

## 作业二

### 1. 修改教材附属代码：Chapter04 中的 B13346\_04\_26-PIL.py，数据

#### 采用 china 的数据

(1) 导入相关库：其中 Pillow 库主要用于图像操作，pyshp 主要用于矢量文件操作。在导入 shapefile 模块的时候遇到一些问题，在运行环境“myPython2”下明明已经下载了 pyshp 库，但是系统仍然提示出现“ModuleNotFoundError”错误提示（如下）。尝试寻找原因之后，最后在老师的帮助下，将环境改为 base 环境之后就可以导入了。（具体原因可能是因为在 myPython 中没有下载 pyshp 所需要的依赖包，但是神奇的是 base 下成功之后其他环境也可以运行了）。

```
try:
    import Image
    import ImageDraw
except:
    from PIL import Image
    from PIL import ImageDraw
import shapefile
import shapefile
ModuleNotFoundError: No module named 'shapefile'
```

(2) 读取 shp 文件：使用 shapefile 中的 Reader 方法，读取 china.shp 数据

```
r = shapefile.Reader("D:\\本科\\时空数据处理与组织\\data\\china.shapefile\\china.shp")#读入shp文件
```

(3) 计算 x、y 轴坐标转换率：使用 shapefile 对象的 bbox 方法获取 china.shp 的 x、y 坐标范围（r.bbox() 返回一个列表[x 坐标最小值，y 坐标最小值，x 坐标最大值，y 坐标最大值]）。根据此求出 x 轴坐标跨度（xdist）和 y 轴坐标跨度（ydist）。然后设置图片的大小（iwidth、iheight），为了实现得到的图片与原矢量图像宽高比相同，则使按照如下公式 1 计算 iheight。最后根据如下公式 2 求得 x、y 坐标转换比率。

$$iheight = iwidth \times \frac{ydist}{xdist} \quad (1)$$

$$xratio = \frac{iwidth}{xdist} \quad (2)$$

$$yratio = \frac{iheight}{ydist}$$

```
xdist = r.bbox[2] - r.bbox[0]#计算x范围
ydist = r.bbox[3] - r.bbox[1]#计算y范围
iwidth = 400
iheight = int(400*ydist/xdist)#实现与原矢量图像相同的宽高比
xratio = iwidth / xdist#计算x轴比例
yratio = iheight / ydist#计算y轴比例
```

(4) 处理多边形：在原始代码的基础上，加入“for i in range(len(r.shapes()))”遍历 shp 文件中的所有多边形，就可以实现对所有多边形的处理。然后对每一个多边形遍历其所有点，然后根据公式转换点坐标，得到图像坐标（公式如下）。然后使用列表的 append 方法把转换后的点加入点集 pixels 中。最后利用 Pillow 库中的 Image 和 ImageDraw 方法画多边形。

$$px = [iwidth - xratio \times (x_{max} - x)]$$

$$py = [yratio \times (y_{max} - y)]$$

```
pixels = []
for i in range(len(r.shapes())):#遍历所有多边形
    for x, y in r.shapes()[i].points:#遍历这个多边形所有点
        px = int(iwidth - ((r.bbox[2] - x) * xratio))#x坐标转换
        py = int((r.bbox[3] - y) * yratio)#y坐标转换
        pixels.append((px, py))#加入点
img = Image.new("RGB", (iwidth, iheight), "white")#新建图片
draw = ImageDraw.Draw(img)
draw.polygon(pixels, outline="rgb(203, 196, 190)", fill="rgb(198, 204, 189)")#画多边形
```

但是如此虽然遍历了所有的多边形，但是会出现很多杂乱直线（如下）：



经过研究发现出现杂乱现象的原因是程序会把相邻两个多边形的终点和起点连在一起。为了改正这些错误，我将 draw.polygon 命令放到多边形遍历循环之中，即每遍历一个多边形就画一次，这样就解决了之前的问题。为了实现颜色的随机填充，使用 random 模块中的 randint 生成不同的 color，然后在使用 polygon 方法时令 fill=color 即可。

```
img = Image.new("RGB", (iwidth, iheight), "white")#新建图片
draw = ImageDraw.Draw(img)
for i in range(len(r.shapes())):#遍历所有多边形
    pixels = []
    for x, y in r.shapes()[i].points:#遍历这个多边形所有点
        px = int(iwidth - ((r.bbox[2] - x) * xratio))#x坐标转换
        py = int((r.bbox[3] - y) * yratio)#y坐标转换
        pixels.append((px, py))#加入点
    #实现每个多边形不同颜色填充
    color='rgb('+str(random.randint(0,255))+','+str(random.randint(0,255))+','+str(random.randint(0,255))+')'
    draw.polygon(pixels, outline="rgb(203, 196, 190)", fill=color)#画多边形
```



2. 将 china.shp 数据导入到 MongoDB, 然后用 python 开发, 访问 MongoDB, 用直线 (84. 26, 27. 34) -- (108. 95, 45. 22) 进行 intersect 查询, 将查询结果的属性信息打印出来 (不要打印几何坐标信息, 导入数据操作也需要截图)

(1) 下载配置 MongoDB: 通过官网下载 (<https://www.mongodb.com/>) MongoDB, 下载完毕之后通过命令行 cd 命令进入 MongoDB 的 bin 目录下。

```
D:\>cd D:\Users\mwz\MongoDB\bin
```

然后输入 mongod --dbpath D:\Users\mwz\MongoDB\data 命令启动数据库

```
D:\Users\mwz\MongoDB\bin>mongod --dbpath D:\Users\mwz\MongoDB\data
```

访问 localhost: 27017, 验证数据库是否连接成功

It looks like you are trying to access MongoDB over HTTP on the native driver port.

输入 mongo 命令进入其中

```
D:\Users\mwz\MongoDB\bin>mongo
MongoDB shell version v5.0.6
connecting to: mongodb://127.0.0.1:27017/?compressors=disabled&gssapiServiceName=mongodb
Implicit session: session { "id" : UUID("bf905a4d-a290-4851-97d8-d2bcb937121d") }
MongoDB server version: 5.0.6
=====
Warning: the "mongo" shell has been superseded by "mongosh",
which delivers improved usability and compatibility. The "mongo" shell has been deprecated and will be removed in
an upcoming release.
For installation instructions, see
https://docs.mongodb.com/mongodb-shell/install/
=====
Welcome to the MongoDB shell.
```



(2) 将 china.shp 导入到 MongoDB 中：首先使用进入 QGIS 的 bin 目录下，使用其自带的 GDAL 工具（最开始忘记进入了，是无法使用 ogr2ogr 命令的）。使用【ogr2ogr -f geoJSON D:\\本科\\时空数据处理与组织\\data\\china.json D:\\本科\\时空数据处理与组织\\data\\china.shapefile\\china.shp】命令将 china.shp 文件转换为 json 文件导出。

```
D:\Users\mwz\QGIS\bin>ogr2ogr -f geoJSON D:\\本科\\时空数据处理与组织\\data\\china.json D:\\本科\\时空数据处理与组织\\data\\china.shapefile\\china.shp
```

```
D: > 本科 > 时空数据处理与组织 > data > {} china.json > {} features > {} 0 > {} geometry > {} coordinates
1 {
2   "type": "FeatureCollection",
3   "name": "china",
4   "features": [
5     { "type": "Feature", "properties": { "AREA": 54.447, "PERIMETER": 68.489, "BOU2_4M_": 2, "BOU2_4M_ID": 23, "ADCODE93": 230000,
      "ADCODE99": 230000, "NAME": "黑龙江省", "geometry": { "type": "Polygon", "coordinates": [ [ [ 121.488441467285156, 53.332649230957031 ], [ 121.499542236328125, 53.336006164550781 ], [ 121.518409729003906, 53.339191436767578 ], [ 121.539070129394531, 53.341720581054688 ], [ 121.573753356933594, 53.348175048828125 ], [ 121.584037780761719, 53.349643707275391 ], [ 121.593673706054688, 53.353237152099609 ], [ 121.603813171386719, 53.357810974121094 ], [ 121.613273620605469, 53.363365173339844 ], [ 121.622917175292969, 53.366798400878906 ], [ 121.635002136230469, 53.371044158935547 ], [ 121.646438598632812, 53.373332977294922 ], [ 121.660652160644531, 53.377906799316406 ], [ 121.667350769042969, 53.382804870605469 ], [ 121.674873352050781, 53.385581970214844 ], [ 121.684013366699219, 53.389175415039062 ], [ 121.697242736816406, 53.38995574951172 ], [ 121.703941345214844, 53.390155792236328 ], [ 121.710960388183594, 53.388359069824219 ], [ 121.718482971191406, 53.386398315429688 ], [ 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此电脑 > Data (D:) > Users > mwz > MongoDB > bin

搜索"bin"

名称	修改日期	类型	大小
bsondump.exe	2022/2/1 21:49	应用程序	18,710 KB
InstallCompass.ps1	2022/1/27 16:20	Windows Power...	2 KB
mongo.exe	2022/1/27 18:03	应用程序	21,780 KB
mongod.cfg	2022/3/25 10:13	Configuration 源...	1 KB
mongod.exe	2022/1/27 18:02	应用程序	46,547 KB
mongod.pdb	2022/1/27 18:02	Program Debug ...	519,684 KB
mongodump.exe	2022/2/1 21:49	应用程序	22,378 KB
mongoexport.exe	2022/2/1 21:50	应用程序	21,945 KB
mongofiles.exe	2022/2/1 21:50	应用程序	23,126 KB
mongoimport.exe	2022/2/1 21:50	应用程序	22,288 KB
mongorestore.exe	2022/2/1 21:49	应用程序	22,835 KB
mongos.exe	2022/1/27 17:17	应用程序	29,367 KB
mongos.pdb	2022/1/27 17:17	Program Debug ...	304,908 KB
mongostat.exe	2022/2/1 21:50	应用程序	21,607 KB
mongotop.exe	2022/2/1 21:50	应用程序	21,219 KB

导入数据库 mwz 成功

```
D:\Users\mwz\MongoDB\bin>mongoimport --db mwz --collection china --jsonArray --file D:\本科\时空数据处理与组织\data\china.json
2022-03-25T11:44:37.197+0800 connected to: mongodb://localhost/
2022-03-25T11:44:37.919+0800 924 document(s) imported successfully. 0 document(s) failed to import.
```

(3) 使用 python 连接 mongdb, 进行 intersect 查询: 主要代码如下。

- ①首先导入 pymongo 库(在导入这个库的时候又出现了上面 pyshp 出现的无法导入问题, 具体怎么解决总结在下面) ;
- ②然后使用 pymongo.MongoClient(host,port) 方法连接 MongoDB (地址为 localhost, 端口为 27017) ;
- ③指定使用的数据库为连接里的 mwz 数据库 (db=client.mwz)
- ④指定 china 集合 (collection=dn.china)
- ⑤在 china 集合中进行查询, 使用集合对象 collection 的 find 方法进行查询
- ⑥遍历结果生成器, 打印结果属性信息

```
1 import pymongo as mg#导入pymongo库
2 import os
3 client=mg.MongoClient(host='localhost',port=27017)#连接MongoDB, 传入地址和端口
4 db=client.mwz#指定mwz数据库
5 collection=db.china#指定china集合
6 #进行intersect查询, 返回Cursor类型, 它相当于一个生成器, 我们需要遍历取到所有的结果, 其中每个结果都是字典类型
7 results=collection.find({
8     "geometry": {"$geoIntersects":
9         {"$geometry": {"type": "LineString","coordinates": [[84.26, 27.34], [108.95,45.22]]}
10     }
11 }
12 }, {"properties":1})
13 for result in results:#遍历结果生成器, 打印每一个结果字典
14     print(result)
15 os.system("pause")
```

```
{'_id': ObjectId('623d3aa5aeb3676aee9d3bca'), 'properties': {'AREA': 41.588, 'PERIMETER': 76.781, 'BOU2_4M_': 7, 'BOU2_4M_ID': 62, 'ADCODE93': 620000, 'ADCODE99': 620000, 'NAME': '甘肃省'}}
{'_id': ObjectId('623d3aa5aeb3676aee9d3bd0'), 'properties': {'AREA': 129.113, 'PERIMETER': 129.933, 'BOU2_4M_': 3, 'BOU2_4M_ID': 15, 'ADCODE93': 150000, 'ADCODE99': 150000, 'NAME': '内蒙古自治区'}}
{'_id': ObjectId('623d3aa5aeb3676aee9d3c04'), 'properties': {'AREA': 71.363, 'PERIMETER': 59.562, 'BOU2_4M_': 68, 'BOU2_4M_ID': 63, 'ADCODE93': 630000, 'ADCODE99': 630000, 'NAME': '青海省'}}
{'_id': ObjectId('623d3aa5aeb3676aee9d3d18'), 'properties': {'AREA': 114.331, 'PERIMETER': 76.629, 'BOU2_4M_': 179, 'BOU2_4M_ID': 54, 'ADCODE93': 540000, 'ADCODE99': 540000, 'NAME': '西藏自治区'}}
Press any key to continue . . .
```

### 3. 问题总结

如果出现明明在 conda 里面下载了 pymongo 或者 pyshp 之类的库，但是 import 它们的时候显示 `NotFoundMoudleErro` 的时候，可以在 conda 的 base 环境下再下载一个一样的库，然后即便使用其他环境里就可以导入了。（应该是其他环境缺少依赖库导致的。