATOR

Home

Environments

Learning

Community



Documentation

Anaconda Blog



Create



Clone



Import



Backup



Remove

Search Environments



Installed

base (root)



Name

Create new environment

Name: matplotlib

Location: D:\Software\anaconda3\envs\matplotlib

Packages: ☒ Python

3.9.16

☐ R

3.6.1

Cancel

Create

☒ argh

☒ argon2-cffi

☒ arrow

☒ asn1crypto

☒ astroid

☒ astropy

☒ async-generator

394 packages available

- 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



湖北大学
HUBEI UNIVERSITY

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



湖北大学
HUBEI UNIVERSITY

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

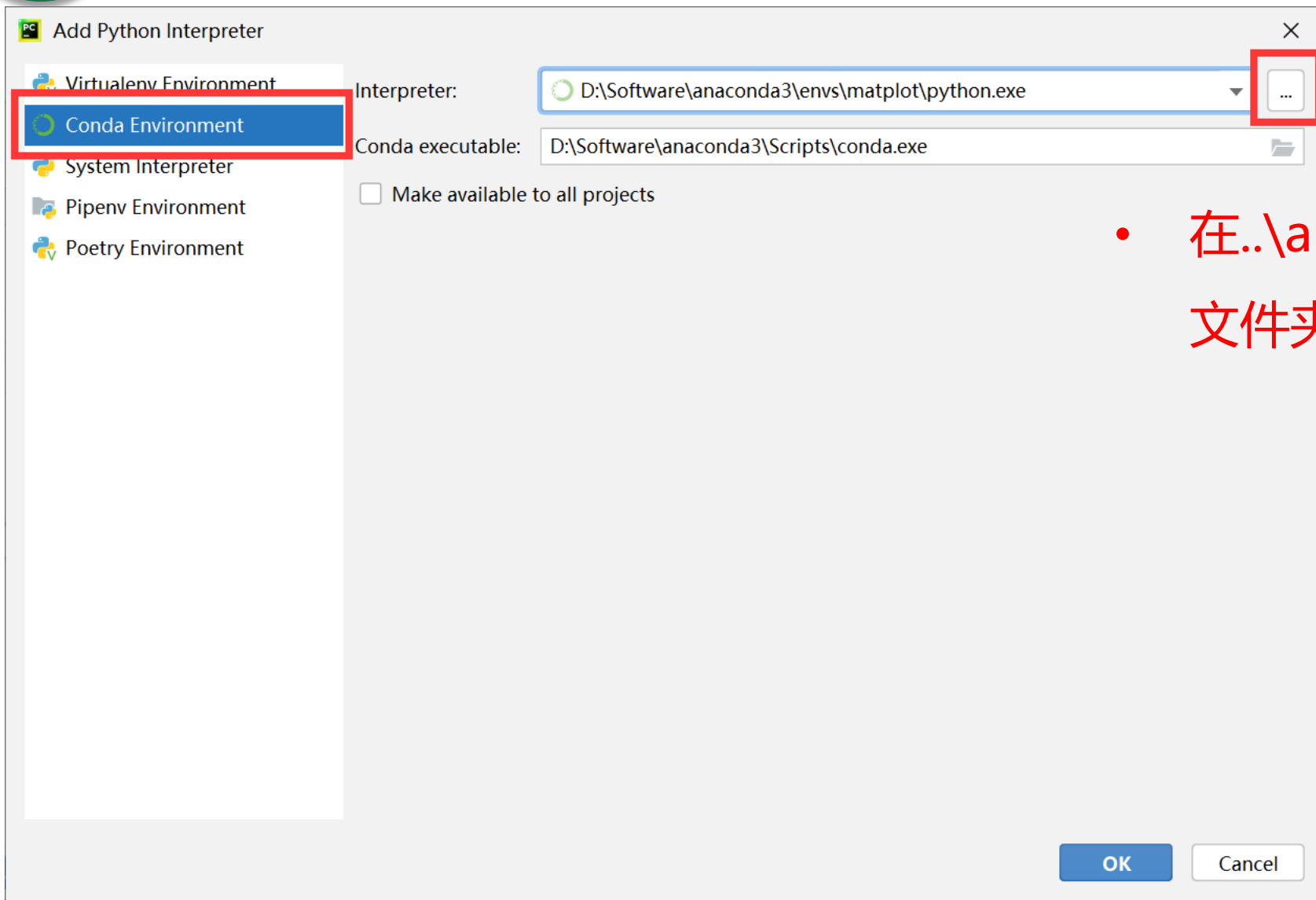
Interpreter: Python 3.9 (matplotlib) D:\Software\anaconda3\envs\matplotlib\python.exe

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

Create Cancel



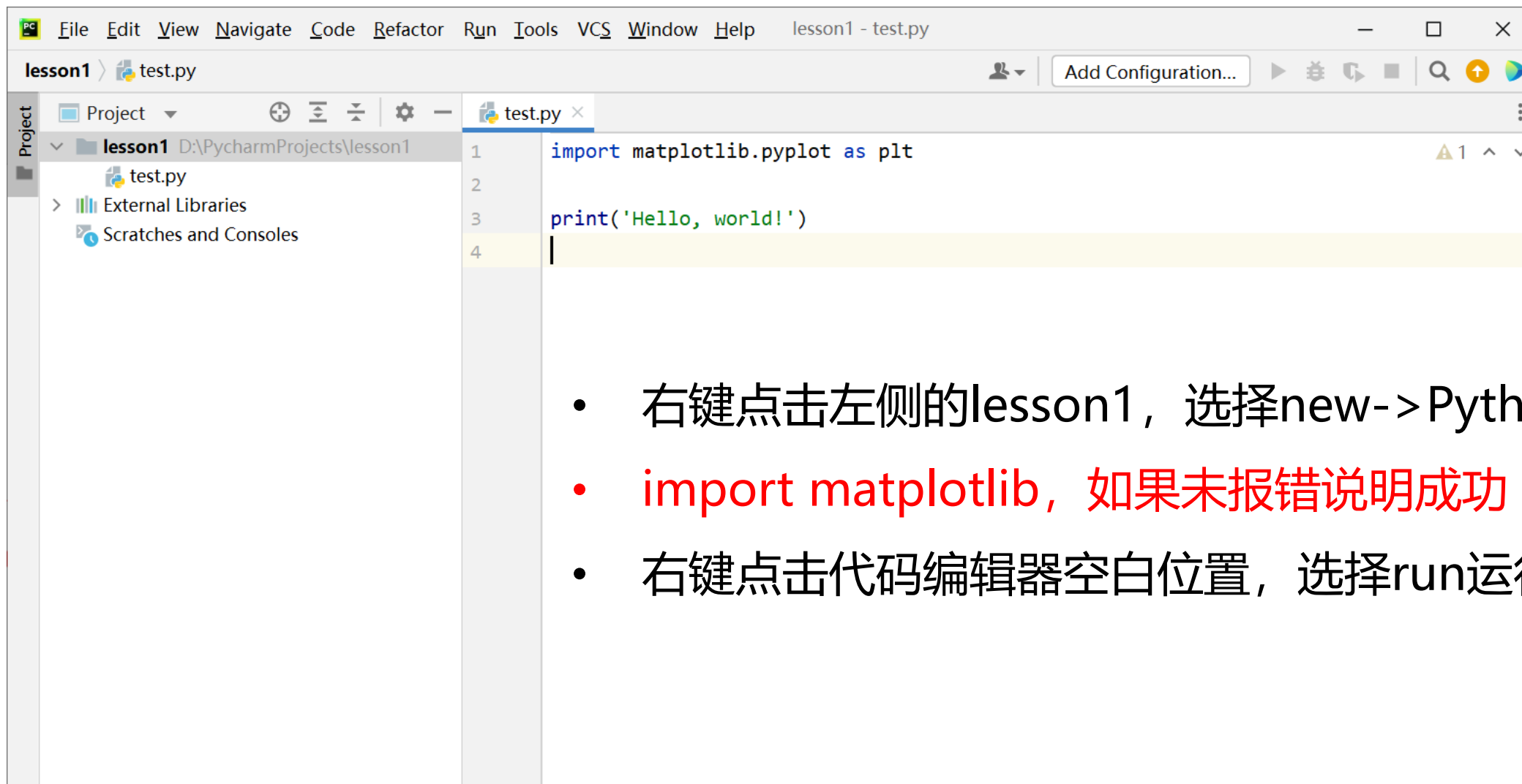
创建一个Python项目



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



创建一个Python项目



- 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

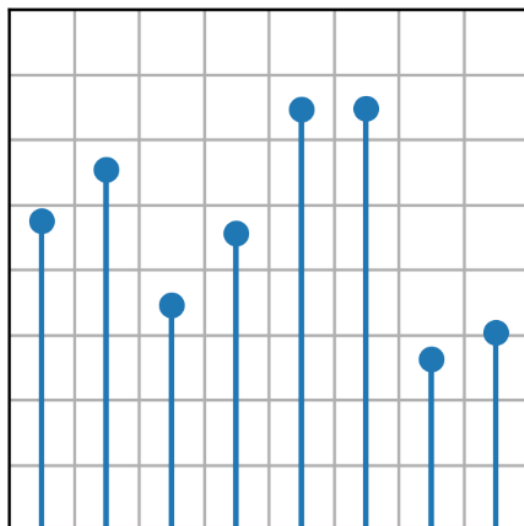
官方网站: <https://matplotlib.org/>



湖北大学
HUBEI UNIVERSITY

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

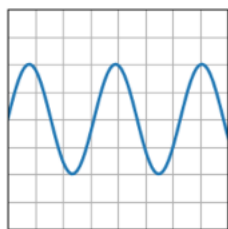


湖北大学
HUBEI UNIVERSITY

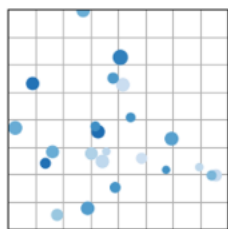
- **作用：**绘制论文中的插图，实现实验数据的可视化

Pairwise data

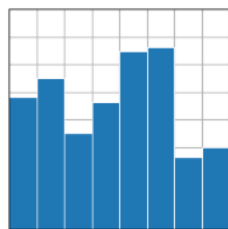
Plots of pairwise (x, y) , tabular (var_0, \dots, var_n) , and functional $f(x) = y$ data.



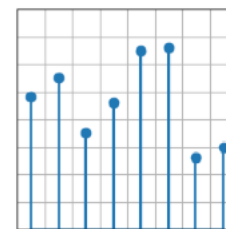
plot(x, y)



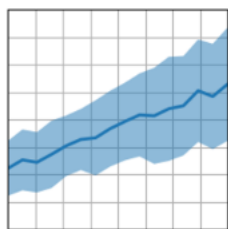
scatter(x, y)



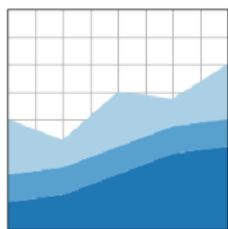
bar(x, height)



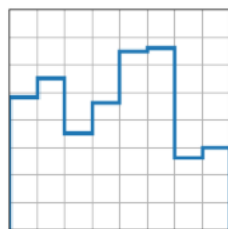
stem(x, y)



fill_between(x, y1,
y2)



stackplot(x, y)



stairs(values)



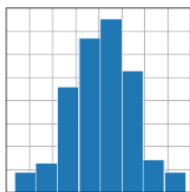
Matplotlib入门



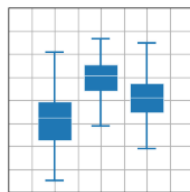
湖北大学
HUBEI UNIVERSITY

Statistical distributions

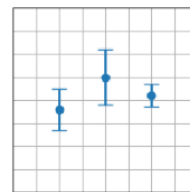
Plots of the distribution of at least one variable in a dataset. Some of these methods also compute the distributions.



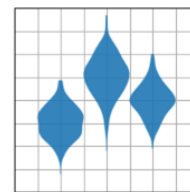
hist(x)



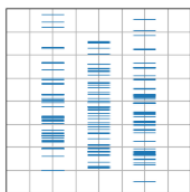
boxplot(X)



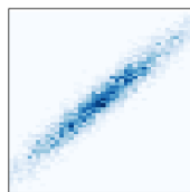
errorbar(x, y, yerr,
xerr)



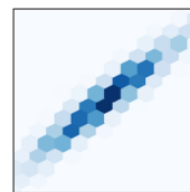
violinplot(D)



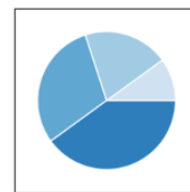
eventplot(D)



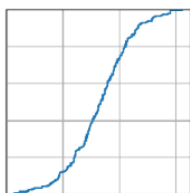
hist2d(x, y)



hexbin(x, y, C)



pie(x)



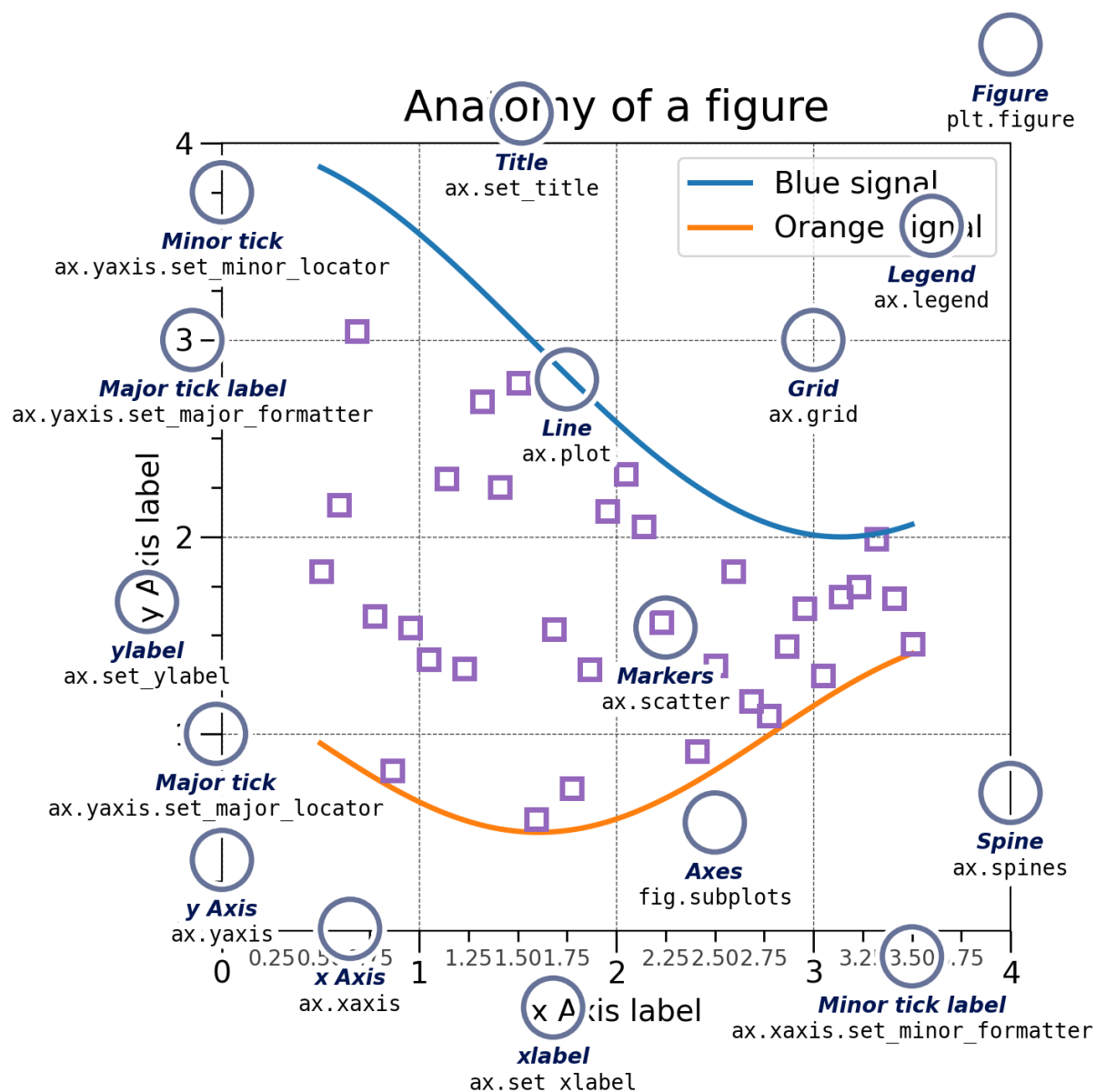
ecdf(x)



Matplotlib入门



湖北大学
HUBEI UNIVERSITY



- **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



湖北大学
HUBEI UNIVERSITY

- 第一步：使用`plt.subplots()`创建画布和图

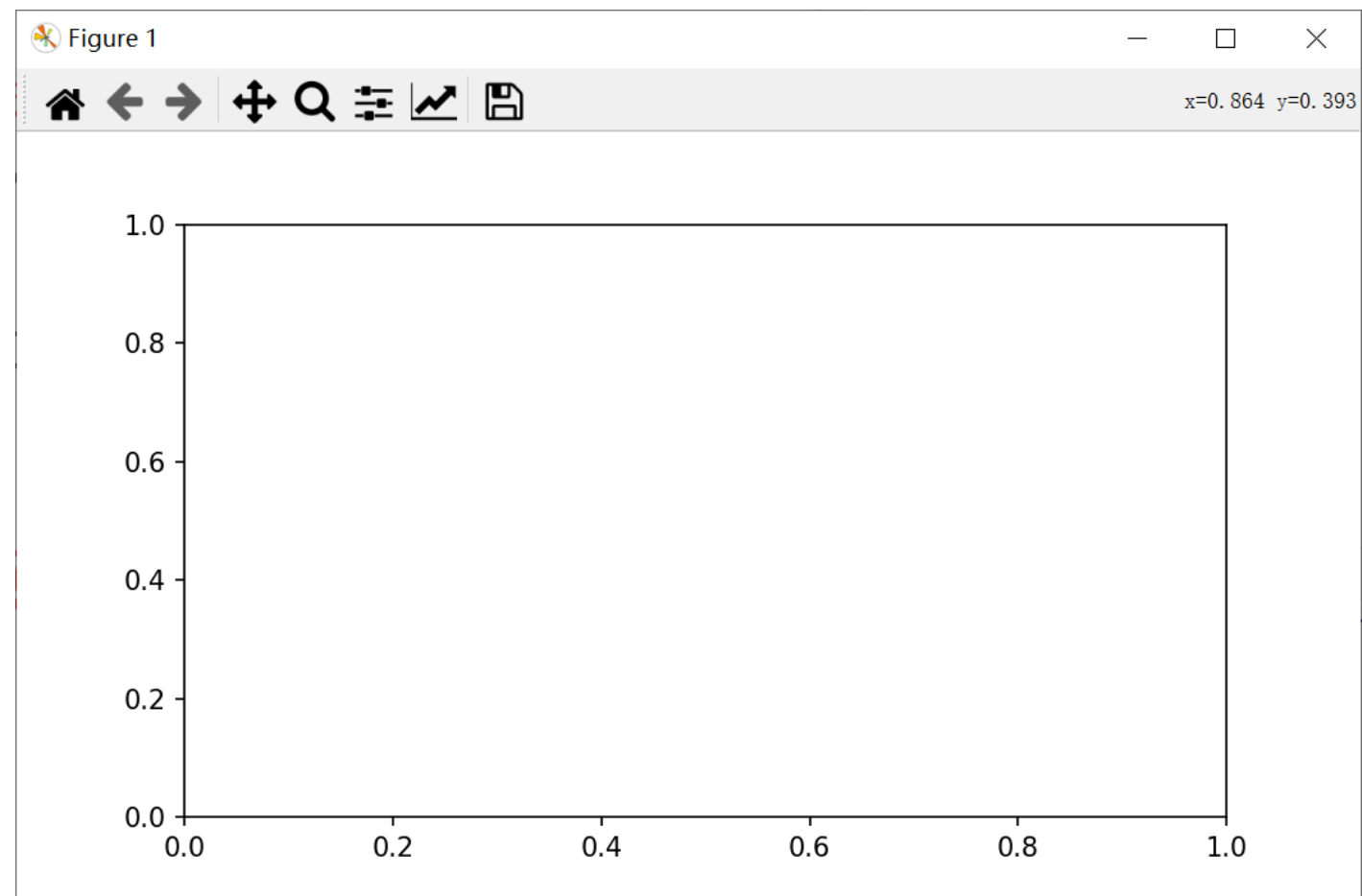
```
import matplotlib.pyplot as plt
```

```
# 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



湖北大学
HUBEI UNIVERSITY

• 第二步：绘制数据（以折线图为例）

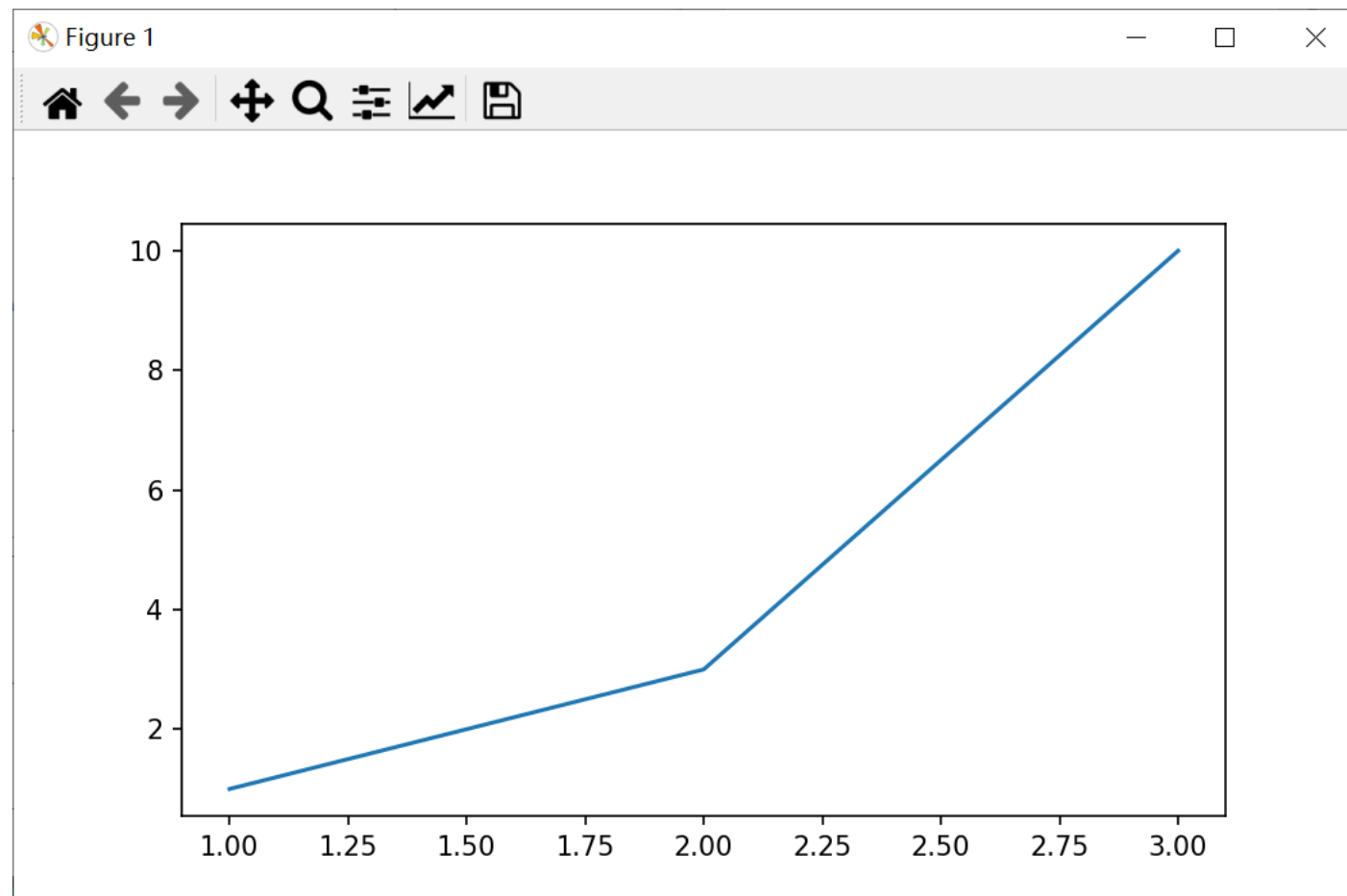
```
import matplotlib.pyplot as plt

# 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



湖北大学
HUBEI UNIVERSITY

- 第三步：添加亿点点细节（添加标题）

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

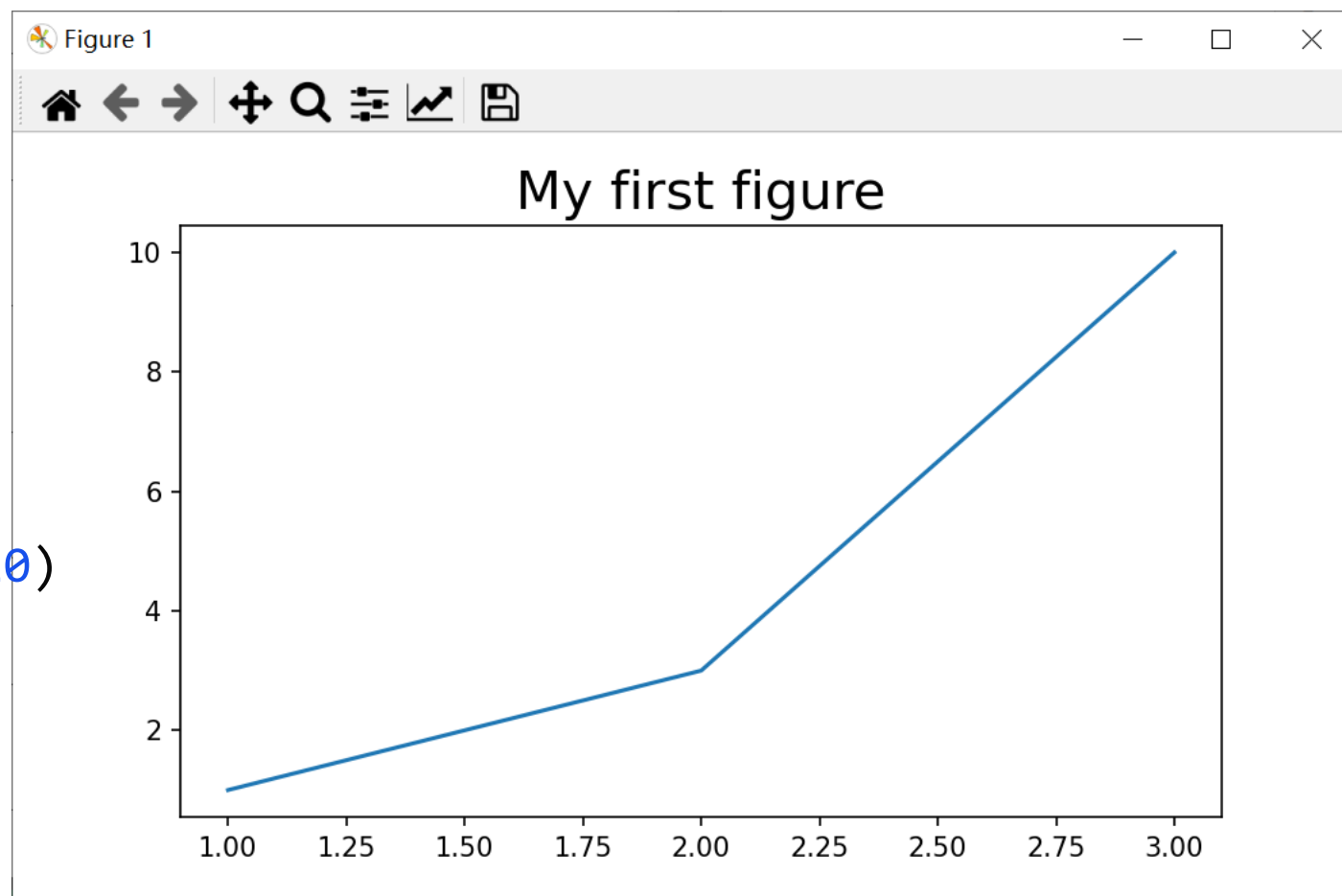
```
x = [1, 2, 3]  
y = [1, 3, 10]
```

```
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



湖北大学
HUBEI UNIVERSITY

• 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
```

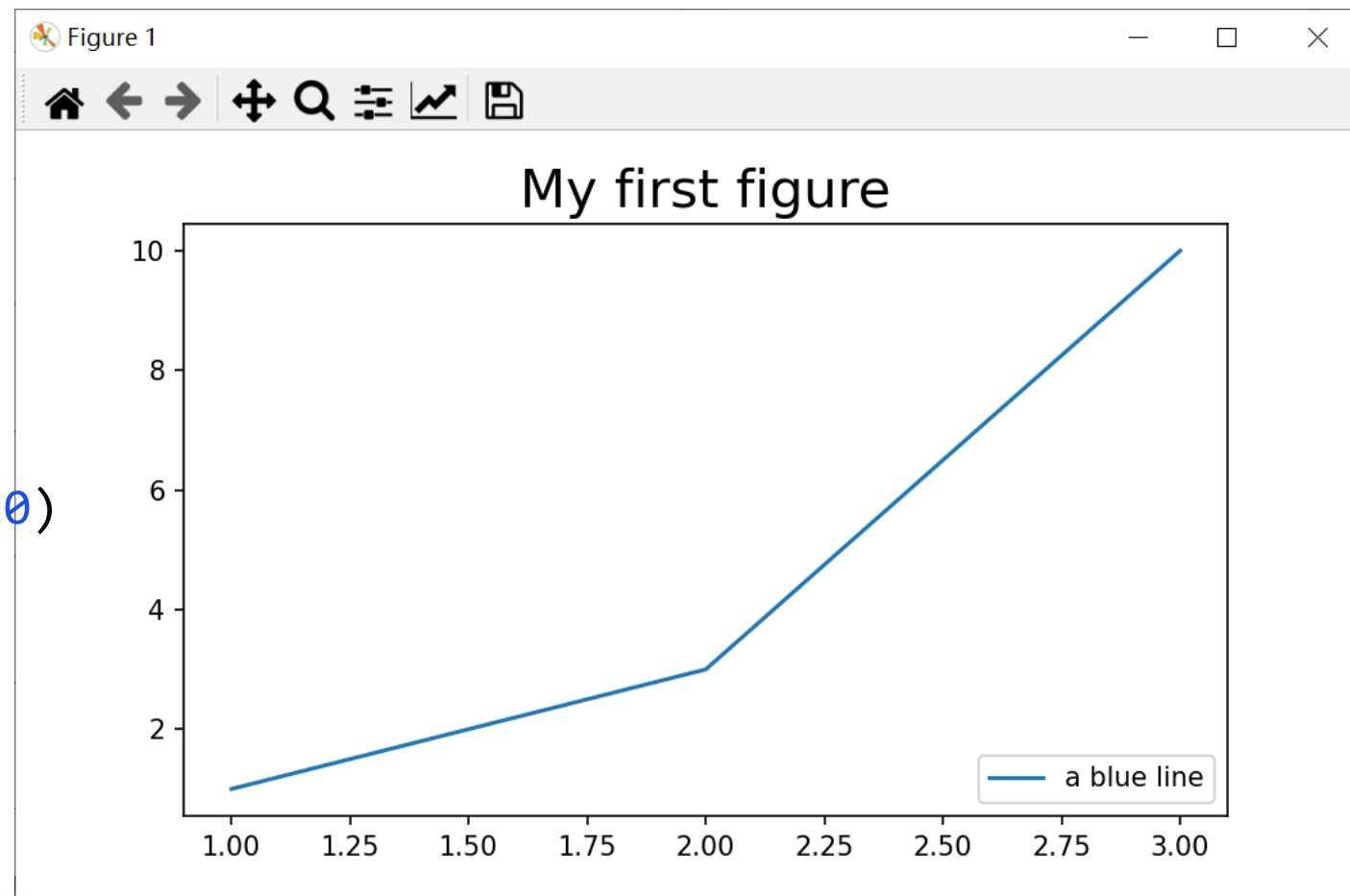
```
ax.plot(x, y, label='a blue line')
```

```
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



湖北大学
HUBEI UNIVERSITY

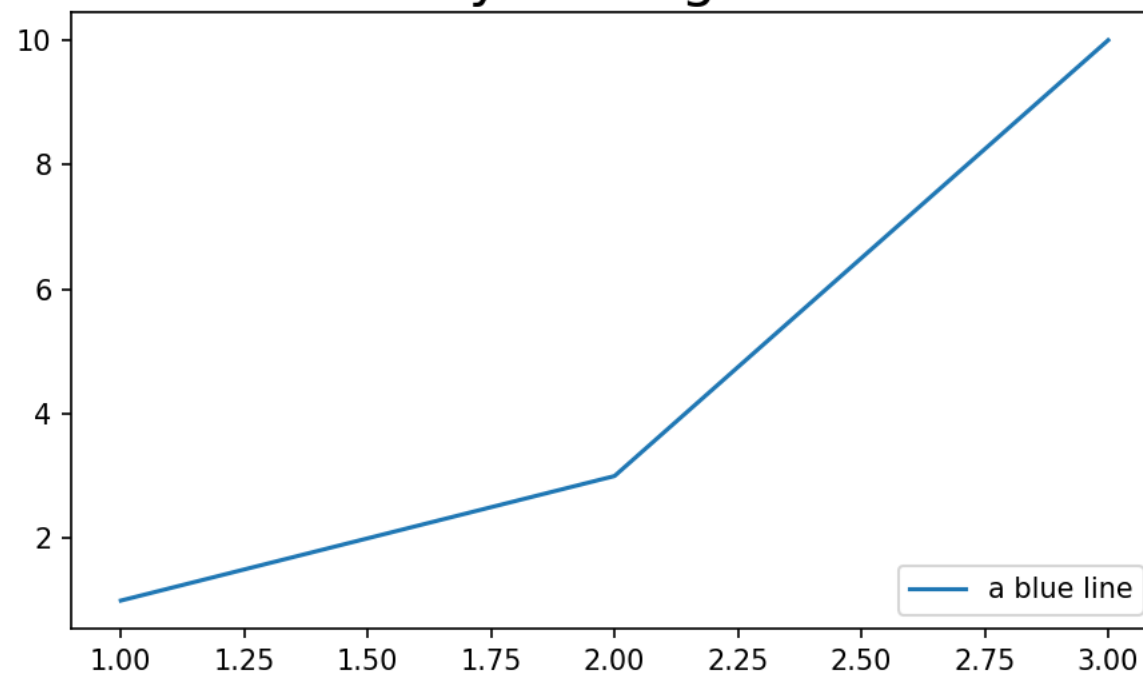
• 第三步：添加亿点点细节（添加图例）

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



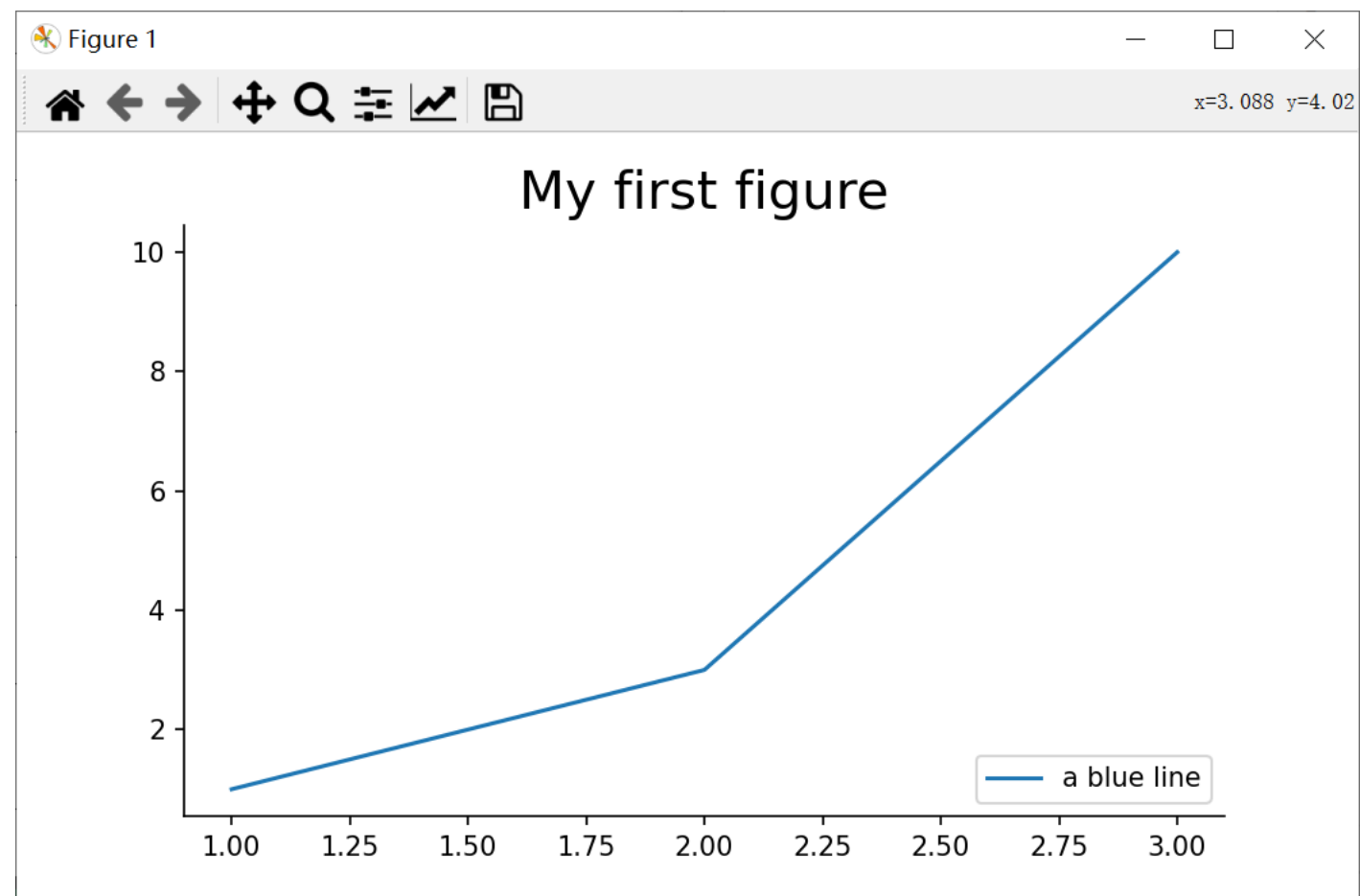
湖北大学
HUBEI UNIVERSITY

- 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

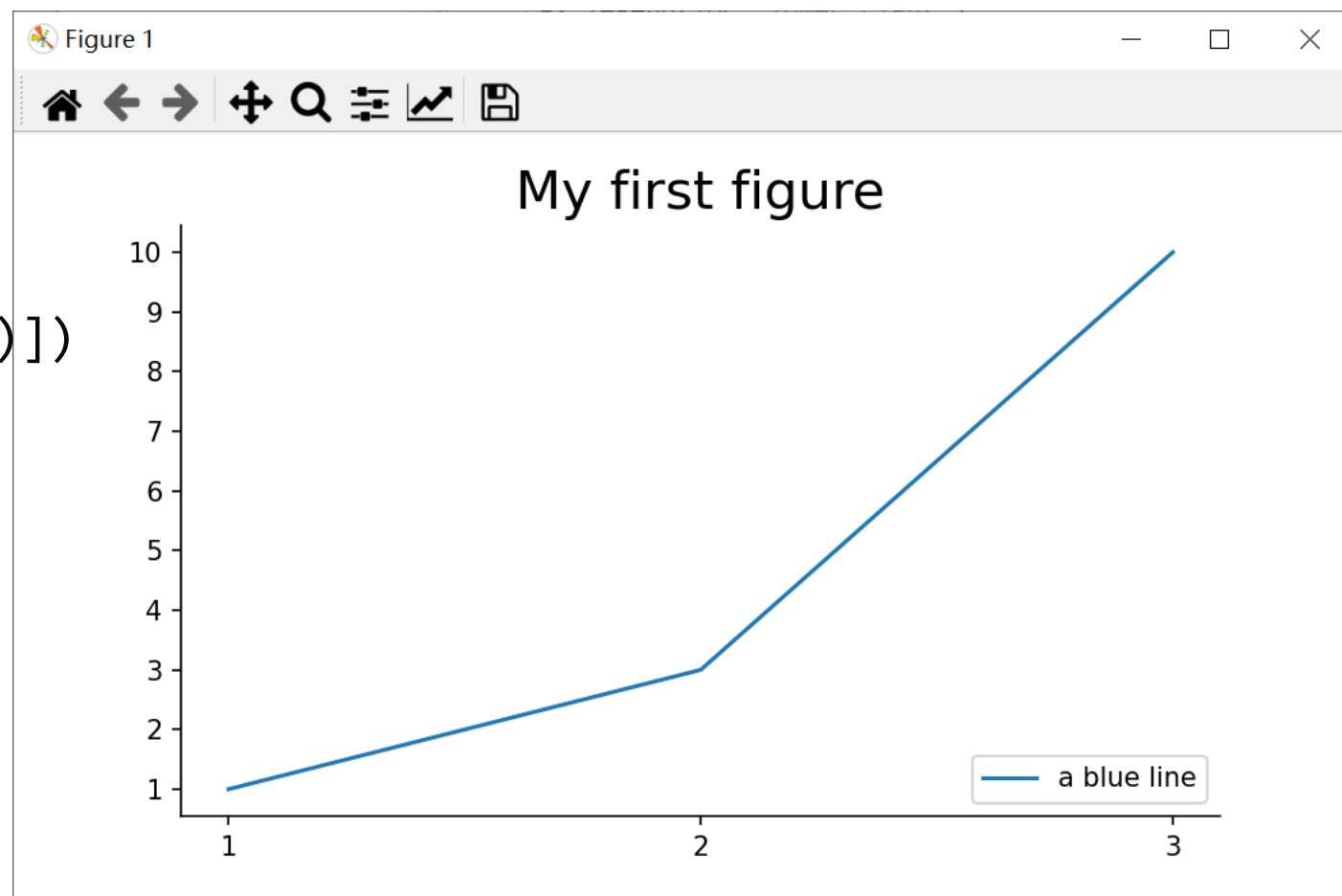


湖北大学
HUBEI UNIVERSITY

- 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



湖北大学
HUBEI UNIVERSITY

- 第三步：添加亿点点细节（增强显示数据点）

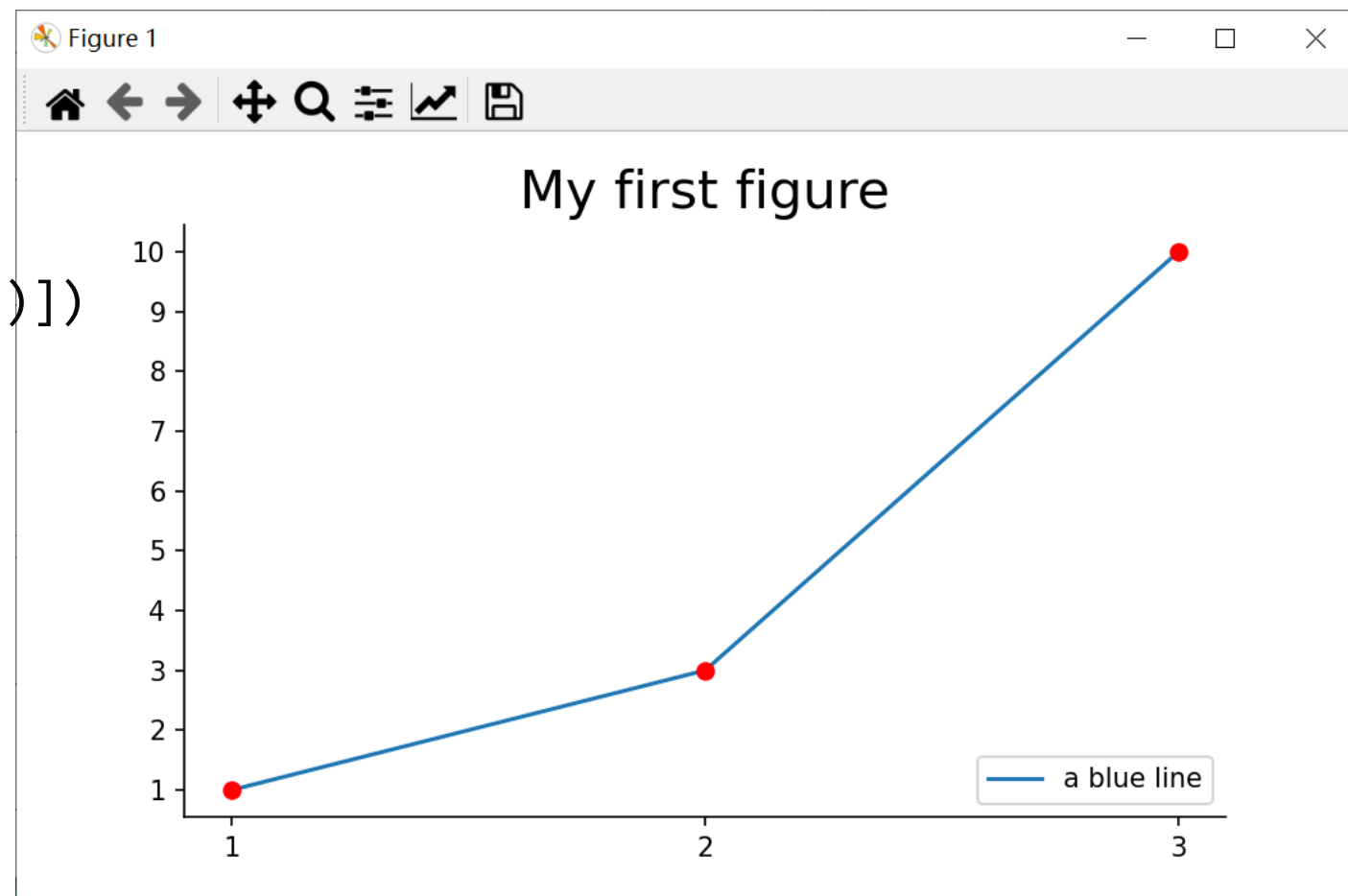
```
ax.set_title('My first figure', fontsize=20)
ax.legend(loc='lower right')
ax.spines['top'].set_visible(False)
ax.spines['right'].set_visible(False)
```

```
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



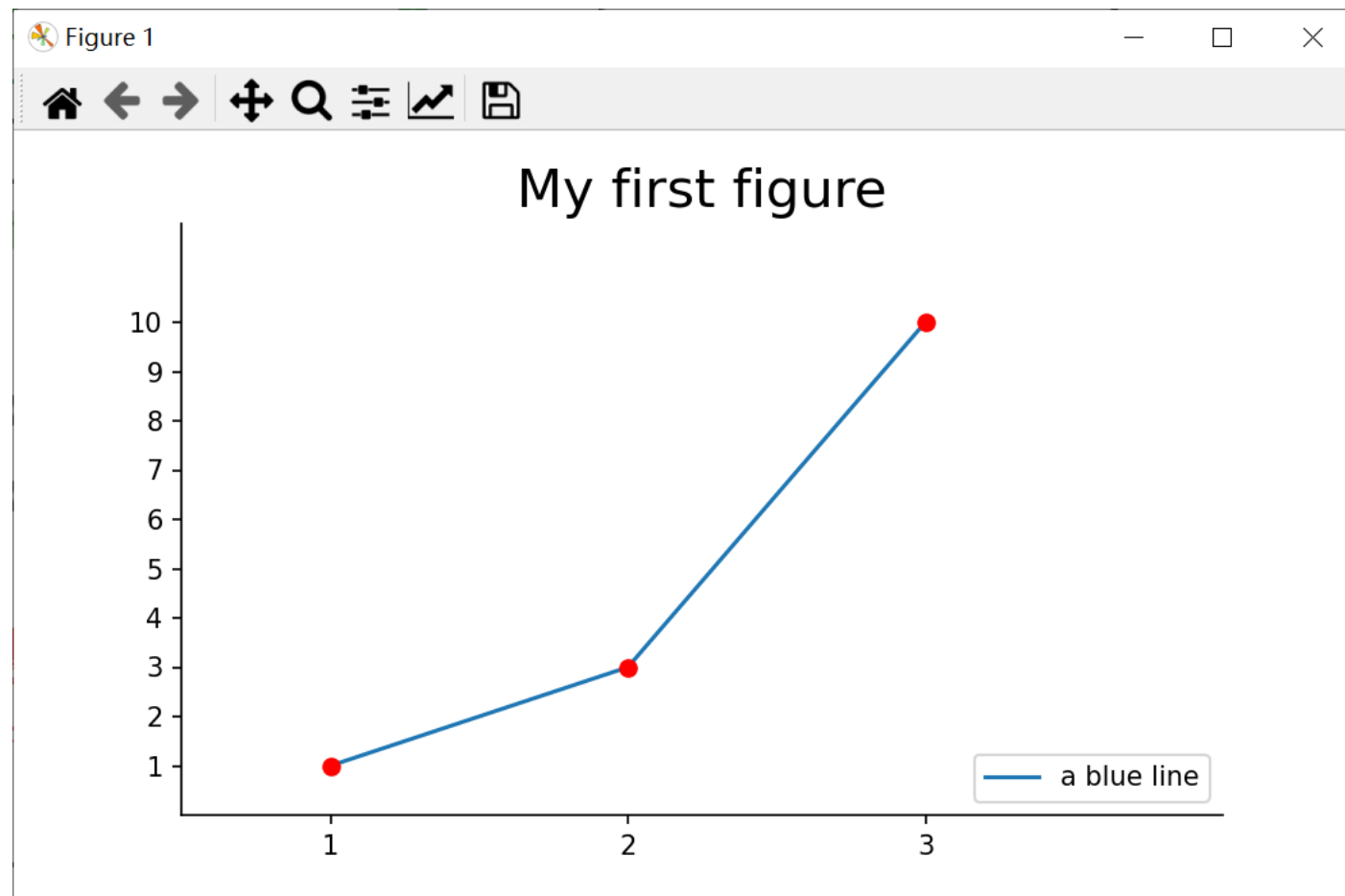
湖北大学
HUBEI UNIVERSITY

- 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



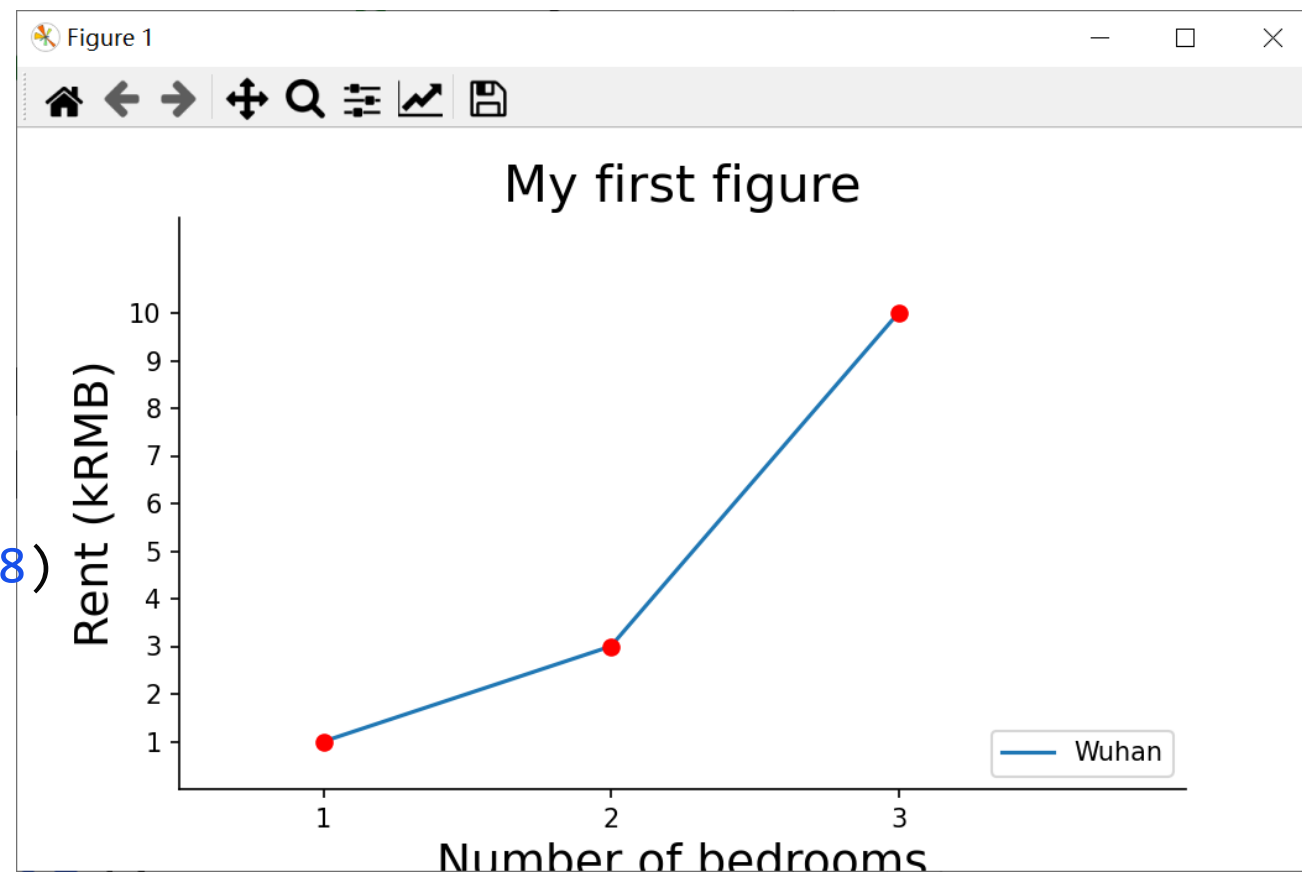
湖北大学
HUBEI UNIVERSITY

- 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)
```





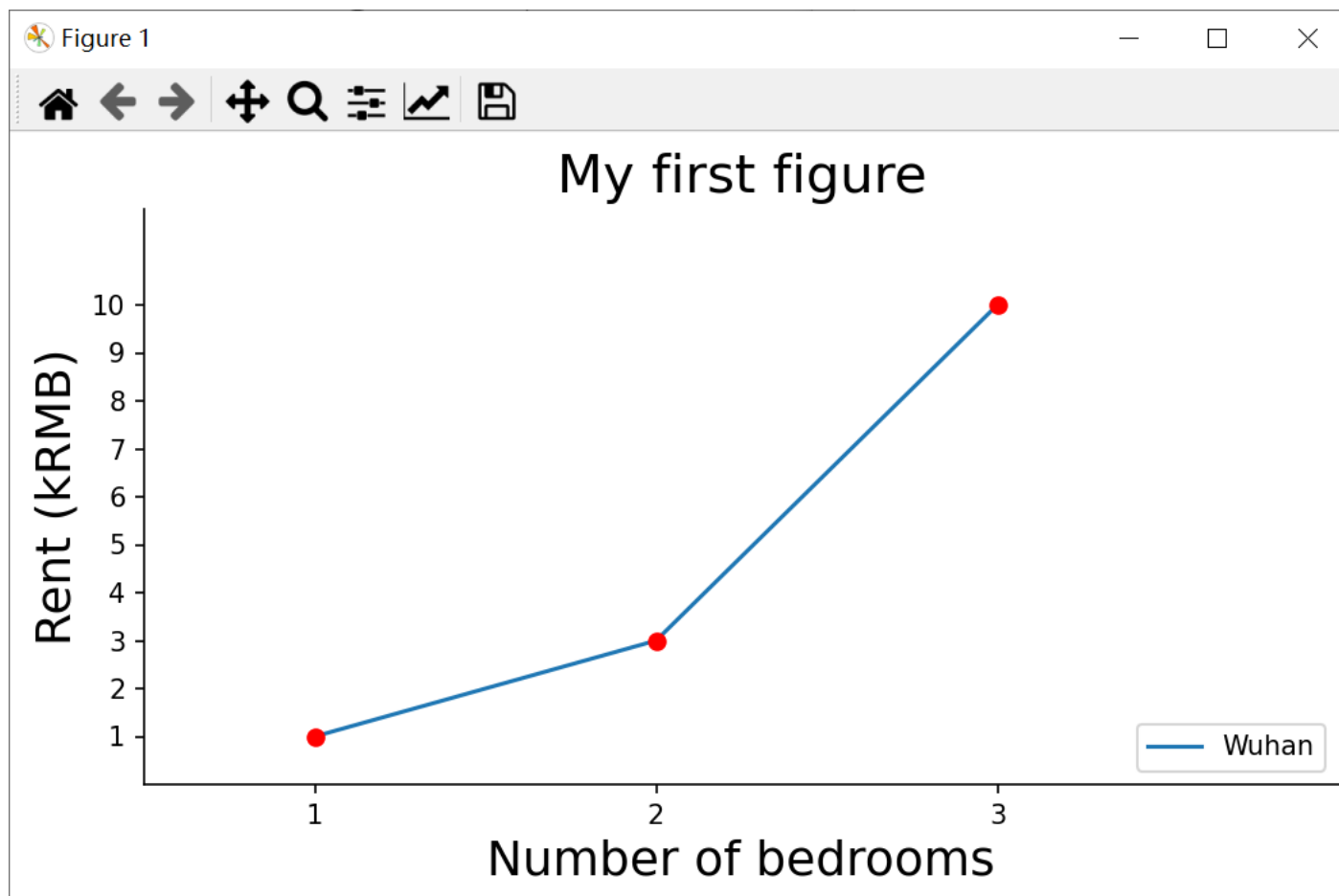
Matplotlib入门



湖北大学
HUBEI UNIVERSITY

- 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



谢谢!