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Python常用代码段

- 最新版本: v1.2
- 更新时间: 20200710

简介

整理出crifan总结的Python各个方面常用的代码段，供需要的参考。包括通用逻辑、变量、系统、日期时间、字符和字符串、文件系统，比如文件和文件夹等、以及第三方库，比如BeautifulSoup、以及多媒体音视频类、包括Pillow、以及网络的Requests等；以及其他常见语法，包括dict字典、list列表、set集合、enum枚举、collections集合等。

源码+浏览+下载

本书的各种源码、在线浏览地址、多种格式文件下载如下：

Gitbook源码

- [crifan/python_common_code_snippet](#): Python常用代码段

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鸣谢

感谢我的老婆陈雪的包容理解和悉心照料，才使得我 crifan 有更多精力去专注技术专研和整理归纳出这些电子书和技术教程，特此鸣谢。

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背景

多年的技术开发，积累了很多关于 Python 的常用的一些函数和功能，都已整理到对应的函数库中：

<https://github.com/crifan/crifanLibPython>

且也给出了很多函数的demo演示如何使用：

<https://github.com/crifan/crifanLibPython/tree/master/crifanLib/demo>

但还是解释的不够清楚和全面。

故此处专门把Python的常用的代码段和调用举例，都整理至此，详细解释。

目的：

方便需要时能快速查阅：直接看代码，一看就懂，无需额外解释。

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常用代码段

下面总结各个方面的Python常用代码段。

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通用逻辑

多次运行一个函数，直到成功运行

执行一个函数（可能有多个可变数量的参数），且尝试多次，直到成功或超出最大此时，最终实现是：

```
def multipleRetry(functionInfoDict, maxRetryNum=5, sleepInterval=1.0, isShowErrWhenFail=False):
    """Do something, retry multiple time if fail

    Args:
        functionInfoDict (dict): function info dict contains:
            maxRetryNum (int): max retry number
            sleepInterval (float): sleep time of each interval
            isShowErrWhenFail (bool): show error when fail if True
    Returns:
        bool
    Raises:
        None

    doSuccess = False
    functionCallback = functionInfoDict["functionCallback"]
    functionParaDict = functionInfoDict.get("functionParaDict", {})

    curRetryNum = maxRetryNum
    while curRetryNum > 0:
        if functionParaDict:
            doSuccess = functionCallback(**functionParaDict)
        else:
            doSuccess = functionCallback()

        if doSuccess:
            break

        time.sleep(sleepInterval)
        curRetryNum -= 1

    if not doSuccess:
        if isShowErrWhenFail:
            functionName = str(functionCallback)
            # '<bound method DevicesMethods.switchToAppStorage of <DevicesMethods object at 0x10c2e0>'
            logging.error("Still fail after %d retry for %s" % (maxRetryNum, functionName))
    return doSuccess
```

说明：

文件

functionCallback 函数类型都要符合：返回值是bool类型才可以

调用举例：

(1) 没有额外参数

```
foundAndClickedWifi = CommonUtils.multipleRetry({"functionC
```

其中：

```
def iOSFromSettingsIntoWifiList(self):  
    ...  
    foundAndClickedWifi = self.findAndClickElement(query=wifiListQuery)  
    return foundAndClickedWifi
```

类似例子：

```
isSwitchOk = self.multipleRetry({"functionCallback": self.isSwitchOk, "functionParaDict": {}})
```

对比之前原始写法：

```
isSwitchOk = self.switchToAppStoreSearchTab()
```

其他类似例子：

```
foundAndClickedDownload = self.multipleRetry({"functionCallback": self.isInputOk, "functionParaDict": {}})
```

详见：

【已解决】AppStore自动安装iOS的app：逻辑优化加等待和多试几次

(2) 有额外参数，参数个数：2个

```
searchInputQuery = {"type": "XCUIElementTypeSearchField", "text": ""}  
isInputOk = CommonUtils.multipleRetry(  
    {  
        "functionCallback": self.wait_element_setText,  
        "functionParaDict": {  
            "locator": searchInputQuery,  
            "text": appName,  
        }  
    }  
)
```

对比之前原始写法：

文件

```
searchInputQuery = {"type": "XCUIElementTypeSearchField", "text": ""}  
isInputOk = self.wait_element_setText(searchInputQuery, appName)
```

其中wait_element_setText的定义是：

```
def wait_element_setText(self, locator, text):
```

对应着之前传入时的：

```
"functionParaDict": {  
    "locator": searchInputQuery,  
    "text": appName,  
}
```

(3) 有额外参数，且加上multipleRetry的额外参数

```
isSwitchOk = CommonUtils.multipleRetry(  
    {"functionCallback": self.switchToAppStoreSearchTab},  
    maxRetryNum = 10,  
    sleepInterval = 0.5,  
)
```

以及类似的：

```
isIntoDetailOk = self.multipleRetry(  
{  
    "functionCallback": self.appStoreSearchResultIntoDetail,  
    "functionParaDict": {  
        "appName": appName,  
    },  
},  
    sleepInterval=0.5  
)
```

之前原始写法：

```
isIntoDetailOk = self.appStoreSearchResultIntoDetail(appName)
```

注：

此处是后来加上的

```
sleepInterval=0.5
```

文件

是因为后来遇到了，即使尝试了5次，依旧没找到，所以增加了没找到的延迟等待时间。

详见：

【已解决】AppStore自动安装iOS的app：逻辑优化加等待和多试几次

(4)

```
isIntoDetailOk = CommonUtils.multipleRetry(  
    {  
        "functionCallback": self.appStoreSearchResultIntoDetail,  
        "functionParaDict": {  
            "appName": appName,  
        }  
    },  
    maxRetryNum = 10,  
    sleepInterval = 0.5,  
)
```

新版：新增参数**isRespFullRetValue**

后续优化新增参数：是否返回完整信息

代码：

```

def multipleRetry(functionInfoDict, maxRetryNum=5, sleepInterval=0.1):
    """do something, retry if single call failed, retry until success or max retry number reached.

    Args:
        functionInfoDict (dict): function info dict containing:
            maxRetryNum (int): max retry number
            sleepInterval (float): sleep time (seconds) of each retry
            isShowErrWhenFail (bool): show error when fail if True
            isRespFullRetValue (bool): whether return full return value if True
    Returns:
        isRespFullRetValue=False: bool
        isRespFullRetValue=True: bool / tuple/list/...
    Raises:
        ...
    """
    finalReturnValue = None
    doSuccess = False
    functionCallback = functionInfoDict["functionCallback"]
    functionParaDict = functionInfoDict.get("functionParaDict", {})

    curRetryNum = maxRetryNum
    while curRetryNum > 0:
        if functionParaDict:
            # doSuccess = functionCallback(**functionParaDict)
            respValue = functionCallback(**functionParaDict)
        else:
            # doSuccess = functionCallback()
            respValue = functionCallback()

        doSuccess = False
        if isinstance(respValue, bool):
            doSuccess = bool(respValue)
        elif isinstance(respValue, tuple):
            doSuccess = bool(respValue[0])
        elif isinstance(respValue, list):
            doSuccess = bool(respValue[0])
        else:
            raise Exception("multipleRetry: Not support type of response value: %s" % type(respValue))

        if doSuccess:
            if isRespFullRetValue:
                finalReturnValue = respValue
            else:
                finalReturnValue = doSuccess
            break

        time.sleep(sleepInterval)
        curRetryNum -= 1

    if not doSuccess:
        if isShowErrWhenFail:
            print("multipleRetry failed after %d retries" % curRetryNum)

```

```
functionName = str(functionCallback)
# '<bound method DevicesMethods.switchToAppStorage of <DevicesMethods object at 0x10c3a10>'>
logging.error("Still fail after %d retry for %s", count, functionName)
# return doSuccess
return finalReturnValue
```

调用举例：

(1)默认不返回完整信息，只返回bool值

```
respBoolOrTuple = CommonUtils.multipleRetry(
    functionInfoDict = {
        "functionCallback": self.isGotoPayPopupPage,
        "functionParaDict": {
            "isRespLocation": False,
        },
    },
)
```

(2)返回完整信息

```
respBoolOrTuple = CommonUtils.multipleRetry(
    functionInfoDict = {
        "functionCallback": self.isGotoPayPopupPage,
        "functionParaDict": {
            "isRespLocation": True,
        },
    },
    isRespFullRetValue = True,
)
```

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变量

判断变量类型

优先用 `isinstance`，而不是 `type`

```
>>> isinstance(2, float)
False
>>> isinstance('a', (str, unicode))
True
>>> isinstance((2, 3), (str, list, tuple))
True
```

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系统

此处整理用Python处理系统相关的通用的代码。

系统类型

```
import sys

def osIsWindows():
    return sys.platform == "win32"

def osIsCygwin():
    return sys.platform == "cygwin"

def osIsMacOS():
    return sys.platform == "darwin"

def osIsLinux():
    return sys.platform == "linux"

def osIsAix():
    return sys.platform == "aix"
```

命令行

获取命令行执行命令返回结果

代码:

```
def get_cmd_lines(cmd, text=False):
    # 执行cmd命令，将结果保存为列表
    resultStr = ""
    resultStrList = []
    try:
        consoleOutputByte = subprocess.check_output(cmd, shell=True)
        try:
            resultStr = consoleOutputByte.decode("utf-8")
        except UnicodeDecodeError:
            # TODO: use chardet auto detect encoding
            # consoleOutputStr = consoleOutputByte.decode('gb18030')
            resultStr = consoleOutputByte.decode("gb18030")

        if not text:
            resultStrList = resultStr.splitlines()
    except Exception as err:
        print("err=%s when run cmd=%s" % (err, cmd))

    if text:
        return resultStr
    else:
        return resultStrList
```

硬件信息

获取当前电脑（Win或Mac）的序列号

代码：

```
def getSerialNumber(self):
    """get current computer serial number"""
    # cmd = "wmic bios get serialnumber"
    cmd = ""
    if CommonUtils.osIsWindows():
        # Windows
        cmd = "wmic bios get serialnumber"
    elif CommonUtils.osIsMacOS():
        # macOS
        cmd = "system_profiler SPHardwareDataType | awk '/"
    # TODO: add support other OS
    # AIX: aix
    # Linux: linux
    # Windows/Cygwin: cygwin

    serialNumber = ""
    lines = CommonUtils.get_cmd_lines(cmd)
    if CommonUtils.osIsWindows():
        # Windows
        serialNumber = lines[1]
    elif CommonUtils.osIsMacOS():
        # macOS
        serialNumber = lines[0] # C02Y3N10JHC8

    return serialNumber
```

日期时间

详见：

<https://github.com/crifan/crifanLibPython/blob/master/crifanLib/crifanDatetime.py>

getCurDatetimeStr 生成当前日期时间字符串

```
def getCurDatetimeStr(outputFormat="%Y%m%d_%H%M%S"):  
    """  
    get current datetime then format to string  
  
    eg:  
        20171111_220722  
  
    :param outputFormat: datetime output format  
    :return: current datetime formatted string  
    """  
    curDatetime = datetime.now() # 2017-11-11 22:07:22.705  
    curDatetimeStr = curDatetime.strftime(format=outputFormat)  
    return curDatetimeStr
```

调用举例：

```
curDatetimeStr = getCurDatetimeStr() # '20191219_143400'
```

datetime转时间戳

```
import time

def datetimeToTimestamp(self, datetimeVal, withMilliseconds=False):
    """
        convert datetime value to timestamp
    eg:
        "2006-06-01 00:00:00.123" -> 1149091200
            if with milliseconds -> 1149091200123
    :param datetimeVal:
    :return:
    """

    timetupleValue = datetimeVal.timetuple()
    timestampFloat = time.mktime(timetupleValue) # 1531468736.0
    timestamp10DigitInt = int(timestampFloat) # 1531468736
    timestampInt = timestamp10DigitInt

    if withMilliseconds:
        microsecondInt = datetimeVal.microsecond # 817762
        microsecondFloat = float(microsecondInt)/float(1000000)
        timestampFloat = timestampFloat + microsecondFloat
        timestampFloat = timestampFloat * 1000 # 1531468736.817762
        timestamp13DigitInt = int(timestampFloat) # 1531468736817762
        timestampInt = timestamp13DigitInt

    return timestampInt
```

获取当前时间戳

```
from datetime import datetime

def getCurTimestamp(withMilliseconds=False):
    """
        get current time's timestamp
        (default)not milliseconds -> 10 digits: 1351670162
        with milliseconds -> 13 digits: 1531464292921
    """

    curDatetime = datetime.now()
    return datetimeToTimestamp(curDatetime, withMilliseconds)
```

时间戳精确到毫秒

```
from datetime import datetime, timedelta
timestampStr = datetime.now().strftime("%Y%m%d_%H%M%S_%f")
# 20180712_154134_660436
```

文件

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字符和字符串

详见：

<https://github.com/crifan/crifanLibPython/blob/master/crifanLib/crifanFile.py>

Python3 str转bytes

Python 3中，把字符串转换成字节码，可以有两种写法：

- 方法1：用bytes去转换

```
convertedBytes = bytes(originStr)
```

- 方法2：用字符串str的编码encode

```
encodedBytes = originStr.encode()
```

其中：

都有额外的encoding参数：

- 由于默认都是UTF-8
 - 所以可加可不加
- 也可以根据需要，去加其他你要的编码
 - 如果要加，就是：

```
convertedBytes = bytes(originStr, "UTF-8")
encodedBytes = originStr.encode("UTF-8")
```

字符串格式化为人类易读格式

```
def formatSize(sizeInBytes, decimalNum=1, isUnitWithI=False):
    """
        format size to human readable string

    example:
        3746 -> 3.7KB
        87533 -> 85.5KiB
        98654 -> 96.3 KB
        352 -> 352.0B
        76383285 -> 72.84MB
        763832854988542 -> 694.70TB
        763832854988542665 -> 678.4199PB

    refer:
        https://stackoverflow.com/questions/1094841/reusable-binary-size-formatting
    """

    # https://en.wikipedia.org/wiki/Binary_prefix#Specific_units
    # K=kilo, M=mega, G=giga, T=tera, P=peta, E=exa, Z=zetta,
    sizeUnitList = ['', 'K', 'M', 'G', 'T', 'P', 'E', 'Z']
    largestUnit = 'Y'

    if isUnitWithI:
        sizeUnitListWithI = []
        for curIdx, eachUnit in enumerate(sizeUnitList):
            unitWithI = eachUnit
            if curIdx >= 1:
                unitWithI += 'i'
            sizeUnitListWithI.append(unitWithI)

    # sizeUnitListWithI = ['', 'Ki', 'Mi', 'Gi', 'Ti', 'Pi', 'Ei'
    sizeUnitList = sizeUnitListWithI

    largestUnit += 'i'

    suffix = "B"
    decimalFormat = "," + str(decimalNum) + "f" # ".1f"
    finalFormat = "%" + decimalFormat + sizeUnitSeperator + "%"

    sizeNum = sizeInBytes
    for sizeUnit in sizeUnitList:
        if abs(sizeNum) < 1024.0:
            return finalFormat % (sizeNum, sizeUnit, suffix)
        sizeNum /= 1024.0
    return finalFormat % (sizeNum, largestUnit, suffix)
```

调用:

```
def testKb():
    kbSize = 3746
    kbStr = formatSize(kbSize)
    print("%s -> %s" % (kbSize, kbStr))

def testI():
    iSize = 87533
    iStr = formatSize(iSize, isUnitWithI=True)
    print("%s -> %s" % (iSize, iStr))

def testSeparator():
    seperatorSize = 98654
    seperatorStr = formatSize(seperatorSize, sizeUnitSeparate=True)
    print("%s -> %s" % (seperatorSize, seperatorStr))

def testBytes():
    bytesSize = 352
    bytesStr = formatSize(bytesSize)
    print("%s -> %s" % (bytesSize, bytesStr))

def testMb():
    mbSize = 76383285
    mbStr = formatSize(mbSize, decimalNum=2)
    print("%s -> %s" % (mbSize, mbStr))

def testTb():
    tbSize = 763832854988542
    tbStr = formatSize(tbSize, decimalNum=2)
    print("%s -> %s" % (tbSize, tbStr))

def testPb():
    pbSize = 763832854988542665
    pbStr = formatSize(pbSize, decimalNum=4)
    print("%s -> %s" % (pbSize, pbStr))

def demoFormatSize():
    testKb()
    testI()
    testSeparator()
    testBytes()
    testMb()
    testTb()
    testPb()
```

文件系统

详见：

- <https://github.com/crifan/crifanLibPython/blob/master/crifanLib/crifanFile.py>
- <https://github.com/crifan/crifanLibPython/blob/master/crifanLib/demo/crifanFileDemo.py>

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文件

获取文件最后更新时间

```
import os

def getUpdateTime(curFileOrPath):
    """get file/folder latest update time = modify time

    Args:
        curFileOrPath (str): some file or folder path
    Returns:
        int: time stamp int of 13 digit, with milliseconds
    Raises:
        .....
    updateTime = None
    try:
        modifyTime = os.path.getmtime(curFileOrPath) # 159...
        updateTime = int(modifyTime * 1000) # 1593748641327
    except OSError as err:
        errMsg = str(err)
        # print("errMsg=%s" % errMsg)
        pass

    return updateTime
```

详见：

[【已解决】Python中获取文件最后更新时间](#)

提取文件名后缀

```
def extractSuffix(fileNameOrUrl):
    .....
    extract file suffix from name or url
    eg:
    https://cdn2.qupeiyin.cn/2018-09-10/15365514898246.mp4 -> r
        15365514894833.srt -> srt
    .....
    return fileNameOrUrl.split('.')[ -1 ]
```

创建空文件

文件

```
import os

def createEmptyFile(fullFilename):
    """Create a empty file like touch"""
    filePath = os.path.dirname(fullFilename)
    # create folder if not exist
    if not os.path.exists(filePath):
        os.makedirs(filePath)

    with open(fullFilename, 'a'):
        # Note: not use 'w' for maybe conflict for others
        os.utime(fullFilename, None)
```

读取文件二进制数据

```
def readBinDataFromFile(fileToRead):
    """Read binary data from file"""
    binaryData = None
    try:
        readFp = open(fileToRead, "rb")
        binaryData = readFp.read()
        readFp.close()
    except:
        binaryData = None

    return binaryData
```

调用：

```
imgBinData = readBinDataFromFile(imageFullPath)
```

保存二进制数据到文件

```
def saveDataToFile(fullFilename, binaryData):
    """save binary data info file"""
    with open(fullFilename, 'wb') as fp:
        fp.write(binaryData)
        fp.close()
    # print("Complete save file %s" % fullFilename)
```

保存json到文件

```
import json
import codecs

def saveJsonToFile(fullFilename, jsonValue):
    """save json dict into file"""
    with codecs.open(fullFilename, 'w', encoding="utf-8") as jsonFp:
        json.dump(jsonValue, jsonFp, indent=2, ensure_ascii=True)
        # print("Complete save json %s" % fullFilename)
```

从文件中加载出json

```
import json
import codecs

def loadJsonFromFile(fullFilename):
    """load and parse json dict from file"""
    with codecs.open(fullFilename, 'r', encoding="utf-8") as jsonFp:
        jsonDict = json.load(jsonFp)
        # print("Complete load json from %s" % fullFilename)
    return jsonDict
```

通过二进制生成文件类型对象

(1) Python 3

```
import io

audioBinaryData = audioObj.read()
audioFileLikeObj = io.BytesIO(audioBinaryData)
```

得到对应的文件类型的对象的: `<_io.BytesIO object at 0x115964468>` , 即可去像操作文件一样去操作这个io。

(2) Python 2

```
import StringIO

audioFileLikeObj = StringIO.StringIO()
audioFileLikeObj.write(audioBinaryData)
```

一行代码把字符串写入保存到文件

文件

```
open(fullFilePath, "w").write(fileContentStr).close()
```

举例：

```
open("0408_1600.xml", "w").write(page).close()
```

给文件增加可执行权限：实现 chmod +x 的效果

代码：

```
import os
import stat

curState = os.stat(someFile)
newState = curState.st_mode | stat.S_IEXEC
os.chmod(someFile, newState)
```

再去优化为函数：

```
import os
import stat

def chmodAddX(someFile):
    """add file executable mode, like chmod +x

    Args:
        someFile (str): file full path
    Returns:
        soup
    Raises:
        None
    if os.path.exists(someFile):
        if os.path.isfile(someFile):
            # add executable
            curState = os.stat(someFile)
            newState = curState.st_mode | stat.S_IEXEC
            os.chmod(someFile, newState)
```

调用：

```
chmodAddX(shellFullPath)
```

继续优化：

参考 [How do you do a simple "chmod +x" from within python? - Stack Overflow](#)

如果想要加上，给任何人都有可执行权限，则可以用：

```
def chmodAddX(someFile):
    """add file executable mode, like chmod +x

    Args:
        someFile (str): file full path
    Returns:
        soup
    Raises:
        None

    if os.path.exists(someFile):
        if os.path.isfile(someFile):
            # add executable
            curState = os.stat(someFile)
            # STAT_OWNER_EXECUTABLE = stat.S_IEXEC
            # executableMode = STAT_OWNER_EXECUTABLE
            STAT_EVERYONE_EXECUTABLE = stat.S_IXUSR | stat.S_IXGRP | stat.S_IXOTH
            executableMode = STAT_EVERYONE_EXECUTABLE
            newState = curState.st_mode | executableMode
            os.chmod(someFile, newState)
```

效果：

- 之前：`-rw-r--r--`
- 之后：`-rwxr-xr-x`
 - 给 user group other 都加上 x 的可执行权限

详见：

[【已解决】Python中给Mac中文件加上可执行权限](#)

判断是否是文件对象

文件

```
import sys

def isFileObject(fileObj):
    """check is file like object or not"""
    if sys.version_info[0] == 2:
        return isinstance(fileObj, file)
    else:
        # for python 3:
        # has read() method for:
        # io.IOBase
        # io.BytesIO
        # io.StringIO
        # io.RawIOBase
        return hasattr(fileObj, 'read')
```

计算当前文件名，如果重名，则位数加1

文件

```
import os
import re

def findNextNumberFilename(curFilename):
    """Find the next available filename from current name

    Args:
        curFilename (str): current filename
    Returns:
        next available (not existed) filename
    Raises:
    Examples:
        (1) 'crifanLib/demo/input/image/20201219_172616_dra
            not exist -> 'crifanLib/demo/input/image/20201219_172617_dra
        (2) 'crifanLib/demo/input/image/20191219_172616_dra
            exists -> next until not exist 'crifanLib/demo/input/...
        ....
    newFilename = curFilename

    newPathRootPart, pointSuffix = os.path.splitext(newFilename)
    # 'crifanLib/demo/input/image/20191219_172616_drawRect'
    filenamePrefix = newPathRootPart
    while os.path.exists(newFilename):
        newTailNumberInt = 1
        foundTailNumber = re.search("^(?P<filenamePrefix>..)(?P<tailNumber>[0-9]+)\.(?P<pointSuffix>[.].*)$",
                                    newFilename)
        if foundTailNumber:
            tailNumberStr = foundTailNumber.group("tailNumber")
            tailNumberInt = int(tailNumberStr)
            newTailNumberInt = tailNumberInt + 1 # 2
            filenamePrefix = foundTailNumber.group("filenamePrefix")
            # existed previously saved, change to new name
            newPathRootPart = "%s_%s" % (filenamePrefix, newTailNumberInt)
            # 'crifanLib/demo/input/image/20191219_172616_drawRect'
            newFilename = newPathRootPart + pointSuffix
            # 'crifanLib/demo/input/image/20191219_172616_drawRect'

    return newFilename
```

调用：

```
notExistFile = "crifanLib/demo/input/image/some_not_exist"
nextFilename = findNextNumberFilename(notExistFile)
print("notExistFile=%s -> nextFilename=%s" % (notExistFile, nextFilename))
# notExistFile=crifanLib/demo/input/image/some_not_exist
# nextFilename=crifanLib/demo/input/image/some_not_exist_1

realExistFile = "crifanLib/demo/input/image/20191219_172616_drawRect"
nextUntilNotExistFilename = findNextNumberFilename(realExistFile)
print("realExistFile=%s -> nextUntilNotExistFilename=%s" % (realExistFile, nextUntilNotExistFilename))
# realExistFile=crifanLib/demo/input/image/20191219_172616_drawRect
# nextUntilNotExistFilename=crifanLib/demo/input/image/20191219_172617_drawRect
```

从文件名后缀推断出MIME类型

用库：

- mime
 - GitHub
 - <https://github.com/liluo/mime>

安装mime：

```
pip install mime
```

代码：

```
import mime

fileMimeType = mime.Types.of(curAudioFullFilename)[0].content_type
```

- 输入文件： 'Lots of Hearts.mp3'
- 输出信息： 'audio/mpeg'

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文件夹=文件路径

新建文件夹

对于: python 3.2+

```
import os

def createFolder(folderFullPath):
    """
        create folder, even if already existed
        Note: for Python 3.2+
    """
    os.makedirs(folderFullPath, exist_ok=True)
    # print("Created folder: %s" % folderFullPath)
```

或:

对于: python 3.5+

```
import pathlib
pathlib.Path('/my/directory').mkdir(parents=True, exist_ok=True)
```

批量删除非空文件夹

```
import shutil

if os.path.exists(folderToDelete):
    shutil.rmtree(folderToDelete)
```

注意:

- 删除之前要先用 `os.path.exists` 判断是非存在该目录
 - 如果不存在就去删除, 则会报错: `OSError: [Errno 2] No such file or directory`

os.path 路径处理

```

#!/usr/bin/python
# -*- coding: utf-8 -*-
# Author: Crifan Li
# Update: 20191219
# Function: Demo os.path common used functions

import os

def osPathDemo():
    currentSystemInfo = os.uname()
    print("currentSystemInfo=%s" % (currentSystemInfo, ))
    # currentSystemInfo=posix.uname_result(sysname='Darwin'

    pathSeparatorInCurrentOS = os.path.sep
    print("pathSeparatorInCurrentOS=%s" % pathSeparatorInC
    # pathSeparatorInCurrentOS=/

    fullFilePath = "/Users/limao/dev/crifan/python/notEnoughUnpack/Snip20191212_113.png"
    print("fullFilePath=%s" % fullFilePath)
    # fullFilePath=/Users/limao/dev/crifan/python/notEnoughUnpack/Snip20191212_113.png

    dirname = os.path.dirname(fullFilePath)
    print("dirname=%s" % dirname)
    # dirname=/Users/limao/dev/crifan/python/notEnoughUnpack
    basename = os.path.basename(fullFilePath)
    print("basename=%s" % basename)
    # basename=Snip20191212_113.png
    joinedFullPath = os.path.join(dirname, basename)
    print("joinedFullPath=%s" % joinedFullPath)
    # joinedFullPath=/Users/limao/dev/crifan/python/notEnoughUnpack/Snip20191212_113.png
    isSame = (fullFilePath == joinedFullPath)
    print("isSame=%s" % isSame)
    # isSame=True

    root, pointSuffix = os.path.splitext(fullFilePath)
    print("root=%s, pointSuffix=%s" % (root, pointSuffix))
    # root=/Users/limao/dev/crifan/python/notEnoughUnpack/
    head, tail = os.path.split(fullFilePath)
    print("head=%s, tail=%s" % (head, tail))
    # head=/Users/limao/dev/crifan/python/notEnoughUnpack,
    drive, tail = os.path.splitdrive(fullFilePath)
    print("drive=%s, tail=%s" % (drive, tail))
    # drive=, tail=/Users/limao/dev/crifan/python/notEnoughUnpack/Snip20191212_113.png

    curPath = os.getcwd()
    print("curPath=%s" % curPath)
    # curPath=/Users/limao/dev/crifan/python
    relativePath = os.path.relpath(fullFilePath)
    print("relativePath=%s" % relativePath)
    # relativePath=notEnoughUnpack/Snip20191212_113.png

```

文件

```
isFile = os.path.isfile(fullFilePath)
print("isFile=%s" % isFile)
# isFile=True

isDirectory = os.path.isdir(fullFilePath)
print("isDirectory=%s" % isDirectory)
# isDirectory=False

fileSize = os.path.getsize(fullFilePath)
print("fileSize=%s" % fileSize)
# fileSize=368810

isFileOrFolderRealExist = os.path.exists(fullFilePath)
print("isFileOrFolderRealExist=%s" % isFileOrFolderRealExist)
# isFileOrFolderRealExist=True

if __name__ == "__main__":
    osPathDemo()
```

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多媒体

详见：

- <https://github.com/crifan/crifanLibPython/blob/master/crifanLib/crifanMultimedia.py>
 - <https://github.com/crifan/crifanLibPython/blob/master/crifanLib/demo/crifanMultimediaDemo.py>
-

此处整理多媒体相关的常用Python代码段，主要包含如下内容：

- 图片=图像
- 音频
- 视频

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图像

Python中图像处理用的最多是： Pillow

下面图像处理处理的代码，基本上都是用 Pillow 实现的。

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Pillow

- Pillow
 - 继承自： PIL
 - PIL = Python Imaging Library
 - 官网资料：
 - [Image Module — Pillow \(PIL Fork\) 7.0.0 documentation](#)
 - [Image Module — Pillow \(PIL Fork\) 3.1.2 documentation](#)

从二进制生成Image

```
if isinstance(inputImage, bytes):  
    openableImage = io.BytesIO(inputImage)  
    curPillowImage = Image.open(openableImage)
```

pillow变量是：

```
# <PIL.PngImagePlugin.PngImageFile image mode=RGBA size=354x288>  
# <PIL.JpegImagePlugin.JpegImageFile image mode=RGB size=1000x1000>
```

详见：

- 【已解决】Python如何从二进制数据中生成Pillow的Image
- 【已解决】Python的Pillow如何从二进制数据中读取图像数据

从Pillow的Image获取二进制数据

```
import io  
  
imageIO = io.BytesIO()  
curImg.save(imageIO, curImg.format)  
imgBytes = imageIO.getvalue()
```

详见：

【已解决】Python的Pillow如何返回图像的二进制数据

缩放图片

```

import io
from PIL import Image, ImageDraw

def resizeImage(inputImage,
                newSize,
                resample=Image.BICUBIC, # Image.LANCZOS,
                outputFormat=None,
                outputImageFile=None
                ):
    """
        resize input image
        resize normally means become smaller, reduce size
    :param inputImage: image file object(fp) / filename / bytes
    :param newSize: (width, height)
    :param resample: PIL.Image.NEAREST, PIL.Image.BILINEAR,
                     https://pillow.readthedocs.io/en/stable/reference/
    :param outputFormat: PNG/JPEG/BMP/GIF/TIFF/WebP/..., more
                         https://pillow.readthedocs.io/en/stable/handbook/image-file-formats.html#file-formats
                         if input image is filename with suffix, can omit this
    :param outputImageFile: output image file filename
    :return:
        input image file filename: output resized image to
        input image binary bytes: resized image binary bytes
    """

    openableImage = None
    if isinstance(inputImage, str):
        openableImage = inputImage
    elif isinstance(inputImage):
        openableImage = inputImage
    elif isinstance(inputImage, bytes):
        inputImageLen = len(inputImage)
        openableImage = io.BytesIO(inputImage)

    imageFile = Image.open(openableImage) # <PIL.PngImagePlugin.PngImageFile>
    imageFile.thumbnail(newSize, resample)
    if outputImageFile:
        # save to file
        imageFile.save(outputImageFile)
        imageFile.close()
    else:
        # save and return binary byte
        imageOutput = io.BytesIO()
        # imageFile.save(imageOutput)
        outputImageFormat = None
        if outputFormat:
            outputImageFormat = outputFormat
        elif imageFile.format:
            outputImageFormat = imageFile.format
        imageFile.save(imageOutput, outputImageFormat)
        imageFile.close()

```

文件

```
compressedImageBytes = imageOutput.getvalue()
compressedImageLen = len(compressedImageBytes)
compressRatio = float(compressedImageLen)/float(inputImageLen)
print("%s -> %s, resize ratio: %d%%" % (inputImageFile,
                                             outputImageFile, compressRatio))
return compressedImageBytes
```

调用：

```

import sys
import os
curFolder = os.path.abspath(__file__)
parentFolder = os.path.dirname(curFolder)
parentParentFolder = os.path.dirname(parentFolder)
parentParentParentFolder = os.path.dirname(parentParentFolder)
sys.path.append(curFolder)
sys.path.append(parentFolder)
sys.path.append(parentParentFolder)
sys.path.append(parentParentParentFolder)

import datetime
from crifanMultimedia import resizeImage

def testFilename():
    imageFilename = "/Users/crifan/dev/tmp/python/resize_image.jpg"
    outputImageFilename = "/Users/crifan/dev/tmp/python/resize_image_out.jpg"
    print("imageFilename=%s" % imageFilename)
    beforeTime = datetime.datetime.now()
    resizeImage(imageFilename, (300, 300), outputImageFile=outputImageFilename)
    afterTime = datetime.datetime.now()
    print("procesTime: %s" % (afterTime - beforeTime))

    outputImageFilename = "/Users/crifan/dev/tmp/python/resize_image.jpg"
    beforeTime = datetime.datetime.now()
    resizeImage(imageFilename, (800, 800), outputImageFile=outputImageFilename)
    afterTime = datetime.datetime.now()
    print("procesTime: %s" % (afterTime - beforeTime))

def testFileObject():
    imageFilename = "/Users/crifan/dev/tmp/python/resize_image.jpg"
    imageFileObj = open(imageFilename, "rb")
    outputImageFilename = "/Users/crifan/dev/tmp/python/resize_image_out.jpg"
    beforeTime = datetime.datetime.now()
    resizeImage(imageFileObj, (600, 600), outputImageFile=outputImageFilename)
    afterTime = datetime.datetime.now()
    print("procesTime: %s" % (afterTime - beforeTime))

def testBinaryBytes():
    imageFilename = "/Users/crifan/dev/tmp/python/resize_image.jpg"
    imageFileObj = open(imageFilename, "rb")
    imageBytes = imageFileObj.read()
    # return binary bytes
    beforeTime = datetime.datetime.now()
    resizedImageBytes = resizeImage(imageBytes, (800, 800))
    afterTime = datetime.datetime.now()
    print("procesTime: %s" % (afterTime - beforeTime))
    print("len(resizedImageBytes)=%s" % len(resizedImageBytes))

    # save to file

```

文件

```
outputImageFilename = "/Users/crifan/dev/tmp/python/resize_image.py"
beforeTime = datetime.datetime.now()
resizeImage(imageBytes, (750, 750), outputImageFile=outputImageFilename)
afterTime = datetime.datetime.now()
print("procesTime: %s" % (afterTime - beforeTime))

imageFileObj.close()

def demoResizeImage():
    testFilename()
    testFileObject()
    testBinaryBytes()

if __name__ == "__main__":
    demoResizeImage()

# imageFilename=/Users/crifan/dev/tmp/python/resize_image.py
# procesTime: 0:00:00.619377
# procesTime: 0:00:00.745228
# procesTime: 0:00:00.606060
# 1146667 -> 753258, resize ratio: 65%
# procesTime: 0:00:00.773289
# len(resizedImageBytes)=753258
# procesTime: 0:00:00.738237
```

给图片画元素所属区域的边框，且带自动保存加了框后的图片

```

from PIL import Image
from PIL import ImageDraw

def imageDrawRectangle(inputImgOrImgPath,
    rectLocation,
    outlineColor="green",
    outlineWidth=0,
    isShow=False,
    isAutoSave=True,
    saveTail="_drawRect_%wx%h",
    isDrawClickedPosCircle=True,
    clickedPos=None,
):
    """Draw a rectangle for image (and a small circle), and
    save the image file.

    Args:
        inputImgOrImgPath (Image/str): a pillow(PIL) Image
        rectLocation (tuple/list/Rect): the rectangle location
        outlineColor (str): Color name
        outlineWidth (int): rectangle outline width
        isShow (bool): True to call image.show() for debug
        isAutoSave (bool): True to auto save the image file
        saveTail(str): save filename tail part. support for
        clickedPos (tuple): x,y of clicked position; default None
        isDrawClickedPosCircle (bool): draw small circle if
    Returns:
        modified image
    Raises:
    """
    inputImg = inputImgOrImgPath
    if isinstance(inputImgOrImgPath, str):
        inputImg = Image.open(inputImgOrImgPath)
    draw = ImageDraw.Draw(inputImg)

    isRectObj = False
    hasX = hasattr(rectLocation, "x")
    hasY = hasattr(rectLocation, "y")
    hasWidth = hasattr(rectLocation, "width")
    hasHeight = hasattr(rectLocation, "height")
    isRectObj = hasX and hasY and hasWidth and hasHeight
    if isinstance(rectLocation, tuple):
        x, y, w, h = rectLocation
    if isinstance(rectLocation, list):
        x = rectLocation[0]
        y = rectLocation[1]
        w = rectLocation[2]
        h = rectLocation[3]
    elif isRectObj:
        x = rectLocation.x
        y = rectLocation.y

```

文件

```
w = rectLocation.width
h = rectLocation.height

w = int(w)
h = int(h)
x0 = x
y0 = y
x1 = x0 + w
y1 = y0 + h
draw.rectangle(
    [x0, y0, x1, y1],
    # fill="yellow",
    # outline="yellow",
    outline=outlineColor,
    width=outlineWidth,
)

if isDrawClickedPosCircle:
    # radius = 3
    # radius = 2
    radius = 4
    # circleOutline = "yellow"
    circleOutline = "red"
    circleLineWidthInt = 1
    # circleLineWidthInt = 3

    if clickedPos:
        clickedX, clickedY = clickedPos
    else:
        clickedX = x + w/2
        clickedY = y + h/2
    startPointInt = (int(clickedX - radius), int(clickedY - radius))
    endPointInt = (int(clickedX + radius), int(clickedY + radius))
    draw.ellipse([startPointInt, endPointInt], outline=circleOutline)

if isShow:
    inputImg.show()

if isAutoSave:
    saveTail = saveTail.replace("%x", str(x))
    saveTail = saveTail.replace("%y", str(y))
    saveTail = saveTail.replace("%w", str(w))
    saveTail = saveTail.replace("%h", str(h))

inputImgPath = None
if isinstance(inputImgOrImgPath, str):
    inputImgPath = str(inputImgOrImgPath)
elif inputImg.filename:
    inputImgPath = str(inputImg.filename)

if inputImgPath:
```

文件

```
    imgFolderAndName, pointSuffix = os.path.split(imgFolderAndName)
    imgFolderAndName = imgFolderAndName + saveTail
    newImgPath = imgFolderAndName + pointSuffix
    newImgPath = findNextNumberFilename(newImgPath)
else:
    curDatetimeStr = getCurDatetimeStr() # '201912101010'
    suffix = str(inputImg.format).lower() # 'jpeg'
    newImgFilename = "%s%s.%s" % (curDatetimeStr, suffix)
    imgPathRoot = os.getcwd()
    newImgPath = os.path.join(imgPathRoot, newImgFilename)

    inputImg.save(newImgPath)

return inputImg
```

说明：

相关函数，详见：findNextNumberFilename，或者干脆去掉这个逻辑即可。

调用：

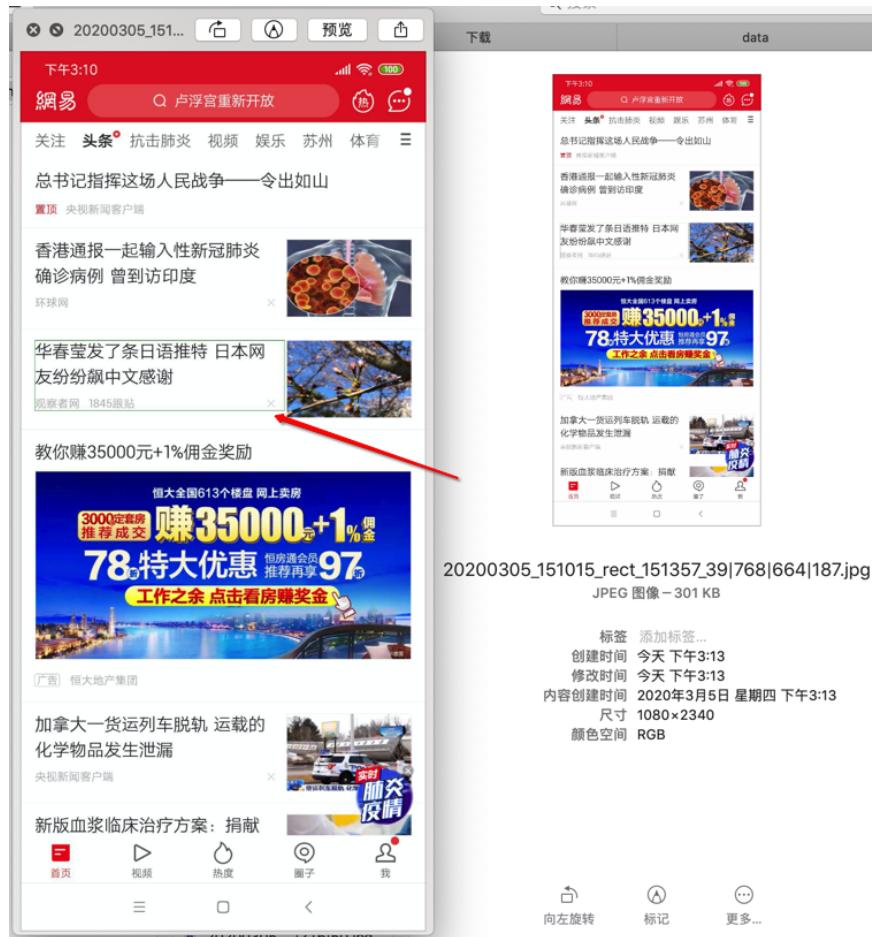
```
curBoundList = self.getElementBounds(eachElement)
curWidth = curBoundList[2] - curBoundList[0]
curHeight = curBoundList[3] - curBoundList[1]
curRect = [curBoundList[0], curBoundList[1], curWidth, curHeight]
curImg = CommonUtils.imageDrawRectangle(curImg, curRect, isRed)
```

或：

```
curTimeStr = CommonUtils.getCurDatetimeStr("%H%M%S")
curSaveTail = "_rect_{0}_{1}{2}|{3}|{4}|{5}{6}.format(curTimeStr)
curImg = CommonUtils.imageDrawRectangle(imgPath, curRect, isRed)
```

效果：

(1) 给原图加上单个元素所属边框



(2) 多次循环后，给同一张图中多个元素加上边框后



20200305_145916_rect_121|
401|232|38_1.jpg
JPEG 图像 – 309 KB

标签 添加标签...
创建时间 今天 下午3:02
修改时间 今天 下午3:02
内容创建时间 2020/3/5
尺寸 1080×2340
颜色空间 RGB

其他调用：

```
imageDrawRectangle(curPillowImg, curLocation)

imageDrawRectangle(curPillowImg, calculatedLocation)

curImg = imageDrawRectangle(imgPath, firstMatchLocation, c)

curImg = imageDrawRectangle(imgPath, firstMatchLocation)
```

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百度OCR

详见：

<https://github.com/crifan/crifanLibPython/blob/master/crifanLib/crifanBaiduOcr.py>

在做安卓和iOS的移动端自动化测试期间，会涉及到从图像中提取文字，用的是百度OCR。

其中有些通用的功能，整理出函数，贴出供参考。

百度OCR初始化

```

import os
import re
import base64
import requests
import time
import logging
from collections import OrderedDict
from PIL import Image, ImageDraw

class BaiduOCR():
    # OCR_URL = "https://aip.baidubce.com/rest/2.0/ocr/v1/general"
    # OCR_URL = "https://aip.baidubce.com/rest/2.0/ocr/v1/general_text"
    # OCR_URL = "https://aip.baidubce.com/rest/2.0/ocr/v1/accurate"
    OCR_URL = "https://aip.baidubce.com/rest/2.0/ocr/v1/accurate"

    TOKEN_URL = 'https://aip.baidubce.com/oauth/2.0/token'

    RESP_ERR_CODE_QPS_LIMIT_REACHED = 18
    RESP_ERR_TEXT_QPS_LIMIT_REACHED = "Open api qps request limit reached"

    RESP_ERR_CODE_DAILY_LIMIT_REACHED = 17
    RESP_ERR_TEXT_DAILY_LIMIT_REACHED = "Open api daily request limit reached"

    API_KEY = 'S0xxxxxxxxxxhu'
    SECRET_KEY = 'wLxxxxxxxxxxxxxxxxxxxxpL'

    def initOcr(self):
        self.curToken = self.baiduFetchToken()

    def baiduFetchToken(self):
        """Fetch Baidu token for OCR"""
        params = {
            'grant_type': 'client_credentials',
            'client_id': self.API_KEY,
            'client_secret': self.SECRET_KEY
        }

        resp = requests.get(self.TOKEN_URL, params=params)
        respJson = resp.json()

        respToken = ""

```

文件

```
if ('access_token' in respJson.keys() and 'scope' :  
    if not 'brain_all_scope' in respJson['scope']:  
        logging.error('please ensure has check the  
    else:  
        respToken = respJson['access_token']  
    else:  
        logging.error('please overwrite the correct API')  
  
# '24.8691f3c6dedd0d0d0b30a9dfec604d52.2592000.1578  
return respToken
```

百度OCR图片转文字

```

def baiduImageToWords(self, imageFullPath):
    """Detect text from image using Baidu OCR api"""

    # # Note: if using un-paid = free baidu api, need follow
    # time.sleep(0.15)

    respWordsResutJson = ""

    # 读取图片二进制数据
    imgBinData = readBinDataFromFile(imageFullPath)
    encodedImgData = base64.b64encode(imgBinData)

    paramDict = {
        "access_token": self.curToken
    }

    headerDict = {
        "Content-Type": "application/x-www-form-urlencoded"
    }

    # 参数含义: http://ai.baidu.com/ai-doc/OCR/vk3h7y58v
    dataDict = {
        "image": encodedImgData,
        "recognize_granularity": "small",
        # "vertexes_location": "true",
    }
    resp = requests.post(self.OCR_URL, params=paramDict, headers=headerDict, data=dataDict)
    respJson = resp.json()

    logging.debug("baidu OCR: imgage=%s -> respJson=%s", imageFullPath, respJson)

    if "error_code" in respJson:
        logging.warning("respJson=%s" % respJson)
        errorCode = respJson["error_code"]
        # {'error_code': 17, 'error_msg': 'Open api daily limit reached'}
        # {'error_code': 18, 'error_msg': 'Open api qps reached, the limit count can found from https://ai.baidu.com/ai-doc/OCR/fk3h7xu7h'}
        # 文字识别 - 免费额度 | 百度AI开放平台
        # for "通用文字识别（高精度含位置版）" is "50次/天"
        if errorCode == self.RESP_ERR_CODE_QPS_LIMIT_REACHED:
            # wait sometime and try again
            time.sleep(1.0)
            resp = requests.post(self.OCR_URL, params=paramDict, headers=headerDict, data=dataDict)
            respJson = resp.json()
            logging.debug("baidu OCR: for errorCode=%s, do it again" % errorCode)
        elif errorCode == self.RESP_ERR_CODE_DAILY_LIMIT_REACHED:
            logging.error("Fail to continue using baidu OCR")
            respJson = None

```

```
....  
{  
    "log_id": 6937531796498618000,  
    "words_result_num": 32,  
    "words_result": [  
        {  
            "chars": [  
                ...  
            ....  
            if "words_result" in respJson:  
                respWordsResutJson = respJson  
  
        return respWordsResutJson
```

调用：

```
wordsResultJson = self.baiduImageToWords(imgPath)  
  
respJson = self.baiduImageToWords(screenImgPath)
```

返回结果举例

安卓游戏 暗黑觉醒 首充豪礼

图片：



返回解析后出 json 格式的文字信息：

文件

```
{  
    "log_id": 9009770747370640007,  
    "words_result_num": 12,  
    "words_result": [  
        {  
            "chars": [  
                {  
                    "char": "首",  
                    "location": { "width": 94, "top": 105, "left": 989 },  
                },  
                {  
                    "char": "充",  
                    "location": { "width": 94, "top": 105, "left": 1061 },  
                },  
                {  
                    "char": "豪",  
                    "location": { "width": 95, "top": 105, "left": 1136 },  
                },  
                {  
                    "char": "礼",  
                    "location": { "width": 77, "top": 105, "left": 1213 },  
                }  
            ],  
            "location": { "width": 370, "top": 105, "left": 989 },  
            "words": "首充豪礼"  
        },  
        {  
            "chars": [  
                {  
                    "char": "x",  
                    "location": { "width": 30, "top": 161, "left": 1887 },  
                }  
            ],  
            "location": { "width": 60, "top": 161, "left": 1887 },  
            "words": "x"  
        },  
        {  
            "chars": [  
                {  
                    "char": "充",  
                    "location": { "width": 43, "top": 273, "left": 756 },  
                },  
                {  
                    "char": "值",  
                    "location": { "width": 43, "top": 273, "left": 809 },  
                },  
                {  
                    "char": "元",  
                    "location": { "width": 67, "top": 273, "left": 922 },  
                }  
            ]  
        }  
    ]  
}
```

文件

```
{
  {
    "char": "可",
    "location": { "width": 44, "top": 273, "left": 97 },
  },
  {
    "char": "领",
    "location": { "width": 43, "top": 273, "left": 106 },
  },
  {
    "char": "总",
    "location": { "width": 44, "top": 273, "left": 115 },
  },
  {
    "char": "价",
    "location": { "width": 23, "top": 273, "left": 124 },
  },
  {
    "char": "值",
    "location": { "width": 89, "top": 273, "left": 133 },
  },
  {
    "char": "8",
    "location": { "width": 36, "top": 273, "left": 142 },
  },
  {
    "char": "8",
    "location": { "width": 36, "top": 273, "left": 151 },
  },
  {
    "char": "8",
    "location": { "width": 35, "top": 273, "left": 160 },
  },
  {
    "char": "钻",
    "location": { "width": 43, "top": 273, "left": 169 },
  },
  {
    "char": "豪",
    "location": { "width": 44, "top": 273, "left": 178 },
  },
  {
    "char": "华",
    "location": { "width": 43, "top": 273, "left": 187 },
  },
  {
    "char": "大",
    "location": { "width": 43, "top": 273, "left": 196 },
  },
  {
    "char": "礼",
    "location": { "width": 27, "top": 273, "left": 205 }
```

文件

```
        },
    ],
    "location": { "width": 911, "top": 273, "left": 758,
    "words": "充值元可领总价值888钻豪华大礼"
},
{
    "chars": [
        {
            "char": "送",
            "location": { "width": 65, "top": 369, "left": 832 },
        }
    ],
    "location": { "width": 107, "top": 369, "left": 832,
    "words": "送"
},
{
    "chars": [
        {
            "char": "绝",
            "location": { "width": 38, "top": 390, "left": 970 },
        },
        {
            "char": "版",
            "location": { "width": 38, "top": 390, "left": 1008 },
        },
        {
            "char": "萌",
            "location": { "width": 38, "top": 390, "left": 1046 },
        },
        {
            "char": "宠",
            "location": { "width": 38, "top": 390, "left": 1084 },
        },
        {
            "char": "\u00b7",
            "location": { "width": 31, "top": 390, "left": 1122 },
        },
        {
            "char": "\u00b2",
            "location": { "width": 39, "top": 390, "left": 1160 },
        },
        {
            "char": "属",
            "location": { "width": 38, "top": 390, "left": 1198 },
        },
        {
            "char": "神",
            "location": { "width": 38, "top": 390, "left": 1236 },
        },
        {
            "char": "兵",
            "location": { "width": 38, "top": 390, "left": 1274 },
        }
    ]
}
```

```
        "location": { "width": 39, "top": 390, "left": 140 },
    ],
    "location": { "width": 524, "top": 390, "left": 934,
        "words": "绝版萌宠、专属神兵"
    },
    {
        "chars": [
            {
                "char": "绝",
                "location": { "width": 20, "top": 515, "left": 378 },
            },
            "location": { "width": 33, "top": 515, "left": 378,
                "words": "绝"
            },
            {
                "chars": [
                    {
                        "char": "\u20e3",
                        "location": { "width": 33, "top": 516, "left": 1992 },
                    },
                    "location": { "width": 33, "top": 516, "left": 1992,
                        "words": "\u20e3"
                    },
                    {
                        "chars": [
                            {
                                "char": "版",
                                "location": { "width": 20, "top": 545, "left": 379 },
                            },
                            "location": { "width": 31, "top": 545, "left": 379,
                                "words": "版"
                            },
                            {
                                "chars": [
                                    {
                                        "char": "\u20e3",
                                        "location": { "width": 26, "top": 776, "left": 125 },
                                    },
                                    {
                                        "char": "外",
                                        "location": { "width": 26, "top": 776, "left": 125 },
                                    },
                                    {
                                        "char": "\u20e3",
                                        "location": { "width": 27, "top": 776, "left": 125 },
                                    },
                                    {

```

文件

```
        "char": "包",
        "location": { "width": 27, "top": 776, "left": 1225 },
    ],
    "location": { "width": 125, "top": 776, "left": 1225 },
    "words": "额外礼包"
},
{
    "chars": [
        {
            "char": "首",
            "location": { "width": 38, "top": 830, "left": 935 },
        },
        {
            "char": "充",
            "location": { "width": 38, "top": 830, "left": 935 },
        },
        {
            "char": "元",
            "location": { "width": 38, "top": 830, "left": 1065 },
        },
        {
            "char": "充",
            "location": { "width": 38, "top": 830, "left": 1225 },
        },
        {
            "char": "9",
            "location": { "width": 31, "top": 830, "left": 1225 },
        },
        {
            "char": "8",
            "location": { "width": 31, "top": 830, "left": 1225 },
        },
        {
            "char": "元",
            "location": { "width": 38, "top": 830, "left": 1455 },
        }
    ],
    "location": { "width": 549, "top": 830, "left": 935 },
    "words": "首充元充98元"
},
{
    "chars": [
        {
            "char": "战",
            "location": { "width": 42, "top": 970, "left": 375 },
        },
        {
            "char": "斗",
            "location": { "width": 42, "top": 970, "left": 425 },
        },
    ],
}
```

文件

```
{
  "char": "1",
  "location": { "width": 35, "top": 970, "left": 52 },
},
{
  "char": "5",
  "location": { "width": 35, "top": 970, "left": 52 },
},
{
  "char": "0",
  "location": { "width": 34, "top": 970, "left": 52 },
},
{
  "char": "0",
  "location": { "width": 35, "top": 970, "left": 62 },
},
{
  "char": "0",
  "location": { "width": 34, "top": 970, "left": 62 },
}
],
"location": { "width": 327, "top": 970, "left": 373,
"words": "战斗15000"
},
{
  "chars": [
    {
      "char": "战",
      "location": { "width": 43, "top": 969, "left": 106 },
    },
    {
      "char": "斗",
      "location": { "width": 43, "top": 969, "left": 110 },
    },
    {
      "char": "1",
      "location": { "width": 36, "top": 969, "left": 114 },
    },
    {
      "char": "6",
      "location": { "width": 36, "top": 969, "left": 118 },
    },
    {
      "char": "0",
      "location": { "width": 35, "top": 969, "left": 122 },
    },
    {
      "char": "0",
      "location": { "width": 36, "top": 969, "left": 126 },
    },
    {
      "char": "0",
      "location": { "width": 36, "top": 969, "left": 130 },
    }
  ]
}
```

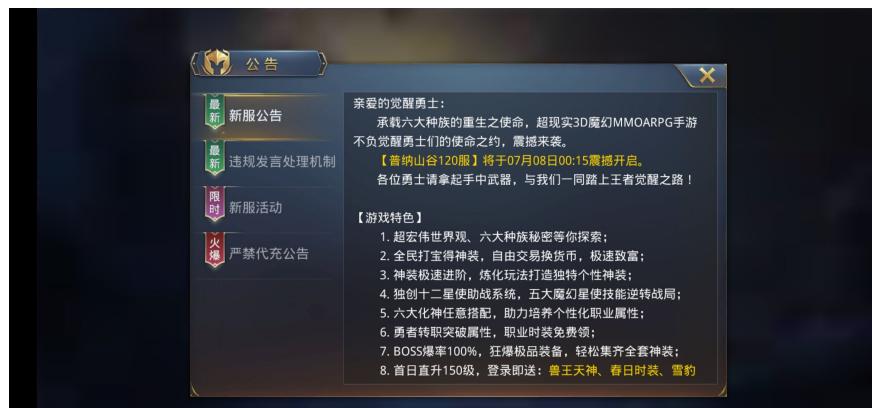
```
        "char": "0",
        "location": { "width": 29, "top": 969, "left": 151 },
    },
    "location": { "width": 330, "top": 969, "left": 1648,
    "words": "战斗16000"
}
]
```

其中：

- 首充豪礼
 - 都能完整检测出来：已经是效果很不错了
 - 当然偶尔也会有失误，比如偶尔
 - 只解析出部分内容：首充豪
 - 或个别字错了：首充豪机
 - 本身图片上 礼 也的确很像 机
 - 作为OCR犯此错误，完全可以理解

安卓游戏 暗黑觉醒 公告弹框

图片：



返回结果json：

```
{  
    "log_id": 2793391773289550472,  
    "words_result_num": 23,  
    "words_result": [  
        {  
            "chars": [  
                {  
                    "char": "公",  
                    "location": { "width": 28, "top": 125, "left": 634 },  
                },  
                {  
                    "char": "告",  
                    "location": { "width": 29, "top": 125, "left": 663 },  
                }  
            ],  
            "location": { "width": 92, "top": 125, "left": 634 },  
            "words": "公告"  
        },  
        {  
            "chars": [  
                {  
                    "char": "最",  
                    "location": { "width": 21, "top": 240, "left": 535 },  
                }  
            ],  
            "location": { "width": 33, "top": 240, "left": 535 },  
            "words": "最"  
        },  
        {  
            "chars": [  
                {  
                    "char": "豪",  
                    "location": { "width": 26, "top": 233, "left": 962 },  
                },  
                {  
                    "char": "爱",  
                    "location": { "width": 26, "top": 233, "left": 962 },  
                },  
                {  
                    "char": "的",  
                    "location": { "width": 26, "top": 233, "left": 962 },  
                },  
                {  
                    "char": "觉",  
                    "location": { "width": 26, "top": 233, "left": 1081 },  
                },  
                {  
                    "char": "醒",  
                    "location": { "width": 26, "top": 233, "left": 1081 },  
                }  
            ]  
        }  
    ]  
}
```

```
{
    "char": "勇",
    "location": { "width": 26, "top": 233, "left": 10 },
},
{
    "char": "士",
    "location": { "width": 25, "top": 233, "left": 10 },
},
{
    "char": ";",
    "location": { "width": 21, "top": 233, "left": 10 },
}
],
"location": { "width": 253, "top": 233, "left": 922,
"words": "亲爱的觉醒勇士:" },
},
{
    "chars": [
        {
            "char": "新",
            "location": { "width": 26, "top": 266, "left": 52 },
        },
        {
            "char": "新",
            "location": { "width": 27, "top": 266, "left": 58 },
        },
        {
            "char": "服",
            "location": { "width": 26, "top": 266, "left": 64 },
        },
        {
            "char": "公",
            "location": { "width": 27, "top": 266, "left": 66 },
        },
        {
            "char": "告",
            "location": { "width": 26, "top": 266, "left": 70 },
        }
    ],
"location": { "width": 201, "top": 266, "left": 535,
"words": "新客服公告" },
},
{
    "chars": [
        {
            "char": "承",
            "location": { "width": 26, "top": 282, "left": 96 },
        },
        {
            "char": "載",
            "location": { "width": 26, "top": 282, "left": 102 },
        }
    ]
}
```

文件

```
},
{
  "char": "六",
  "location": { "width": 26, "top": 282, "left": 10 },
},
{
  "char": "大",
  "location": { "width": 26, "top": 282, "left": 10 },
},
{
  "char": "种",
  "location": { "width": 26, "top": 282, "left": 10 },
},
{
  "char": "族",
  "location": { "width": 26, "top": 282, "left": 10 },
},
{
  "char": "的",
  "location": { "width": 26, "top": 282, "left": 10 },
},
{
  "char": "重",
  "location": { "width": 26, "top": 282, "left": 10 },
},
{
  "char": "生",
  "location": { "width": 26, "top": 282, "left": 10 },
},
{
  "char": "之",
  "location": { "width": 26, "top": 282, "left": 10 },
},
{
  "char": "使",
  "location": { "width": 27, "top": 282, "left": 10 },
},
{
  "char": "命",
  "location": { "width": 26, "top": 282, "left": 10 },
},
{
  "char": ",",
  "location": { "width": 21, "top": 282, "left": 10 },
},
{
  "char": "超",
  "location": { "width": 26, "top": 282, "left": 10 },
},
{
  "char": "现",
```

文件

```
        "location": { "width": 26, "top": 282, "left": 14 },
},
{
    "char": "实",
    "location": { "width": 26, "top": 282, "left": 14 },
},
{
    "char": "3",
    "location": { "width": 22, "top": 282, "left": 14 },
},
{
    "char": "D",
    "location": { "width": 21, "top": 282, "left": 14 },
},
{
    "char": "魔",
    "location": { "width": 26, "top": 282, "left": 14 },
},
{
    "char": "M",
    "location": { "width": 61, "top": 284, "left": 14 },
},
{
    "char": "M",
    "location": { "width": 35, "top": 284, "left": 14 },
},
{
    "char": "0",
    "location": { "width": 31, "top": 284, "left": 14 },
},
{
    "char": "A",
    "location": { "width": 25, "top": 284, "left": 14 },
},
{
    "char": "R",
    "location": { "width": 25, "top": 284, "left": 14 },
},
{
    "char": "P",
    "location": { "width": 25, "top": 284, "left": 14 },
},
{
    "char": "G",
    "location": { "width": 25, "top": 284, "left": 14 },
},
{
    "char": "幻",
    "location": { "width": 26, "top": 282, "left": 14 },
},
```

文件

```
        "char": "手",
        "location": { "width": 26, "top": 282, "left": 10 },
    },
    {
        "char": "游",
        "location": { "width": 26, "top": 282, "left": 16 },
    }
],
"location": { "width": 867, "top": 282, "left": 984,
"words": "承载六大种族的重生之使命，超现实3D魔 MMOARPG幻手游"
},
{
    "chars": [
        {
            "char": "不",
            "location": { "width": 37, "top": 337, "left": 984 },
        },
        {
            "char": "负",
            "location": { "width": 23, "top": 337, "left": 984 },
        },
        {
            "char": "觉",
            "location": { "width": 25, "top": 337, "left": 984 },
        },
        {
            "char": "體",
            "location": { "width": 23, "top": 337, "left": 1041 },
        },
        {
            "char": "勇",
            "location": { "width": 23, "top": 337, "left": 1041 },
        },
        {
            "char": "士",
            "location": { "width": 25, "top": 337, "left": 1041 },
        },
        {
            "char": "们",
            "location": { "width": 25, "top": 337, "left": 1041 },
        },
        {
            "char": "的",
            "location": { "width": 25, "top": 337, "left": 1041 },
        },
        {
            "char": "使",
            "location": { "width": 25, "top": 337, "left": 1041 },
        },
        {
            "char": "命",
            "location": { "width": 25, "top": 337, "left": 1041 },
        }
    ]
}
```

```
        "location": { "width": 25, "top": 337, "left": 12 },
    },
    {
        "char": "之",
        "location": { "width": 25, "top": 337, "left": 12 },
    },
    {
        "char": "约",
        "location": { "width": 25, "top": 337, "left": 12 },
    },
    {
        "char": ",",
        "location": { "width": 20, "top": 337, "left": 12 },
    },
    {
        "char": "震",
        "location": { "width": 25, "top": 337, "left": 12 },
    },
    {
        "char": "撼",
        "location": { "width": 25, "top": 337, "left": 12 },
    },
    {
        "char": "来",
        "location": { "width": 23, "top": 337, "left": 12 },
    },
    {
        "char": "袭",
        "location": { "width": 25, "top": 337, "left": 12 },
    },
    {
        "char": "\u2022",
        "location": { "width": 18, "top": 337, "left": 12 }
    }
],
"location": { "width": 580, "top": 337, "left": 923,
"words": "不负觉醒勇士们的使命之约,震撼来袭。"
},
{
    "chars": [
    {
        "char": "最",
        "location": { "width": 20, "top": 364, "left": 535 },
    }
],
"location": { "width": 33, "top": 364, "left": 535,
"words": "最"
},
{
    "chars": [
    {
```

文件

```
        "char": "新",
        "location": { "width": 26, "top": 389, "left": 535 },
    },
    {
        "char": "违",
        "location": { "width": 26, "top": 389, "left": 561 },
    },
    {
        "char": "规",
        "location": { "width": 25, "top": 389, "left": 621 },
    },
    {
        "char": "发",
        "location": { "width": 26, "top": 389, "left": 667 },
    },
    {
        "char": "言",
        "location": { "width": 26, "top": 389, "left": 703 },
    },
    {
        "char": "处",
        "location": { "width": 26, "top": 389, "left": 749 },
    },
    {
        "char": "理",
        "location": { "width": 26, "top": 389, "left": 785 },
    },
    {
        "char": "机",
        "location": { "width": 26, "top": 389, "left": 831 },
    },
    {
        "char": "制",
        "location": { "width": 26, "top": 389, "left": 867 },
    }
],
"location": { "width": 343, "top": 389, "left": 535,
"words": "新规发言处理机制"
},
{
    "chars": [
        {
            "char": "[",
            "location": { "width": 21, "top": 387, "left": 95 },
        },
        {
            "char": "普",
            "location": { "width": 25, "top": 387, "left": 106 },
        },
        {
            "char": "纳",
            "location": { "width": 25, "top": 387, "left": 132 },
        }
    ]
}
```

文件

```
        "location": { "width": 26, "top": 387, "left": 10 },
},
{
    "char": "山",
    "location": { "width": 25, "top": 387, "left": 10 },
},
{
    "char": "谷",
    "location": { "width": 26, "top": 387, "left": 10 },
},
{
    "char": "1",
    "location": { "width": 21, "top": 387, "left": 10 },
},
{
    "char": "2",
    "location": { "width": 21, "top": 387, "left": 10 },
},
{
    "char": "0",
    "location": { "width": 21, "top": 387, "left": 10 },
},
{
    "char": "服",
    "location": { "width": 26, "top": 387, "left": 10 },
},
{
    "char": "]",
    "location": { "width": 21, "top": 387, "left": 10 },
},
{
    "char": "将",
    "location": { "width": 25, "top": 387, "left": 10 },
},
{
    "char": "于",
    "location": { "width": 26, "top": 387, "left": 10 },
},
{
    "char": "0",
    "location": { "width": 20, "top": 387, "left": 10 },
},
{
    "char": "7",
    "location": { "width": 21, "top": 387, "left": 10 },
},
{
    "char": "月",
    "location": { "width": 25, "top": 387, "left": 10 },
},
```

文件

```
        "char": "0",
        "location": { "width": 21, "top": 387, "left": 14 },
    },
    {
        "char": "8",
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    },
    {
        "char": "\u20e3",
        "location": { "width": 25, "top": 387, "left": 14 },
    },
    {
        "char": "0",
        "location": { "width": 21, "top": 387, "left": 14 },
    },
    {
        "char": "0",
        "location": { "width": 21, "top": 387, "left": 14 },
    },
    {
        "char": "\u20e3",
        "location": { "width": 21, "top": 387, "left": 14 },
    },
    {
        "char": "1",
        "location": { "width": 21, "top": 387, "left": 14 },
    },
    {
        "char": "5",
        "location": { "width": 21, "top": 387, "left": 14 },
    },
    {
        "char": "\u20e3",
        "location": { "width": 25, "top": 387, "left": 14 },
    },
    {
        "char": "\u20e3",
        "location": { "width": 26, "top": 387, "left": 14 },
    },
    {
        "char": "\u20e3",
        "location": { "width": 25, "top": 387, "left": 14 },
    },
    {
        "char": "\u20e3",
        "location": { "width": 26, "top": 387, "left": 14 },
    },
    {
        "char": "\u20e3",
        "location": { "width": 21, "top": 387, "left": 14 }
    }
```

文件

```
        ],
        "location": { "width": 711, "top": 387, "left": 997,
        "words": "【普纳山谷120服】将于07月08日00:15震撼开启。"
    },
    {
        "chars": [
            {
                "char": "各",
                "location": { "width": 23, "top": 438, "left": 967 },
            },
            {
                "char": "位",
                "location": { "width": 25, "top": 438, "left": 1000 },
            },
            {
                "char": "勇",
                "location": { "width": 25, "top": 438, "left": 1033 },
            },
            {
                "char": "士",
                "location": { "width": 25, "top": 438, "left": 1066 },
            },
            {
                "char": "请",
                "location": { "width": 25, "top": 438, "left": 1100 },
            },
            {
                "char": "拿",
                "location": { "width": 23, "top": 438, "left": 1133 },
            },
            {
                "char": "起",
                "location": { "width": 25, "top": 438, "left": 1166 },
            },
            {
                "char": "手",
                "location": { "width": 23, "top": 438, "left": 1200 },
            },
            {
                "char": "中",
                "location": { "width": 23, "top": 438, "left": 1233 },
            },
            {
                "char": "武",
                "location": { "width": 25, "top": 438, "left": 1266 },
            },
            {
                "char": "器",
                "location": { "width": 23, "top": 438, "left": 1300 },
            },
        ]
    }
}
```

文件

```
        "char": "、",
        "location": { "width": 20, "top": 438, "left": 16 },
    },
    {
        "char": "亅",
        "location": { "width": 25, "top": 438, "left": 16 },
    },
    {
        "char": "我",
        "location": { "width": 23, "top": 438, "left": 16 },
    },
    {
        "char": "们",
        "location": { "width": 25, "top": 438, "left": 16 },
    },
    {
        "char": "—",
        "location": { "width": 23, "top": 438, "left": 16 },
    },
    {
        "char": "同",
        "location": { "width": 23, "top": 438, "left": 16 },
    },
    {
        "char": "踏",
        "location": { "width": 25, "top": 438, "left": 16 },
    },
    {
        "char": "上",
        "location": { "width": 23, "top": 438, "left": 16 },
    },
    {
        "char": "王",
        "location": { "width": 25, "top": 438, "left": 16 },
    },
    {
        "char": "者",
        "location": { "width": 25, "top": 438, "left": 16 },
    },
    {
        "char": "覺",
        "location": { "width": 23, "top": 438, "left": 16 },
    },
    {
        "char": "體",
        "location": { "width": 25, "top": 438, "left": 16 },
    },
    {
        "char": "之",
        "location": { "width": 23, "top": 438, "left": 16 },
    },
},
```

文件

```
{
    "char": "路",
    "location": { "width": 25, "top": 438, "left": 17 },
},
{
    "char": "!",
    "location": { "width": 20, "top": 438, "left": 18 },
}
],
"location": { "width": 853, "top": 438, "left": 987,
"words": "各位勇士请拿起手中武器,与我们一同踏上王者觉醒之路!" },
{
    "chars": [
        {
            "char": "限",
            "location": { "width": 21, "top": 486, "left": 535 },
        },
        {
            "location": { "width": 35, "top": 486, "left": 535,
"words": "限"
        },
        {
            "chars": [
                {
                    "char": "时",
                    "location": { "width": 26, "top": 512, "left": 535 },
                },
                {
                    "char": "新",
                    "location": { "width": 26, "top": 512, "left": 535 },
                },
                {
                    "char": "服",
                    "location": { "width": 26, "top": 512, "left": 601 },
                },
                {
                    "char": "活",
                    "location": { "width": 25, "top": 512, "left": 601 },
                },
                {
                    "char": "动",
                    "location": { "width": 26, "top": 512, "left": 601 },
                }
            ],
"location": { "width": 202, "top": 512, "left": 534,
"words": "时新服活动"
        },
        {
            "chars": [
                {
                    "char": "!"
                }
            ]
        }
    ]
}
```

文件

```
        "char": "【",
        "location": { "width": 22, "top": 538, "left": 927 },
    },
    {
        "char": "游",
        "location": { "width": 26, "top": 538, "left": 953 },
    },
    {
        "char": "戏",
        "location": { "width": 26, "top": 538, "left": 989 },
    },
    {
        "char": "特",
        "location": { "width": 26, "top": 538, "left": 1025 },
    },
    {
        "char": "鱼",
        "location": { "width": 27, "top": 538, "left": 1061 },
    },
    {
        "char": "】",
        "location": { "width": 19, "top": 538, "left": 1090 },
    }
],
"location": { "width": 187, "top": 538, "left": 927,
"words": "【游戏特色】"
},
{
    "chars": [
        {
            "char": "火",
            "location": { "width": 20, "top": 612, "left": 537 },
        }
    ],
"location": { "width": 33, "top": 612, "left": 537,
"words": "火"
},
{
    "chars": [
        {
            "char": "1",
            "location": { "width": 21, "top": 588, "left": 927 },
        },
        {
            "char": "·",
            "location": { "width": 21, "top": 588, "left": 1061 },
        },
        {
            "char": "超",
            "location": { "width": 26, "top": 588, "left": 1090 },
        }
    ],
"location": { "width": 100, "top": 588, "left": 927,
"words": "超燃"
}
]
```

文件

```
{
  "char": "宏",
  "location": { "width": 26, "top": 588, "left": 10 },
},
{
  "char": "伟",
  "location": { "width": 26, "top": 588, "left": 10 },
},
{
  "char": "世",
  "location": { "width": 26, "top": 588, "left": 10 },
},
{
  "char": "界",
  "location": { "width": 26, "top": 588, "left": 10 },
},
{
  "char": "观",
  "location": { "width": 26, "top": 588, "left": 10 },
},
{
  "char": "\u20e5",
  "location": { "width": 21, "top": 588, "left": 10 },
},
{
  "char": "六",
  "location": { "width": 26, "top": 588, "left": 10 },
},
{
  "char": "大",
  "location": { "width": 26, "top": 588, "left": 10 },
},
{
  "char": "种",
  "location": { "width": 26, "top": 588, "left": 10 },
},
{
  "char": "族",
  "location": { "width": 26, "top": 588, "left": 10 },
},
{
  "char": "秘",
  "location": { "width": 26, "top": 588, "left": 10 },
},
{
  "char": "密",
  "location": { "width": 26, "top": 588, "left": 10 },
},
{
  "char": "等",
  "location": { "width": 26, "top": 588, "left": 10 }
```

```
},
{
  "char": "你",
  "location": { "width": 26, "top": 588, "left": 14 },
},
{
  "char": "探",
  "location": { "width": 26, "top": 588, "left": 14 },
},
{
  "char": "索",
  "location": { "width": 26, "top": 588, "left": 14 },
},
{
  "char": ";",
  "location": { "width": 18, "top": 588, "left": 14 }
},
],
"location": { "width": 642, "top": 588, "left": 971,
"words": "1.超宏伟世界观、六大种族秘密等你探索;" },
},
{
  "chars": [
    {
      "char": "爆",
      "location": { "width": 27, "top": 635, "left": 55 },
    },
    {
      "char": "",
      "location": { "width": 27, "top": 635, "left": 55 },
    },
    {
      "char": "禁",
      "location": { "width": 26, "top": 635, "left": 62 },
    },
    {
      "char": "代",
      "location": { "width": 27, "top": 635, "left": 66 },
    },
    {
      "char": "充",
      "location": { "width": 27, "top": 635, "left": 70 },
    },
    {
      "char": "公",
      "location": { "width": 26, "top": 635, "left": 72 },
    },
    {
      "char": "告",
      "location": { "width": 27, "top": 635, "left": 72 }
    }
  ]
}
```

```
        ],
        "location": { "width": 273, "top": 635, "left": 534,
        "words": "爆严禁代充公告"
    },
    {
        "chars": [
            {
                "char": "2",
                "location": { "width": 22, "top": 642, "left": 954 }
            },
            {
                "char": ".",
                "location": { "width": 21, "top": 642, "left": 1000 }
            },
            {
                "char": "全",
                "location": { "width": 26, "top": 642, "left": 1026 }
            },
            {
                "char": "民",
                "location": { "width": 26, "top": 642, "left": 1052 }
            },
            {
                "char": "打",
                "location": { "width": 26, "top": 642, "left": 1078 }
            },
            {
                "char": "宝",
                "location": { "width": 27, "top": 642, "left": 1104 }
            },
            {
                "char": "得",
                "location": { "width": 26, "top": 642, "left": 1130 }
            },
            {
                "char": "神",
                "location": { "width": 27, "top": 642, "left": 1156 }
            },
            {
                "char": "装",
                "location": { "width": 26, "top": 642, "left": 1182 }
            },
            {
                "char": ",",
                "location": { "width": 21, "top": 642, "left": 1208 }
            },
            {
                "char": "自",
                "location": { "width": 26, "top": 642, "left": 1234 }
            },
            {
                "char": "由",
                "location": { "width": 26, "top": 642, "left": 1260 }
            }
        ]
    }
}
```

```
        "char": "由",
        "location": { "width": 26, "top": 642, "left": 10 },
    },
    {
        "char": "交",
        "location": { "width": 26, "top": 642, "left": 10 },
    },
    {
        "char": "易",
        "location": { "width": 27, "top": 642, "left": 10 },
    },
    {
        "char": "换",
        "location": { "width": 27, "top": 642, "left": 10 },
    },
    {
        "char": "货",
        "location": { "width": 27, "top": 642, "left": 10 },
    },
    {
        "char": "而",
        "location": { "width": 26, "top": 642, "left": 10 },
    },
    {
        "char": ",",
        "location": { "width": 21, "top": 642, "left": 10 },
    },
    {
        "char": "极",
        "location": { "width": 26, "top": 642, "left": 10 },
    },
    {
        "char": "速",
        "location": { "width": 26, "top": 642, "left": 10 },
    },
    {
        "char": "致",
        "location": { "width": 26, "top": 642, "left": 10 },
    },
    {
        "char": "富",
        "location": { "width": 27, "top": 642, "left": 10 },
    },
    {
        "char": ";",
        "location": { "width": 22, "top": 642, "left": 10 }
    }
],
"location": { "width": 719, "top": 642, "left": 992,
"words": "2.全民打宝得神装,自由交易换货币,极速致富;" },
},
```

文件

```
{  
  "chars": [  
    {  
      "char": "3",  
      "location": { "width": 21, "top": 693, "left": 96 }  
    },  
    {  
      "char": ".",  
      "location": { "width": 21, "top": 693, "left": 108 }  
    },  
    {  
      "char": "神",  
      "location": { "width": 25, "top": 693, "left": 110 }  
    },  
    {  
      "char": "裝",  
      "location": { "width": 25, "top": 693, "left": 110 }  
    },  
    {  
      "char": "极",  
      "location": { "width": 26, "top": 693, "left": 110 }  
    },  
    {  
      "char": "速",  
      "location": { "width": 25, "top": 693, "left": 110 }  
    },  
    {  
      "char": "进",  
      "location": { "width": 26, "top": 693, "left": 110 }  
    },  
    {  
      "char": "阶",  
      "location": { "width": 26, "top": 693, "left": 110 }  
    },  
    {  
      "char": ",",  
      "location": { "width": 20, "top": 693, "left": 110 }  
    },  
    {  
      "char": "炼",  
      "location": { "width": 25, "top": 693, "left": 110 }  
    },  
    {  
      "char": "化",  
      "location": { "width": 26, "top": 693, "left": 110 }  
    },  
    {  
      "char": "玩",  
      "location": { "width": 25, "top": 693, "left": 110 }  
    },  
    {  
      "char": "","  
      "location": { "width": 25, "top": 693, "left": 110 }  
    }  
  ]  
}
```

文件

```
        "char": "法",
        "location": { "width": 25, "top": 693, "left": 10 },
    },
    {
        "char": "打",
        "location": { "width": 26, "top": 693, "left": 10 },
    },
    {
        "char": "造",
        "location": { "width": 25, "top": 693, "left": 10 },
    },
    {
        "char": "独",
        "location": { "width": 25, "top": 693, "left": 10 },
    },
    {
        "char": "特",
        "location": { "width": 26, "top": 693, "left": 10 },
    },
    {
        "char": "↑",
        "location": { "width": 25, "top": 693, "left": 10 },
    },
    {
        "char": "性",
        "location": { "width": 25, "top": 693, "left": 10 },
    },
    {
        "char": "神",
        "location": { "width": 26, "top": 693, "left": 10 },
    },
    {
        "char": "装",
        "location": { "width": 26, "top": 693, "left": 10 },
    },
    {
        "char": ";",
        "location": { "width": 21, "top": 693, "left": 10 }
    }
],
"location": { "width": 686, "top": 693, "left": 994,
"words": "3. 神装极速进阶, 炼化玩法打造独特个性神装;" },
},
{
    "chars": [
    {
        "char": "4",
        "location": { "width": 19, "top": 746, "left": 994 },
    },
    {
        "char": ".",
        "location": { "width": 19, "top": 746, "left": 994 },
    }
]
```

文件

```
        "location": { "width": 19, "top": 746, "left": 10 },
},
{
    "char": "独",
    "location": { "width": 22, "top": 746, "left": 10 },
},
{
    "char": "创",
    "location": { "width": 23, "top": 746, "left": 10 },
},
{
    "char": "十",
    "location": { "width": 23, "top": 746, "left": 10 },
},
{
    "char": "二",
    "location": { "width": 23, "top": 746, "left": 10 },
},
{
    "char": "星",
    "location": { "width": 23, "top": 746, "left": 10 },
},
{
    "char": "使",
    "location": { "width": 23, "top": 746, "left": 10 },
},
{
    "char": "助",
    "location": { "width": 23, "top": 746, "left": 10 },
},
{
    "char": "战",
    "location": { "width": 23, "top": 746, "left": 10 },
},
{
    "char": "系",
    "location": { "width": 23, "top": 746, "left": 10 },
},
{
    "char": "统",
    "location": { "width": 23, "top": 746, "left": 10 },
},
{
    "char": ",",
    "location": { "width": 19, "top": 746, "left": 10 },
},
{
    "char": "五",
    "location": { "width": 22, "top": 746, "left": 10 },
},
```

```
        "char": "大",
        "location": { "width": 23, "top": 746, "left": 14 },
    },
    {
        "char": "魔",
        "location": { "width": 23, "top": 746, "left": 14 },
    },
    {
        "char": "幻",
        "location": { "width": 22, "top": 746, "left": 14 },
    },
    {
        "char": "星",
        "location": { "width": 23, "top": 746, "left": 14 },
    },
    {
        "char": "使",
        "location": { "width": 23, "top": 746, "left": 14 },
    },
    {
        "char": "技",
        "location": { "width": 23, "top": 746, "left": 14 },
    },
    {
        "char": "能",
        "location": { "width": 23, "top": 746, "left": 14 },
    },
    {
        "char": "逆",
        "location": { "width": 23, "top": 746, "left": 14 },
    },
    {
        "char": "转",
        "location": { "width": 23, "top": 746, "left": 14 },
    },
    {
        "char": "战",
        "location": { "width": 23, "top": 746, "left": 14 },
    },
    {
        "char": "局",
        "location": { "width": 22, "top": 746, "left": 14 },
    },
    {
        "char": ";",
        "location": { "width": 15, "top": 746, "left": 14 }
    }
],
"location": { "width": 821, "top": 746, "left": 989,
"words": "4.独创十二星使助战系统,五大魔幻星使技能逆转战局;" },
},
```

文件

```
{
  "chars": [
    {
      "char": "五",
      "location": { "width": 21, "top": 795, "left": 96 },
    },
    {
      "char": ".",
      "location": { "width": 21, "top": 795, "left": 108 },
    },
    {
      "char": "\u2022",
      "location": { "width": 25, "top": 795, "left": 110 },
    },
    {
      "char": "大",
      "location": { "width": 25, "top": 795, "left": 110 },
    },
    {
      "char": "化",
      "location": { "width": 25, "top": 795, "left": 110 },
    },
    {
      "char": "神",
      "location": { "width": 25, "top": 795, "left": 110 },
    },
    {
      "char": "任",
      "location": { "width": 25, "top": 795, "left": 110 },
    },
    {
      "char": "意",
      "location": { "width": 23, "top": 795, "left": 110 },
    },
    {
      "char": "搭",
      "location": { "width": 25, "top": 795, "left": 110 },
    },
    {
      "char": "配",
      "location": { "width": 25, "top": 795, "left": 110 },
    },
    {
      "char": ",",
      "location": { "width": 20, "top": 795, "left": 110 },
    },
    {
      "char": "助",
      "location": { "width": 23, "top": 795, "left": 110 },
    }
  ]
}
```

文件

```
        "char": "力",
        "location": { "width": 25, "top": 795, "left": 10 },
    },
    {
        "char": "培",
        "location": { "width": 25, "top": 795, "left": 10 },
    },
    {
        "char": "养",
        "location": { "width": 25, "top": 795, "left": 10 },
    },
    {
        "char": "个",
        "location": { "width": 25, "top": 795, "left": 10 },
    },
    {
        "char": "性",
        "location": { "width": 23, "top": 795, "left": 10 },
    },
    {
        "char": "化",
        "location": { "width": 25, "top": 795, "left": 10 },
    },
    {
        "char": "职",
        "location": { "width": 25, "top": 795, "left": 10 },
    },
    {
        "char": "业",
        "location": { "width": 25, "top": 795, "left": 10 },
    },
    {
        "char": "属",
        "location": { "width": 23, "top": 795, "left": 10 },
    },
    {
        "char": "性",
        "location": { "width": 25, "top": 795, "left": 10 },
    },
    {
        "char": ";",
        "location": { "width": 18, "top": 795, "left": 10 }
    }
],
"location": { "width": 719, "top": 795, "left": 992,
"words": "5.六大化神任意搭配,助力培养个性化职业属性;" },
{
    "chars": [
        {
            "char": "6",
            "location": { "width": 25, "top": 795, "left": 10 }
        }
    ]
}
```

```
        "location": { "width": 20, "top": 844, "left": 98 },
},
{
    "char": ".",
    "location": { "width": 20, "top": 844, "left": 108 },
},
{
    "char": "勇",
    "location": { "width": 25, "top": 844, "left": 118 },
},
{
    "char": "者",
    "location": { "width": 26, "top": 844, "left": 118 },
},
{
    "char": "轉",
    "location": { "width": 25, "top": 844, "left": 118 },
},
{
    "char": "職",
    "location": { "width": 25, "top": 844, "left": 118 },
},
{
    "char": "突",
    "location": { "width": 26, "top": 844, "left": 118 },
},
{
    "char": "破",
    "location": { "width": 26, "top": 844, "left": 118 },
},
{
    "char": "屬",
    "location": { "width": 25, "top": 844, "left": 118 },
},
{
    "char": "性",
    "location": { "width": 25, "top": 844, "left": 118 },
},
{
    "char": ",",
    "location": { "width": 21, "top": 844, "left": 118 },
},
{
    "char": "職",
    "location": { "width": 25, "top": 844, "left": 118 },
},
{
    "char": "業",
    "location": { "width": 25, "top": 844, "left": 118 },
},
```

文件

```
        "char": "时",
        "location": { "width": 25, "top": 844, "left": 12 },
    },
    {
        "char": "装",
        "location": { "width": 25, "top": 844, "left": 14 },
    },
    {
        "char": "免",
        "location": { "width": 38, "top": 844, "left": 14 },
    },
    {
        "char": "费",
        "location": { "width": 25, "top": 844, "left": 14 },
    },
    {
        "char": "领",
        "location": { "width": 25, "top": 844, "left": 14 },
    },
    {
        "char": ";",
        "location": { "width": 21, "top": 844, "left": 14 },
    }
],
"location": { "width": 586, "top": 844, "left": 994,
"words": "6. 勇者转职突破属性, 职业时装免费领;" },
{
    "chars": [
        {
            "char": "7",
            "location": { "width": 23, "top": 893, "left": 994 },
        },
        {
            "char": ".",
            "location": { "width": 22, "top": 893, "left": 1016 },
        },
        {
            "char": "B",
            "location": { "width": 23, "top": 893, "left": 1038 },
        },
        {
            "char": "0",
            "location": { "width": 22, "top": 893, "left": 1060 },
        },
        {
            "char": "S",
            "location": { "width": 23, "top": 893, "left": 1082 },
        },
        {
            "char": "S",
            "location": { "width": 23, "top": 893, "left": 1104 },
        }
    ]
}
```

```
        "location": { "width": 23, "top": 893, "left": 12 },
},
{
    "char": "爆",
    "location": { "width": 28, "top": 893, "left": 12 },
},
{
    "char": "率",
    "location": { "width": 27, "top": 893, "left": 12 },
},
{
    "char": "1",
    "location": { "width": 22, "top": 893, "left": 12 },
},
{
    "char": "0",
    "location": { "width": 22, "top": 893, "left": 12 },
},
{
    "char": "0",
    "location": { "width": 23, "top": 893, "left": 12 },
},
{
    "char": "%",
    "location": { "width": 28, "top": 893, "left": 12 },
},
{
    "char": ",",
    "location": { "width": 22, "top": 893, "left": 12 },
},
{
    "char": "狂",
    "location": { "width": 28, "top": 893, "left": 12 },
},
{
    "char": "爆",
    "location": { "width": 27, "top": 893, "left": 12 },
},
{
    "char": "极",
    "location": { "width": 28, "top": 893, "left": 12 },
},
{
    "char": "品",
    "location": { "width": 27, "top": 893, "left": 12 },
},
{
    "char": "装",
    "location": { "width": 28, "top": 893, "left": 12 },
},
```

```
        "char": "备",
        "location": { "width": 27, "top": 893, "left": 14 },
    },
    {
        "char": ",",
        "location": { "width": 22, "top": 893, "left": 14 },
    },
    {
        "char": "轻",
        "location": { "width": 28, "top": 893, "left": 14 },
    },
    {
        "char": "松",
        "location": { "width": 28, "top": 893, "left": 14 },
    },
    {
        "char": "集",
        "location": { "width": 28, "top": 893, "left": 14 },
    },
    {
        "char": "齐",
        "location": { "width": 28, "top": 893, "left": 14 },
    },
    {
        "char": "全",
        "location": { "width": 28, "top": 893, "left": 14 },
    },
    {
        "char": "套",
        "location": { "width": 27, "top": 893, "left": 14 },
    },
    {
        "char": "神",
        "location": { "width": 28, "top": 893, "left": 14 },
    },
    {
        "char": "装",
        "location": { "width": 28, "top": 893, "left": 14 },
    },
    {
        "char": ";",
        "location": { "width": 23, "top": 893, "left": 14 }
    }
],
"location": { "width": 813, "top": 893, "left": 992,
"words": "7.BOSS爆率100%,狂爆极品装备,轻松集齐全套神装;" },
{
    "chars": [
        {
            "char": "8",
            "location": { "width": 28, "top": 893, "left": 14 }
        }
    ]
}
```

文件

```
        "location": { "width": 25, "top": 945, "left": 96 },
},
{
    "char": ".",
    "location": { "width": 23, "top": 945, "left": 101 },
},
{
    "char": "首",
    "location": { "width": 44, "top": 945, "left": 101 },
},
{
    "char": "日",
    "location": { "width": 29, "top": 945, "left": 101 },
},
{
    "char": "直",
    "location": { "width": 29, "top": 945, "left": 101 },
},
{
    "char": "升",
    "location": { "width": 29, "top": 945, "left": 101 },
},
{
    "char": "1",
    "location": { "width": 23, "top": 945, "left": 101 },
},
{
    "char": "5",
    "location": { "width": 25, "top": 945, "left": 101 },
},
{
    "char": "0",
    "location": { "width": 25, "top": 945, "left": 101 },
},
{
    "char": "级",
    "location": { "width": 29, "top": 945, "left": 101 },
},
{
    "char": ",",
    "location": { "width": 25, "top": 945, "left": 101 },
},
{
    "char": "登",
    "location": { "width": 30, "top": 945, "left": 101 },
},
{
    "char": "录",
    "location": { "width": 29, "top": 945, "left": 101 },
},
```

文件

```
        "char": "即",
        "location": { "width": 29, "top": 945, "left": 16 },
    },
    {
        "char": "送",
        "location": { "width": 29, "top": 945, "left": 16 },
    },
    {
        "char": "丨",
        "location": { "width": 23, "top": 945, "left": 16 },
    },
    {
        "char": "兽",
        "location": { "width": 29, "top": 945, "left": 16 },
    },
    {
        "char": "王",
        "location": { "width": 29, "top": 945, "left": 16 },
    },
    {
        "char": "天",
        "location": { "width": 29, "top": 945, "left": 16 },
    },
    {
        "char": "神",
        "location": { "width": 29, "top": 945, "left": 16 },
    },
    {
        "char": "丶",
        "location": { "width": 25, "top": 945, "left": 16 },
    },
    {
        "char": "春",
        "location": { "width": 29, "top": 945, "left": 16 },
    },
    {
        "char": "日",
        "location": { "width": 30, "top": 945, "left": 16 },
    },
    {
        "char": "时",
        "location": { "width": 29, "top": 945, "left": 16 },
    },
    {
        "char": "装",
        "location": { "width": 29, "top": 945, "left": 16 },
    },
    {
        "char": "丶",
        "location": { "width": 25, "top": 945, "left": 16 },
    },
```

```
{  
    "char": "雪",  
    "location": { "width": 29, "top": 945, "left": 17 }  
},  
{  
    "char": "豹",  
    "location": { "width": 28, "top": 945, "left": 16 }  
}  
,  
{"location": { "width": 879, "top": 945, "left": 968,  
    "words": "8.首日直升150级,登录即送:兽王天神、春日时装、雪豹"  
}}  
]
```

计算文字的位置

背景：百度OCR返回的文字都是json字典，希望能从对应匹配到的单词，找到对应的位置坐标信息

代码：

```
def calcWordsLocation(self, wordStr, curWordsResult):
    """Calculate words location from result

    Args:
        wordStr (str): the words to check
        curWordsResult (dict): the baidu OCR result of current words
    Returns:
        location, a tuple (x, y, width, height)
    Raises:
    Examples
        wordStr="首充"
        curWordsResult= {
            "chars": [
                {
                    "char": "寻",
                    "location": {
                        "width": 15,
                        "top": 51,
                        "left": 725,
                        "height": 24
                    }
                },
                ...
                {
                    "char": "首",
                    "location": {
                        "width": 15,
                        "top": 51,
                        "left": 971,
                        "height": 24
                    }
                },
                {
                    "char": "充",
                    "location": {
                        "width": 15,
                        "top": 51,
                        "left": 986,
                        "height": 24
                    }
                }
            ],
            "location": {
                "width": 280,
                "top": 51,
                "left": 725,
                "height": 24
            },
            "words": "寻宝福利大厅商城首充"
        }
```

```

        }
        -> (971, 51, 30, 24)
    ....
    (x, y, width, height) = (0, 0, 0, 0)
    matchedStr = curWordsResult["words"]
    # Note: for special, contain multilple words, here only
    foundWords = re.search(wordStr, matchedStr)
    if foundWords:
        logging.debug("foundWords=%s" % foundWords)

    firstMatchedPos = foundWords.start()
    lastMatchedPos = foundWords.end() - 1

    matchedStrLen = len(matchedStr)
    charResultList = curWordsResult["chars"]
    charResultListLen = len(charResultList)

    firstCharResult = None
    lastCharResult = None
    if matchedStrLen == charResultListLen:
        firstCharResult = charResultList[firstMatchedPos]
        lastCharResult = charResultList[lastMatchedPos]
    else:
        # Special: for 'Loading' matched ' Loading', but
        # so using find the corresponding char, then go
        # Note: following method not work for regex str

        firtToMatchChar = wordStr[0]
        lastToMatchChar = wordStr[-1]

        for eachCharResult in charResultList:
            if firstCharResult and lastCharResult:
                break

            eachChar = eachCharResult["char"]
            if firtToMatchChar == eachChar:
                firstCharResult = eachCharResult
            elif lastToMatchChar == eachChar:
                lastCharResult = eachCharResult

    # Note: follow no need check words, to support input
    # firstLocation = None
    # lastLocation = None
    # if firstCharResult["char"] == firtToMatchChar:

```

文件

```
#     firstLocation = firstCharResult["location"]
# if lastCharResult["char"] == lastToMatchChar:
#     lastLocation = lastCharResult["location"]
firstLocation = firstCharResult["location"]
lastLocation = lastCharResult["location"]

# if firstLocation and lastLocation:

# support both horizontal and vertical words
firstLeft = firstLocation["left"]
lastLeft = lastLocation["left"]
minLeft = min(firstLeft, lastLeft)
x = minLeft

firstHorizontalEnd = firstLeft + firstLocation["width"]
lastHorizontalEnd = lastLeft + lastLocation["width"]
maxHorizontalEnd = max(firstHorizontalEnd, lastHorizontalEnd)
width = maxHorizontalEnd - x

lastTop = lastLocation["top"]
minTop = min(firstLocation["top"], lastTop)
y = minTop

lastVerticalEnd = lastTop + lastLocation["height"]
height = lastVerticalEnd - y

return x, y, width, height
```

调用：

```
calculatedLocation = self.calcWordsLocation(eachInputWords)
```

把坐标位置转成中间坐标值

作用：用于后续点击按钮中间坐标值

代码：

文件

```
def locationToCenterPos(self, wordslocation):
    """Convert location of normal button to center position

    Args:
        wordslocation (tuple): words location, (x, y, width, height)
            Example: (267, 567, 140, 39)
    Returns:
        tuple, (x, y), the location's center position, norm
            Example: (337.0, 586.5)
    Raises:
        .....
    """
    x, y, width, height = wordslocation
    centerX = x + width/2
    centerY = y + height/2
    centerPosition = (centerX, centerY)
    return centerPosition
```

调用：

```
curCenterX, curCenterY = self.locationToCenterPos(eachLocat
```

检测文字是否在结果中

代码：

```
def isWordsInResult(self, respJson, wordsOrWordsList, isMatchMultiple):
    """Check words is in result or not

    Args:
        respJson (dict): Baidu OCR responded json
        wordsOrWordsList (str/list): single input str or str list
        isMatchMultiple (bool): for each single str, to match multiple
    Returns:
        dict, matched result
    Raises:
        ...
    # Note: use OrderedDict instead dict to keep order, for orderedDict
    orderedMatchedResultDict = OrderedDict()

    inputWordsList = wordsOrWordsList
    if isinstance(wordsOrWordsList, str):
        inputWords = str(wordsOrWordsList)
        inputWordsList = [inputWords]

    wordsResultList = respJson["words_result"]
    for curInputWords in inputWordsList:
        curMatchedResultList = []
        for eachWordsResult in wordsResultList:
            eachWords = eachWordsResult["words"]
            foundCurWords = re.search(curInputWords, eachWords)
            if foundCurWords:
                curMatchedResultList.append(eachWordsResult)
                if not isMatchMultiple:
                    break

    orderedMatchedResultDict[curInputWords] = curMatchedResultList
    return orderedMatchedResultDict
```

调用：

```
matchedResultDict = self.isWordsInResult(wordsResultJson, True)
```

检测当前屏幕中是否包含对应文字

```

def isWordsInCurScreen(self, wordsOrWordsList, imgPath=None):
    """Found words in current screen

    Args:
        wordsOrWordsList (str/list): single input str or str/list
        imgPath (str): current screen image file path; default None
        isMatchMultiple (bool): for each single str, to match multiple
        isRespShortInfo (bool): return simple=short=normal=full
    Returns:
        matched result, type=bool/list[bool]/dict/tuple, depends on args
    Raises:
    .....
    returnValue = None

    if not imgPath:
        # do screenshot
        imgPath = self.getCurScreenshot()

    wordsResultJson = self.baiduImageToWords(imgPath)

    isMultipleInput = False
    inputWords = None
    inputWordsList = []

    if isinstance(wordsOrWordsList, list):
        isMultipleInput = True
        inputWordsList = list(wordsOrWordsList)
    elif isinstance(wordsOrWordsList, str):
        isMultipleInput = False
        inputWords = str(wordsOrWordsList)
        inputWordsList = [inputWords]

    matchedResultDict = self.isWordsInResult(wordsResultJson)

    # add calculated location and words
    # Note: use OrderedDict instead dict to keep order, for better compatibility
    processedResultDict = OrderedDict()
    for eachInputWords in inputWordsList:
        isCurFound = False
        # curLocatoinList = []
        # curWordsList = []
        curResultList = []

```

```

curWordsMatchedResultList = matchedResultDict[each]
if curWordsMatchedResultList:
    isCurFound = True
    for curIdx, eachWordsMatchedResult in enumerate(curWordsMatchedResultList):
        curMatchedWords = eachWordsMatchedResult["words"]
        calculatedLocation = self.calcWordsLocation(curMatchedWords)
        # curLocatoinList.append(calculatedLocation)
        # curWordsList.append(curMatchedWords)
        curResult = (curMatchedWords, calculatedLocation)
        curResultList.append(curResult)

        # processedResultDict[eachInputWords] = (isCurFound, curResultList)
        processedResultDict[eachInputWords] = (isCurFound, curResultList)
        logging.debug("For %s, matchedResult=%s from imgPath=%s" % (each, curResultList, imgPath))

if isMultipleInput:
    if isRespShortInfo:
        isFoundList = []
        for eachInputWords in processedResultDict.keys():
            isCurFound, noUse = processedResultDict[eachInputWords]
            isFoundList.append(isCurFound)
        # Note: no mattter isMatchMultiple, both only one result
        retBoolList = isFoundList
        retValue = retBoolList
    else:
        if isMatchMultiple:
            retTuple = processedResultDict, imgPath
            retValue = retTuple
        else:
            # Note: use OrderedDict instead dict to keep order
            respResultDict = OrderedDict()
            for eachInputWords in processedResultDict.keys():
                # isCurFound, curLocatoinList, curWordsList
                isCurFound, curResultList = processedResultDict[eachInputWords]
                # singleLocation = None
                # singleWords = None
                singleResult = (None, None)
                if isCurFound:
                    # singleLocation = curLocatoinList
                    # singleWords = curWordsList[0]
                    singleResult = curResultList[0]
                # respResultDict[eachInputWords] = (isCurFound, curResultList)
                respResultDict[eachInputWords] = (isCurFound, curResultList)
            retTuple = respResultDict, imgPath
            retValue = retTuple
    else:
        singleInputResult = processedResultDict[inputWords]
        # isCurFound, curLocatoinList, curWordsList = singleInputResult

```

文件

```
isCurFound, curResultList = singleInputResult
if isRespShortInfo:
    # Note: no matter isMatchMultiple, both only
    retBool = isCurFound
    retValue = retBool
else:
    if isMatchMultiple:
        # retTuple = isCurFound, curLocatoinList, curWordsList
        retTuple = isCurFound, curResultList, imgPath
        retValue = retTuple
    else:
        singleResult = (None, None)
        # singleLocation = None
        # singleWords = None
        if isCurFound:
            # singleLocation = curLocatoinList[0]
            # singleWords = curWordsList[0]
            singleResult = curResultList[0]
        # retTuple = isCurFound, singleLocation, singleWords
        retTuple = isCurFound, singleResult, imgPath
        retValue = retTuple

logging.debug("Input: %s, output=%s", wordsOrWordsList,
return retValue
```

调用：

```
allResultDict, _ = self.isWordsInCurScreen(allStrList, imgPath)
```

获取当前屏幕中的文字

```
def getWordsInCurScreen(self):
    """get words in current screenshot"""
    screenImgPath = self.getCurScreenshot()
    wordsResultJson = self.baiduImageToWords(screenImgPath)
    return wordsResultJson
```

调用：

```
curScreenWords = self.getWordsInCurScreen()
```

检测当前屏幕中是否存在某些信息

```

def checkExistInScreen(self,
                      imgPath=None,
                      mandatoryStrList=[],
                      mandatoryMinMatchCount=0,
                      optionalStrList=[],
                      # optionalMinMatchCount=2,
                      optionalMinMatchCount=1,
                      isRespFullInfo=False
                      ):
    """
    Check whether mandatory and optional str list in current screen
    """

    Args:
        imgPath (str): current screen image file path; default None
        mandatoryStrList (list): mandatory str, at least one str
        mandatoryMinMatchCount (int): minimal match count
        optionalStrList (list): optional str, some may match
        optionalMinMatchCount (int): for `optionalStrList`, if match
        isRespFullInfo (bool): return full info or not, full info
    Returns:
        matched result, type=bool/tuple, depends on `isRespFullInfo`
    Raises:
        None

    if not imgPath:
        imgPath = self.getCurScreenshot()
        logging.debug("imgPath=%s", imgPath)

    isExist = False
    # Note: use OrderedDict instead dict to keep order, for
    respMatchLocation = OrderedDict()

    isMandatoryMatch = True
    isMandatoryShouldMatchAll = (mandatoryMinMatchCount <=
                                  len(mandatoryStrList))
    isOptionalMatch = True

    allStrList = []
    allStrList.extend(mandatoryStrList)
    allStrList.extend(optionalStrList)

    optionalMatchCount = 0
    mandatoryMatchCount = 0
    allResultDict, _ = self.isWordsInCurScreen(allStrList,
                                              for eachStr, (isFoundCur, curResultList) in allResultD:
                                                  if eachStr in mandatoryStrList:
                                                      if isFoundCur:
                                                          mandatoryMatchCount += 1
    """

```

文件

```
        respMatchLocation[eachStr] = curResultList
    else:
        if isMandatoryShouldMatchAll:
            isMandatoryMatch = False
            break
    elif eachStr in optionalStrList:
        if isFoundCur:
            optionalMatchCount += 1
            respMatchLocation[eachStr] = curResultList

    if mandatoryStrList:
        if not isMandatoryShouldMatchAll:
            if mandatoryMatchCount >= mandatoryMinMatchCount:
                isMandatoryMatch = True
        else:
            isMandatoryMatch = False

    if optionalStrList:
        if optionalMatchCount >= optionalMinMatchCount:
            isOptionalMatch = True
        else:
            isOptionalMatch = False

    isExist = isMandatoryMatch and isOptionalMatch
    logging.debug("isMandatoryMatch=%s, isOptionalMatch=%s"

    if isRespFullInfo:
        logging.debug("mandatoryStrList=%s, optionalStrList=%s"
                      "mandatoryStrList, optionalStrList, isExist, respMatchLocation, imgPath)
        return (isExist, respMatchLocation, imgPath)
    else:
        logging.debug("mandatoryStrList=%s, optionalStrList=%s"
                      "mandatoryStrList, optionalStrList, isExist)
        return isExist
```

调用：

```
checkResult = self.checkExistInScreen(
    imgPath=imgPath,
    optionalStrList=strList,
    optionalMinMatchCount=1,
    isRespFullInfo=isRespFullInfo,
)
```

和：

文件

```
minOptionalMatchCount = 2

mandatoryList = [
    # "公告",
    "^\u5e02\u53d6$",
    '^strongly_recommended$', # 王城英雄，不规则弹框
    ...
]

possibleTitleList = [
    "^\u53d6\u5316\u53d6\u5316$",
]
optionalList = []
otherOptionalList = [
    "new(\u5e02\u53d6)?",
    "game\u53d6\u5316",
    "(\u53d6\u5316)?update(\u5e02\u53d6)?",
    ...
    "log\u53d6\u5316",
]
optionalList.extend(possibleTitleList)
optionalList.extend(otherOptionalList)

checkResult = self.checkExistInScreen(
    imgPath=imgPath,
    mandatoryStrList=mandatoryList,
    mandatoryMinMatchCount=1,
    optionalStrList=optionalList,
    optionalMinMatchCount=minOptionalMatchCount,
    isRespFullInfo=isRespFullInfo,
)
```

和：

文件

```
mandatoryList = [
    "^购买$", # 造梦西游: '购买'
    "^¥\d+元?", # 剑玲珑, 至尊屠龙
    "\d+元", # 造梦西游: '6元券3元券3'
    "^充值$", # 剑玲珑, 至尊屠龙
]
optionalList = [
    # common
    "元宝",
    "月卡",
    ...
    # 剑玲珑
    "赠",
]
isRealPay, matchResult, imgPath = self.checkExistInScreen(
    mandatoryStrList=mandatoryList,
    mandatoryMinMatchCount=2,
    optionalStrList=optionalList,
    optionalMinMatchCount=2,
    isRespFullInfo=True,
)
```

和:

```
mandatoryList = [
    "^((继续)|(结束))$", # 暗黑觉醒: '继续' or '结束'
    "\d秒$", # 暗黑觉醒: '5秒', '1秒'
]
isAutoConverstion, matchResult, imgPath = self.checkExistInScreen(
    imgPath=imgPath,
    mandatoryStrList=mandatoryList,
    mandatoryMinMatchCount=2,
    isRespFullInfo=True,
)
```

和:

文件

```
mandatoryList = [
    "充值", # 造梦西游: "充值战神榜邮件各但,挑战竞技好友"
    "首充$", # 剑玲珑, 至尊屠龙
    ...
]
optionalList = [
    # common
    "组队", # 至尊屠龙, 剑玲珑
    "任务", # 至尊屠龙, 剑玲珑

    # "商城", # 剑玲珑
    "寻宝", # 剑玲珑
    "福利大厅", # 剑玲珑
    ...
    "背包",
]

isHome, matchResult, imgPath = self.checkExistInScreen(
    mandatoryStrList=mandatoryList,
    mandatoryMinMatchCount=1,
    optionalStrList=optionalList,
    isRespFullInfo=True,
)
```

和:

```
mandatoryList = [
    "立即登录", # 剑玲珑, 至尊屠龙
    ...
    "登录$", # 暗黑觉醒
]
optionalList = [
    # common
    "一键((注册)|(试玩))",
    "忘记密码", # 至尊屠龙, 青云诀
    "((用户)|(账号)|(手机))登录", # 剑玲珑, 至尊屠龙,
    "点击选服", # 青云诀, 暗黑觉醒
    ...
    # 造梦西游
    "游客登录", #更新: 不能用游客登录, 否则后续无法弹出支付页面
]

respUserLogin = self.checkExistInScreen(
    mandatoryStrList=mandatoryList,
    mandatoryMinMatchCount=1,
    optionalStrList=optionalList,
    isRespFullInfo=isRespFullInfo
)
```

是否存在任意一个词组

```
def isExistAnyStr(self, strList, imgPath=None, isRespFullInfo=False):
    """Is any str exist or not

    Args:
        strList (list): str list to check exist or not
        imgPath (str): current screen image file path; default None
        isRespFullInfo (bool): return full info or not, full info includes
    Returns:
        matched result, type=bool/tuple, depends on `isRespFullInfo`
    Raises:
        ...
    if not imgPath:
        imgPath = self.getCurScreenshot()

    checkResult = self.checkExistInScreen(
        imgPath=imgPath,
        optionalStrList=strList,
        optionalMinMatchCount=1,
        isRespFullInfo=isRespFullInfo,
    )
    if isRespFullInfo:
        isExistAny, matchResult, imgPath = checkResult
        logging.debug("isExistAny=%s, matchResult=%s, imgPath=%s", isExistAny, matchResult, imgPath)
        return (isExistAny, matchResult, imgPath)
    else:
        isExistAny = checkResult
        logging.debug("isExistAny=%s, for %s", isExistAny, strList)
        return isExistAny
```

调用：

```
isExist, matchResult, imgPath = self.isExistAnyStr(buttonList)
```

和：

```
mandatoryList = [
    # 御剑仙缘
    "^(请)?点击\s?[^"]+[^"]+\{1,6\}[^"]+?", # '请点击' ...
]

respResult = self.isExistAnyStr(mandatoryList, imgPath=imgPath)
```

和：

```
requireManualOperationList = [
    "完成指定操作", # speical: 造梦西游 的 '(请完成指定操作)梦口'
]
isRequireManual, _, imgPath = self._existAnyStr(requireMa
```

和:

```
lanuchStrList = [
    "^4399手机游戏$", # 剑玲珑
    "^西瓜游戏$", # 青云诀
]
isLaunch, _, imgPath = self._existAnyStr(lanuchStrList, is
```

和:

```
loadingStrList = [
    # 登录类
    "正在登录", # 正在登录
    "logging",
    ...
    "游戏资源", # 青云诀:本地游戏资源已是最新
    ...
]
isLoadingSth, _, imgPath = self._existAnyStr(loadingSt
```

和:

```
gotoPayStrList = [
    "^前往充值$", # 剑玲珑
    "^立即充值$", # 至尊屠龙
    ...
]
respBoolOrTuple = self._existAnyStr(gotoPayStrList, isRes
```

判断是否所有的字符都存在

```
def isExistAllStr(self, strList, imgPath=None, isRespFullInfo=False):
    """Is all str exist or not

    Args:
        strList (list): str list to check exist or not
        imgPath (str): current screen image file path; default None
        isRespFullInfo (bool): return full info or not, full info means return matched result, type=bool/tuple, depends on `isRespFullInfo` parameter
    Returns:
        matched result, type=bool/tuple, depends on `isRespFullInfo` parameter
    Raises:
        None

    if not imgPath:
        imgPath = self.getCurScreenshot()
    checkResult = self.checkExistInScreen(imgPath=imgPath, strList=strList)
    if isRespFullInfo:
        isExistAll, matchResult, imgPath = checkResult
        logging.debug("isExistAll=%s, matchResult=%s, imgPath=%s", isExistAll, matchResult, imgPath)
        return (isExistAll, matchResult, imgPath)
    else:
        isExistAll = checkResult
        logging.debug("isExistAll=%s, for %s", isExistAll, strList)
        return isExistAll
```

调用：

```
realPayStrList = [
    "^\u20ac\d+\u20ac?", # 剑玲珑，至尊屠龙
    "^\u20ac充值$", # 剑玲珑，至尊屠龙
]
return self.isExistAllStr(realPayStrList, isRespFullInfo=isExistAll)
```

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音频

播放音频

树莓派中用python播放音频

前提：

树莓派中，先去安装vlc：

```
sudo apt-get install vlc
```

代码：

```
import vlc
instance = vlc.Instance('--aout=alsa')
p = instance.media_player_new()
m = instance.media_new('/home/pi/Music/lizhongsheng_massif.mp3')
p.set_media(m)
p.play()
```

即可播放音频。

实现设置音量，暂停，继续播放等操作的代码是：

```
p.pause()
vlc.libvlc_audio_set_volume(p, 40)
p.play()
vlc.libvlc_audio_set_volume(p, 90)
```

Mac中调用mpv播放音频

播放音频：

```
cmdPlayer = "mpv"
cmdParaFilePath = tmpAudioFileFullPath
cmdArgList = [cmdPlayer, cmdParaFilePath]

if gCurSubProcess:
    gCurSubProcess.terminate()

gCurSubProcess = subprocess.Popen(cmdArgList)
log.debug("gCurSubProcess=%s", gCurSubProcess)
```

文件

停止播放：

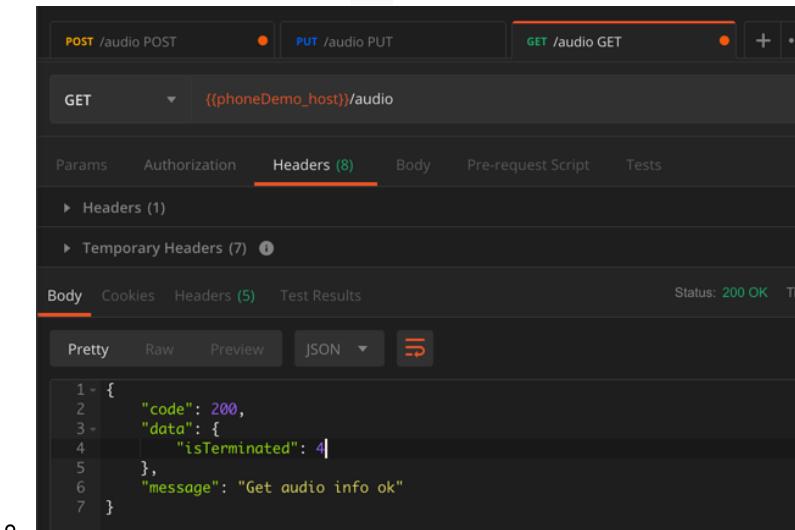
```
if audioControl == "stop":  
    if gCurSubProcess:  
        gCurSubProcess.terminate()  
  
    respData = {  
        "audioControl": "ok"  
    }  
  
else:  
    respData = {  
        "audioControl": "Unsupport command"  
    }
```

获取播放效果：

```
if gCurSubProcess:  
    isTerminated = gCurSubProcess.poll() # None  
    # stdout_data, stderr_data = gCurSubProcess.communicate()  
    # stdoutStr = str(stdout_data)  
    # stderrStr = str(stderr_data)  
    respData = {  
        "isTerminated": isTerminated,  
        # "stdout_data": stdoutStr,  
        # "stderr_data": stderrStr,  
    }
```

返回结果：

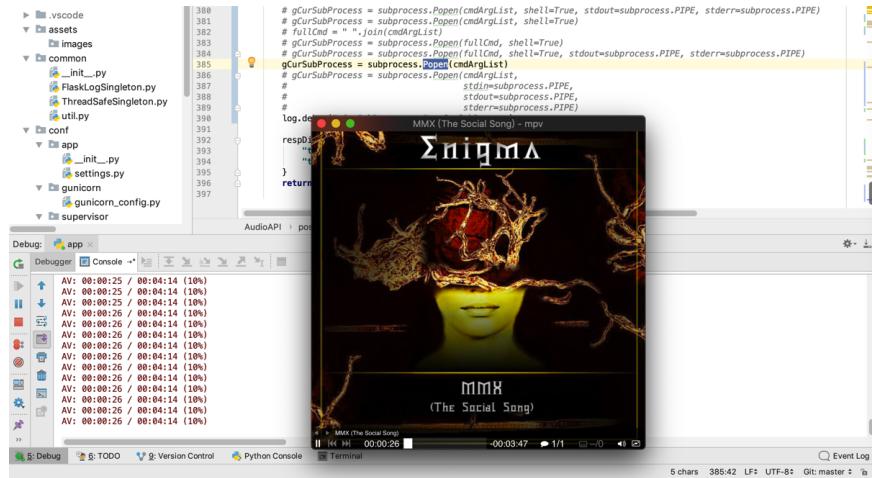
- 正在播放：返回isTerminated为 null
- 被终止后，返回isTerminated为 4



播放的效果：

mac系统中播放音频

PyCharm的console中输出当前播放的信息 -》 如果是mac的terminal中，则是覆盖式的，不会这么多行同时弹框GUI窗口



mp3

解析mp3等音频文件得到时长信息

用库：

- audioread
 - GitHub
 - beetbox/audioread: cross-library (GStreamer + Core Audio + MAD + FFmpeg) audio decoding for Python

```
import audioread

try:
    audioFullPath = "/your/input/audio/file.mp3"

    with audioread.audio_open(audioFullPath) as audioFp:
        audioInfo["duration"] = audioFp.duration
        audioInfo["channels"] = audioFp.channels
        audioInfo["sampleRate"] = audioFp.samplerate

except OSError as osErr:
    logging.error("OSError when open %s error %s", audioFullPath)
except EOFError as eofErr:
    logging.error("EOFError when open %s error %s", audioFullPath)
except audioread.DecodeError as decodeErr:
    logging.error("Decode audio %s error %s", audioFullPath)
```

后经整理成函数：

文件

```
import audioread

def detectAudioMetaInfo(audioFullPath):
    """
        detect audio meta info: duration, channels, sampleRate
    """
    isOk = False
    errMsg = ""
    audioMetaInfo = {
        "duration": 0,
        "channels": 0,
        "sampleRate": 0,
    }

    try:
        with audioread.audio_open(audioFullPath) as audioFp:
            audioMetaInfo["duration"] = audioFp.duration
            audioMetaInfo["channels"] = audioFp.channels
            audioMetaInfo["sampleRate"] = audioFp.samplerate

            isOk = True
    except OSError as osErr:
        errMsg = "detect audio info error: %s" % str(osErr)
    except EOFError as eofErr:
        errMsg = "detect audio info error: %s" % str(eofErr)
    except audioread.DecodeError as decodeErr:
        errMsg = "detect audio info error: %s" % str(decodeErr)

    if isOk:
        return isOk, audioMetaInfo
    else:
        return isOk, errMsg
```

调用:

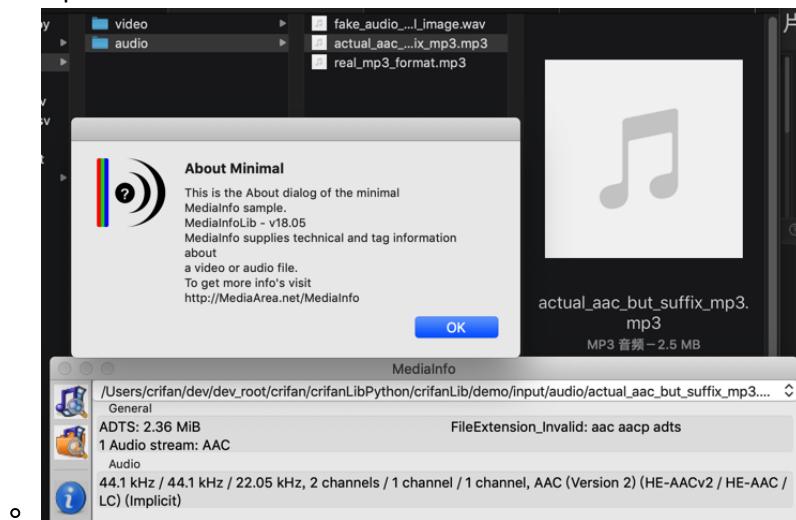
```
def demoDetectAudioMeta():
    curPath = os.path.dirname(__file__)
    inputAudioList = [
        "input/audio/actual_aac_but_suffix_mp3.mp3",
        "input/audio/real_mp3_format.mp3",
        "not_exist_audio.wav",
        "input/audio/fake_audio_actual_image.wav",
    ]

    for eachAudioPath in inputAudioList:
        eachAudioFullPath = os.path.join(curPath, eachAudioPath)
       isOk, errOrInfo = detectAudioMetaInfo(eachAudioFullPath)
        print("isOk=%s, errOrInfo=%s" % (isOk, errOrInfo))

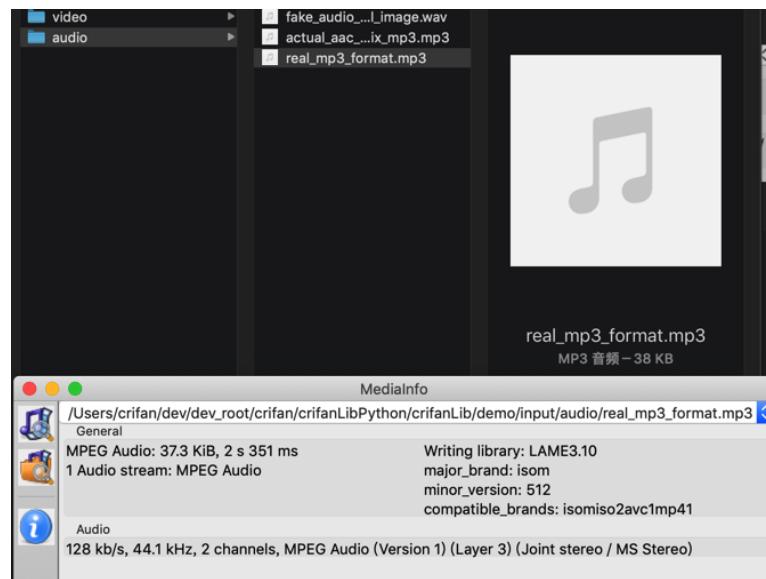
if __name__ == "__main__":
    demoDetectAudioMeta()
```

对应的音频文件，用MediaInfo检测出的信息：

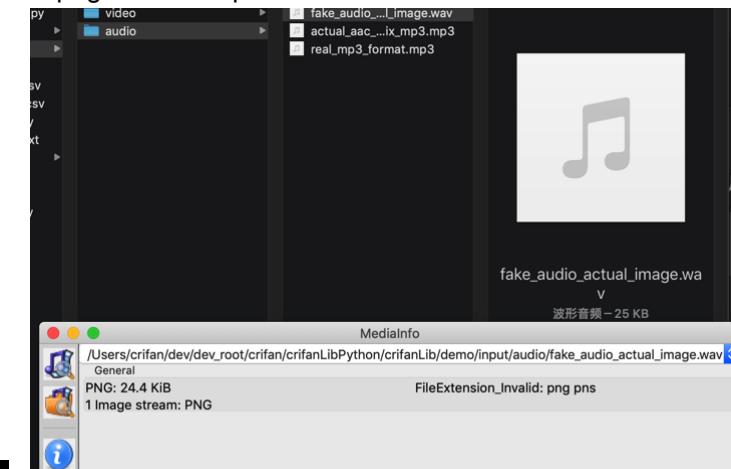
- 正常mp3



文件



- 异常mp3：
 - 故意把png图片改成mp3



输出：

```
# isOk=True, errOrInfo={'duration': 637.8, 'channels': 2,
# isOk=True, errOrInfo={'duration': 2.3510204081632655, 'ch
# isOk=False, errOrInfo=detect audio info error: [Errno 2]
# isOk=False, errOrInfo=detect audio info error:
```

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视频

从视频中提取出音频mp3文件

```

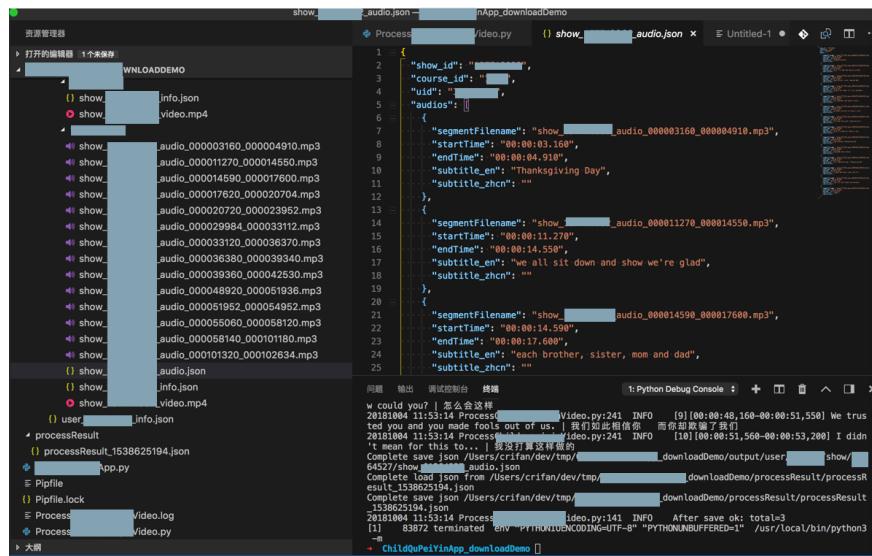
import os
import logging
import subprocess

videoFullPath = "show_157712932_video.mp4"
startTimeStr = "00:00:11.270"
# startTimeStr = "%02d:%02d:%02d.%03d" % (startTime.hours,
endTimeStr = "00:00:14.550"
# endTimeStr = "%02d:%02d:%02d.%03d" % (endTime.hours, end
outputAudioFullPath = "show_157712932_audio_000011270_000011270.mp3"

# extract audio segment from video
# ffmpeg -i show_157712932_video.mp4 -ss 00:00:11.270 -to 00:00:14.550 -c:a mp3 -b:a 128k -f mp3 > show_157712932_audio_000011270_000011270.mp3
if not os.path.exists(outputAudioFullPath):
    ffmpegCmd = "ffmpeg -i %s -ss %s -to %s -b:a 128k %s" % (videoFullPath, startTimeStr, endTimeStr, outputAudioFullPath)
    subprocess.call(ffmpegCmd, shell=True)
    logging.info("Complete use ffmpeg extract audio: %s", outputAudioFullPath)

```

可以从mp4中提取出mp3音频：



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网络相关

此处整理和网络相关的一些常用代码段。

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BeautifulSoup

用网络库下载到页面源码后，就是去解析（HTML等）内容了。

Python中最常用的HTML（和XML）解析库之一就是： BeautifulSoup

从xml转换出soup

背景：

iOS自动化期间，常会涉及到，获取到当前页面源码，是xml字符串，需要转换为soup，才能后续操作

所以整理出通用转换逻辑

```
def xmlToSoup(xmlStr):
    """convert to xml string to soup
       Note: xml is tag case sensitive -> retain tag upper

    Args:
        xmlStr (str): xml str, normally page source
    Returns:
        soup
    Raises:
        ...
    # HtmlParser = 'html.parser'
    # XmlParser = 'xml'
    XmlParser = 'lxml-xml'
    curParser = XmlParser

    soup = BeautifulSoup(xmlStr, curParser)
    return soup
```

举例：

(1)

```
curPageXml = self.get_page_source()
soup = CommonUtils.xmlToSoup(curPageXml)
```

获取到xml字符串后，去转换为soup

是否包含符合特定条件的soup节点

```
def isContainSpecificSoup(soupList, elementName, isSizeValidCallback, matchNum):
    """判断BeautifulSoup的soup的list中，是否包含符合条件的soup
    只匹配指定个数的元素才视为找到了
    元素名相同
    面积大小是否符合条件

    Args:
        soupList (list): list of BeautifulSoup objects
        elementName (str): element name
        isSizeValidCallback (function): callback function to check if size is valid
        matchNum (int): number of soups that should only matched specific number

    Returns:
        bool
    Raises:
        None

    isFound = False

    matchedSoupList = []

    for eachSoup in soupList:
        # if hasattr(eachSoup, "tag"):
        if hasattr(eachSoup, "name"):
            # curSoupTag = eachSoup.tag
            curSoupTag = eachSoup.name
            if curSoupTag == elementName:
                if hasattr(eachSoup, "attrs"):
                    soupAttr = eachSoup.attrs
                    soupWidth = int(soupAttr["width"])
                    soupHeight = int(soupAttr["height"])
                    curSoupSize = soupWidth * soupHeight
                    isSizeValid = isSizeValidCallback(curSoupSize)
                    if isSizeValid:
                        matchedSoupList.append(eachSoup)

    matchedSoupNum = len(matchedSoupList)
    if matchNum == 0:
        isFound = True
    else:
        if matchedSoupNum == matchNum:
            isFound = True

    return isFound
```

说明：

判断soup内，是否有符合特定条件的soup

举例：

(1) iOS的弹框，有上角带关闭按钮时，去判断一个弹框，是否符合对应条件，以便于判断是否可能是弹框

```
nextSiblingeSoupGenerator = possibleCloseSoup.next_sibling:  
nextSiblingeSoupList = list(nextSiblingeSoupGenerator)  
  
hasLargeImage = CommonUtils.isContainSpecificSoup(nextSibl:  
isPossibleClose = hasLargeImage
```

相关函数

```
def isPopupWindowSize(self, curSize):  
    """判断一个soup的宽高大小是否是弹框类窗口(Image, Other等) 的大/  
    # global FullScreenSize  
    FullScreenSize = self.X * self.totalY  
    curSizeRatio = curSize / FullScreenSize # 0.289  
    PopupWindowSizeMinRatio = 0.25  
    # PopupWindowSizeMaxRatio = 0.9  
    PopupWindowSizeMaxRatio = 0.8  
    # isSizeValid = curSizeRatio >= MinPopupWindowSizeRatio  
    # is popup like window, size should large enough, but :  
    isSizeValid = PopupWindowSizeMinRatio <= curSizeRatio <  
    return isSizeValid
```

(2)

```
hasNormalButton = CommonUtils.isContainSpecificSoup(nextSibl:
```

相关函数：

```
def isNormalButtonSize(self, curSize):  
    """判断一个soup的宽高大小是否是普通的按钮大小"""  
    NormalButtonSizeMin = 30*30  
    NormalButtonSizeMax = 100*100  
    isNormalSize = NormalButtonSizeMin <= curSize <= NormalBu  
    return isNormalSize
```

查找元素，限定条件是符合对应的几级的父元素的条件

背景：

很多时候，需要对于iOS的app的页面的源码，即xml中，查找符合特定情况的的元素

文件

这些特定情况，往往是parent或者前几层级的parent中，元素符合一定条件，往往是type，以及宽度是屏幕宽度，高度是屏幕高度等等

所以提取出公共函数，用于bs的find查找元素

```
def bsChainFind(curLevelSoup, queryChainList):
    """BeautifulSoup find with query chain

    Args:
        curLevelSoup (soup): BeautifulSoup
        queryChainList (list): str list of all level q
    Returns:
        soup
    Raises:
    Examples:
        input:
            [
                {
                    "tag": "XCUIElementTypeWindow",
                    "attrs": {"visible": "true", "enable"
                },
                {
                    "tag": "XCUIElementTypeButton",
                    "attrs": {"visible": "true", "enable"
                },
                {
                    "tag": "XCUIElementTypeStaticText",
                    "attrs": {"visible": "true", "enable"
                },
            ]
        output:
            soup node of
                <XCUIElementTypeStaticText type="XCUIE
            in :
                <XCUIElementTypeWindow type="XCUIEleme
                    <XCUIElementTypeOther type="XCUIEl
                        <XCUIElementTypeOther type="XC
                            <XCUIElementTypeOther type=
                                <XCUIElementTypeButton
                                    <XCUIElementTypeSt
                                    <XCUIElementTypeSt
                                    <XCUIElementTypeSt
                                    <XCUIElementTypeSt
                                </XCUIElementTypeButton
                            </XCUIElementTypeOther>
                        </XCUIElementTypeOther>
                    </XCUIElementTypeOther>
                </XCUIElementTypeWindow>
            ....
    foundSoup = None
    if queryChainList:
        chainListLen = len(queryChainList)

        if chainListLen == 1:
            # last one
```

```
curLevelFindDict = queryChainList[0]
curTag = curLevelFindDict["tag"]
curAttrs = curLevelFindDict["attrs"]
foundSoup = curLevelSoup.find(curTag, attrs=curAttrs)
else:
    highestLevelFindDict = queryChainList[0]
    curTag = highestLevelFindDict["tag"]
    curAttrs = highestLevelFindDict["attrs"]
    foundSoupList = curLevelSoup.find_all(curTag, attrs=curAttrs)
    if foundSoupList:
        childrenChainList = queryChainList[1:]
        for eachSoup in foundSoupList:
            eachSoupResult = CommonUtils.bsChainedParse(eachSoup)
            if eachSoupResult:
                foundSoup = eachSoupResult
                break

return foundSoup
```

举例：

(1)

```
.....
    微信-小程序 弹框 警告 尚未进行授权:
    <XCUIElementTypeButton type="XCUIElementTypeButton"
        <XCUIElementTypeOther type="XCUIElementTypeOther"
            <XCUIElementTypeImage type="XCUIElementTypeImage"/>
            <XCUIElementTypeStaticText type="XCUIElementTypeStaticText"/>
            <XCUIElementTypeTextView type="XCUIElementTypeTextView"/>
            <XCUIElementTypeButton type="XCUIElementTypeButton"/>
            <XCUIElementTypeButton type="XCUIElementTypeButton"/>
        </XCUIElementTypeOther>
    </XCUIElementTypeButton>
.....
warningChainList = [
{
    "tag": "XCUIElementTypeButton",
    "attrs": {"visible": "true", "enabled": "true", "width": 100, "height": 40}
},
{
    "tag": "XCUIElementTypeOther",
    "attrs": {"visible": "true", "enabled": "true"}
},
{
    "tag": "XCUIElementTypeStaticText",
    "attrs": {"visible": "true", "enabled": "true", "value": "尚未进行授权，无法使用该功能。"}
},
]
warningSoup = CommonUtils.bsChainFind(soup, warningChainList)
```

相关:

找到元素后，再去点击：

```
if warningSoup:
    parentOtherSoup = warningSoup.parent
    confirmSoup = parentOtherSoup.find(
        "XCUIElementTypeButton",
        attrs={"visible": "true", "enabled": "true", "name": "确认"})
    if confirmSoup:
        self.clickElementCenterPosition(confirmSoup)
        foundAndProcessedPopup = True
```

(2)

```
.....
    系统弹框 拍照或录像:
    <XCUIElementTypeOther type="XCUIElementTypeOther" >
        <XCUIElementTypeOther type="XCUIElementTypeOther" >
            <XCUIElementTypeOther type="XCUIElementTypeOther" >
                <XCUIElementTypeOther type="XCUIElementTypeOther" >
                    <XCUIElementTypeOther type="XCUIElementTypeOther" >
                        <XCUIElementTypeOther type="XCUIElementTypeOther" >
                            <XCUIElementTypeOther type="XCUIElementTypeOther" >
                                <XCUIElementTypeOther type="XCUIElementTypeOther" >
                                    <XCUIElementTypeOther type="XCUIElementTypeOther" >
                                        <XCUIElementTypeOther type="XCUIElementTypeOther" >
                                            <XCUIElementTypeOther type="XCUIElementTypeOther" >
                                                <XCUIElementTypeOther type="XCUIElementTypeOther" >
                                                    <XCUIElementTypeOther type="XCUIElementTypeOther" >
                                                        <XCUIElementTypeOther type="XCUIElementTypeOther" >
                                                            <XCUIElementTypeOther type="XCUIElementTypeOther" >
                                                                <XCUIElementTypeOther type="XCUIElementTypeOther" >
                                                                    <XCUIElementTypeOther type="XCUIElementTypeOther" >
                                                                        <XCUIElementTypeOther type="XCUIElementTypeOther" >
                                                                            <XCUIElementTypeOther type="XCUIElementTypeOther" >
                                                                                <XCUIElementTypeOther type="XCUIElementTypeOther" >
                                                                                    <XCUIElementTypeOther type="XCUIElementTypeOther" >
                                                                                        <XCUIElementTypeOther type="XCUIElementTypeOther" >
                                                                                            <XCUIElementTypeOther type="XCUIElementTypeOther" >
                                                                                                <XCUIElementTypeOther type="XCUIElementTypeOther" >
                                                                                                 .....
    photoCameraChainList = [
        {
            "tag": "XCUIElementTypeOther",
            "attrs": {"enabled":"true", "visible":"true"}
        },
    ]
```

```
{  
    "tag": "XCUIElementTypeTable",  
    "attrs": {"enabled":"true", "visible":"true", "x":  
},  
{  
    "tag": "XCUIElementTypeStaticText",  
    "attrs": {"enabled":"true", "visible":"true", "val  
},  
]  
photoCameraSoup = CommonUtils.bsChainFind(soup, photoCamera
```

(3) iOS 设置 无线局域网 列表页 找 当前已连接的WiFi, 特征是带蓝色
 的:

```
....  
    设置 无线局域网 列表页:  
    <XCUIElementTypeTable type="XCUIElementTypeTable" >  
        . . .  
        <XCUIElementTypeCell type="XCUIElementTypeCell"  
            <XCUIElementTypeStaticText type="XCUIElementTypeText" value="WLAN" />  
            <XCUIElementTypeOther type="XCUIElementTypeImage" />  
            <XCUIElementTypeOther type="XCUIElementTypeImage" />  
            <XCUIElementTypeImage type="XCUIElementTypeImage" />  
        </XCUIElementTypeCell>  
    <XCUIElementTypeTable type="XCUIElementTypeTable" >  
        . . .  
        <XCUIElementTypeCell type="XCUIElementTypeCell"  
            <XCUIElementTypeStaticText type="XCUIElementTypeText" value="WLAN" />  
            <XCUIElementTypeImage type="XCUIElementTypeImage" />  
            <XCUIElementTypeImage type="XCUIElementTypeImage" />  
            <XCUIElementTypeImage type="XCUIElementTypeImage" />  
            <XCUIElementTypeButton type="XCUIElementTypeImage" />  
        </XCUIElementTypeCell>  
    ....  
  
curPageXml = self.get_page_source()  
soup = CommonUtils.xmlToSoup(curPageXml)  
blueCheckChainList = [  
    {  
        "tag": "XCUIElementTypeCell",  
        "attrs": {"enabled": "true", "visible": "true", "x": "100", "y": "100"}  
    },  
    {  
        "tag": "XCUIElementTypeOther",  
        "attrs": {"enabled": "true", "visible": "true"}  
    },  
    {  
        "tag": "XCUIElementTypeImage",  
        "# attrs": {"enabled": "true", "visible": "true", "name": "UIPreferenceIcon"},  
        "attrs": {"enabled": "true", "name": "UIPreferenceIcon"}  
    },  
]  
blueCheckSoup = CommonUtils.bsChainFind(soup, blueCheckChainList)  
if blueCheckSoup:
```

requests

下载图片，保存为二进制文件

```
import requests
resp = requests.get(pictureUrl)
with open(saveFullPath, 'wb') as saveFp:
    saveFp.write(resp.content)
```

详见：

[【已解决】Python的requests中如何下载二进制数据保存为图片文件](#)

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数学

详见：

<https://github.com/crifan/crifanLibPython/blob/master/crifanLib/crifanMath.py>

md5

md5计算

- md5
 - Python 3 中已改名 hashlib
 - 且update参数只允许 bytes
 - 不允许 str

的md5代码：

```
from hashlib import md5 # only for python 3.x

def generateMd5(strToMd5) :
    """
    generate md5 string from input string
    eg:
        xxxxxxxx -> af0230c7fcc75b34cbb268b9bf64da79
    :param strToMd5: input string
    :return: md5 string of 32 chars
    """

    encryptedMd5 = ""
    md5Instance = md5()
    # print("type(md5Instance)=%s" % type(md5Instance)) # 1
    # print("type(strToMd5)=%s" % type(strToMd5)) # type(str)
    bytesToMd5 = bytes(strToMd5, "UTF-8")
    # print("type(bytesToMd5)=%s" % type(bytesToMd5)) # type(bytes)
    md5Instance.update(bytesToMd5)
    encryptedMd5 = md5Instance.hexdigest()
    # print("type(encryptedMd5)=%s" % type(encryptedMd5)) # 1
    # print("encryptedMd5=%s" % encryptedMd5) # encryptedMd5=af0230c7...
    return encryptedMd5
```

之前旧版本的 Python 2 (<= 2.7) 版本：

- md5还是个独立模块
 - 还没有并入 hashlib

- 注：
 - 好像 python 2.7 中已将md5并入 hashlib
 - 但是 update 参数还允许 str (而不是 bytes)
- update参数允许str

的md5代码：

```
try:  
    import md5  
except ImportError:  
    from hashlib import md5  
  
def generateMd5(strToMd5) :  
    encryptedMd5 = ""  
    md5Instance = md5.new()  
    #md5Instance=<md5 HASH object @ 0x1062af738>  
    md5Instance.update(strToMd5)  
    encryptedMd5 = md5Instance.hexdigest()  
    #encryptedMd5=af0230c7fcc75b34ccb268b9bf64da79  
    return encryptedMd5
```

常见语法

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函数参数

可变参数

之前一个用到了可变参数的函数是：

```
def multipleRetry(self, functionInfoDict, maxRetryNum=5, sleepInterval=0.5):
    """
    do something, retry mutiple time if fail
    """

    Args:
        functionInfoDict (dict): function info dict contains
        maxRetryNum (int): max retry number
        sleepInterval (float): sleep time of each interval

    Returns:
        bool
    Raises:
        .....

    doSuccess = False
    functionCallback = functionInfoDict["functionCallback"]
    functionParaDict = functionInfoDict.get("functionParaDict", {})

    curRetryNum = maxRetryNum
    while curRetryNum > 0:
        if functionParaDict:
            doSuccess = functionCallback(**functionParaDict)
        else:
            doSuccess = functionCallback()

        if doSuccess:
            break

        time.sleep(sleepInterval)
        curRetryNum -= 1

    if not doSuccess:
        functionName = str(functionCallback)
        # '<bound method DevicesMethods.switchToAppStoreSession of <DevicesMethods object at 0x10c2d10>'

        logging.error("Still fail after %d retry for %s", curRetryNum, functionName)
        return doSuccess
```

其中的：

```
functionCallback(**functionParaDict)
```

中的：

```
**functionParaDict
```

表示，dict类型的参数，内部包含多个key和value，用**去展开后，传入真正要执行的函数

几种调用中带参数的例子是：

```
searchInputQuery = {"type": "XCUIElementTypeSearchField", "isInputOk": self.multipleRetry(  
    {  
        "functionCallback": self.wait_element_setText,  
        "functionParaDict": {  
            "locator": searchInputQuery,  
            "text": appName,  
        }  
    }  
)}
```

之前原始写法：

```
searchInputQuery = {"type": "XCUIElementTypeSearchField", "isInputOk": self.wait_element_setText(searchInputQuery, app)}
```

其中wait_element_setText的定义是：

```
def wait_element_setText(self, locator, text):
```

对应着之前传入时的：

```
"functionParaDict": {  
    "locator": searchInputQuery,  
    "text": appName,  
}
```

即可，给出上述细节，便于理解，传入的参数是如何用 ** 展开的。

详见：

[【已解决】Python中如何实现函数调用时多个可变数量的参数传递](#)

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dict字典

删除dict中某个键（和值）

- 常见写法：

```
del yourDict["keyToDelete"]
```

- 更加Pythonic的写法：

```
yourDict.pop("keyToDelete")
```

注意：

为了防止出现 `KeyError`，注意确保要删除的key都是存在的，否则就要先判断存在，再去删除。

OrderedDict

想要获取OrderedDict的最后一个item（的key和value）

```
next(reversed(someOrderedDict.items()))
```

另外，只需要获取最后一个元素的key，则可以：

```
next(reversed(someOrderedDict.keys()))
```

或：

```
next(reversed(someOrderedDict))
```

详见：

【已解决】Python中获取OrderedDict中最后一个元素

合并2个dict的值

(1) 如果无需保留原有（第一个dict）的值，则用`update`即可：

```
firstDict.update(secondDict)
```

支持: Python >=3.5

(2) 如果要保留之前的dict的值, 则用**展开

```
thirdDict = (**firstDict, **secondDict)
```

支持: Python 2 和 Python <=3.4

详见:

【已解决】Python中如何合并2个dict字典变量的值

有序字典OrderedDict的初始化

```
from collections import OrderedDict

orderedDict = OrderedDict()
```

后续正常作为普通dict使用

```
>>> from collections import OrderedDict
>>> orderedDict = OrderedDict()
>>> orderedDict["key2"] = "value2"
>>> orderedDict["key1"] = "value1"
>>> orderedDict["key3"] = "value3"

>>> orderedDict
OrderedDict([('key2', 'value2'), ('key1', 'value1'), ('key3', 'value3')])
```

dict的递归的合并更新

```
def recursiveMergeDict(aDict, bDict):
    """
    Recursively merge dict a to b, return merged dict b
    Note: Sub dict and sub list's won't be overwritten but
          added.

    example:
    (1) input and output example:
    input:
    {
        "keyStr": "strValueA",
        "keyInt": 1,
        "keyBool": true,
        "keyList": [
            {
                "index0Item1": "index0Item1",
                "index0Item2": "index0Item2"
            },
            {
                "index1Item1": "index1Item1"
            },
            {
                "index2Item1": "index2Item1"
            }
        ]
    }

    and

    {
        "keyStr": "strValueB",
        "keyInt": 2,
        "keyList": [
            {
                "index0Item1": "index0Item1_b"
            },
            {
                "index1Item1": "index1Item1_b"
            }
        ]
    }

    output:

    {
        "keyStr": "strValueB",
        "keyBool": true,
        "keyInt": 2,
        "keyList": [
            {

```

```

        "index0Item1": "index0Item1_b",
        "index0Item2": "index0Item2"
    },
    {
        "index1Item1": "index1Item1_b"
    },
    {
        "index2Item1": "index2Item1"
    }
]
}

(2) code usage example:
import copy
cDict = recursiveMergeDict(aDict, copy.deepcopy(bDict))

Note:
bDict should use deepcopy, otherwise will be altered after

.....
aDictItems = None
if (sys.version_info[0] == 2): # is python 2
    aDictItems = aDict.iteritems()
else: # is python 3
    aDictItems = aDict.items()

for aKey, aValue in aDictItems:
    # print("----- [%s]=%s" % (aKey, aValue))
    if aKey not in bDict:
        bDict[aKey] = aValue
    else:
        bValue = bDict[aKey]
        # print("aValue=%s" % aValue)
        # print("bValue=%s" % bValue)
        if isinstance(aValue, dict):
            recursiveMergeDict(aValue, bValue)
        elif isinstance(aValue, list):
            aValueListLen = len(aValue)
            bValueListLen = len(bValue)
            bValueListMaxIdx = bValueListLen - 1
            for aListIdx in range(aValueListLen):
                # print("---[%d]" % aListIdx)
                aListItem = aValue[aListIdx]
                # print("aListItem=%s" % aListItem)
                if aListIdx <= bValueListMaxIdx:
                    bListItem = bValue[aListIdx]
                    # print("bListItem=%s" % bListItem)
                    recursiveMergeDict(aListItem, bListItem)
                else:
                    # print("bDict=%s" % bDict)
                    # print("aKey=%s" % aKey)

```

文件

```
# print("aListItem=%s" % aListItem)
bDict[aKey].append(aListItem)
```

```
return bDict
```

调用举例：

```
templateJson = {
    "author": "Crifan Li <admin@crifan.com>",
    "description": "gitbook书的描述",
    "gitbook": "3.2.3",
    "language": "zh-hans",
    "links": { "sidebar": { "主页": "http://www.crifan.com" } },
    "plugins": [
        "theme-comscore",
        "anchors",
        "-lunr",
        "-search",
        "search-plus",
        "disqus",
        "-highlight",
        "prism",
        "prism-themes",
        "github-buttons",
        "splitter",
        "-sharing",
        "sharing-plus",
        "tbfed-pagefooter",
        "expandable-chapters-small",
        "ga",
        "donate",
        "sitemap-general",
        "copy-code-button",
        "callouts",
        "toolbar-button"
    ],
    "pluginsConfig": {
        "callouts": { "showTypeInHeader": false },
        "disqus": { "shortName": "crifan" },
        "donate": {
            "alipay": "https://www.crifan.com/files/res/crifan_cc_alipay.html",
            "alipayText": "支付宝打赏给Crifan",
            "button": "打赏",
            "title": "",
            "wechat": "https://www.crifan.com/files/res/crifan_cc_wechat.html",
            "wechatText": "微信打赏给Crifan"
        },
        "ga": { "token": "UA-28297199-1" },
        "github-buttons": {
            "buttons": [
                {
                    "count": true,
                    "repo": "gitbook_name",
                    "size": "small",
                    "type": "star",
                    "user": "crifan"
                }
            ]
        }
    }
}
```

```
},
{
  "count": false,
  "size": "small",
  "type": "follow",
  "user": "crifan",
  "width": "120"
}
]
},
"prism": { "css": ["prism-themes/themes/prism-atom-dark.css"] },
"sharing": {
  "all": [
    "douban",
    "facebook",
    "google",
    "instapaper",
    "line",
    "linkedin",
    "messenger",
    "pocket",
    "qq",
    "qzone",
    "stumbleupon",
    "twitter",
    "viber",
    "vk",
    "weibo",
    "whatsapp"
  ],
  "douban": false,
  "facebook": true,
  "google": false,
  "hatenaBookmark": false,
  "instapaper": false,
  "line": false,
  "linkedin": false,
  "messenger": false,
  "pocket": false,
  "qq": true,
  "qzone": false,
  "stumbleupon": false,
  "twitter": true,
  "viber": false,
  "vk": false,
  "weibo": true,
  "whatsapp": false
},
"sitemap-general": {
  "prefix": "https://book.crifan.com/gitbook/gitbook_ng.html"
},
```

```
"tbfed-pagefooter": {
    "copyright": "crifan.com, 使用CC BY 4.0协议发布 all right reserved,
    "modify_format": "YYYY-MM-DD HH:mm:ss",
    "modify_label": "最后更新: "
},
"theme-default": { "showLevel": true },
"toolbar-button": {
    "icon": "fa-file-pdf-o",
    "label": "下载PDF",
    "url": "http://book.crifan.com/books/gitbook_name/pdf"
}
},
"root": "./src",
"title": "Gitbook的书名"
}

currentJson = {
    "description": "crifan整理的Python各个方面常用的代码段，供需要的读者参考和学习",
    "pluginsConfig": {
        "github-buttons": { "buttons": [{ "repo": "python_common_code" }]},
        "sitemap-general": {
            "prefix": "https://book.crifan.com/gitbook/python_common_code"
        },
        "toolbar-button": {
            "url": "http://book.crifan.com/books/python_common_code/index.html"
        }
    },
    "title": "Python常用代码段"
}

bookJson = recursiveMergeDict(templateJson, copy.deepcopy(currentJson))
```

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list列表和set集合

list vs set

- set
 - 适用于检测某元素是否在集合内、对集合进行一定的数学操作
 - 不支持indexing, slicing
- list
 - 普通的数组
 - 支持indexing, slicing

把list换成set

```
someSet = set([])
for eachItem in someList:
    someSet.add(eachItem)
```

set集合转换为字符串

```
someSetStr = ", ".join(someSet)
```

把列表转为python正则中的group中可能出现的选项

```
def listToPatternGroup(curList):
    """Convert list to pattern group"""
    patternGroupList = list(map(lambda curType: "(%s)" % curType,
                                curList))
    groupP = "|".join(patternGroupList) # '(loan)|(card)|'
    return groupP
```

调用：

```
ValidPlatformTypeList = ["iOS", "Android"]
ValidPlatformRule = listToPatternGroup(ValidPlatformTypeList)
```

目的是用于后续的正则判断

```
TaskFilenamePattern = "(?P<taskDate>\d+)_(?P<businessType>%s)
```

文件

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sort排序

详见：

- <https://github.com/crifan/crifanLibPython/blob/master/crifanLib/crifanDict.py>
- <https://github.com/crifan/crifanLibPython/blob/master/crifanLib/demo/crifanDictDemo.py>

对字典根据key去排序

```
from collections import OrderedDict

def sortDictByKey(originDict):
    """
        Sort dict by key
    """
    originItems = originDict.items()
    sortedOriginItems = sorted(originItems)
    sortedOrderedDict = OrderedDict(sortedOriginItems)
    return sortedOrderedDict
```

调用：

```
def demoSortDictByKey():
    originDict = {
        "c": "abc",
        "a": 1,
        "b": 22
    }
    print("originDict=%s" % originDict)
    # originDict={'c': 'abc', 'a': 1, 'b': 22}
    sortedOrderedDict = sortDictByKey(originDict)
    print("sortedOrderedDict=%s" % sortedOrderedDict)
    # sortedOrderedDict=OrderedDict([('a', 1), ('b', 22), ('c', 'abc')])
```

sort和sorted

```

# Function: Demo sorted
#   mainly refer official doc:
#       排序指南 - Python 3.8.2 文档
#       https://docs.python.org/zh-cn/3/howto/sorting.html
# Author: Crifan Li
# Update: 20200304

from operator import itemgetter, attrgetter

print("%s %s %s" % ('='*40, "sort", '='*40))

originIntList = [5, 2, 3, 1, 4]
originIntList.sort()
sortedSelfIntList = originIntList
print("sortedSelfIntList=%s" % sortedSelfIntList)
# sortedSelfIntList=[1, 2, 3, 4, 5]

print("%s %s %s" % ('='*40, "sorted", '='*40))

intList = [5, 2, 3, 1, 4]
sortedIntList = sorted(intList)
print("sortedIntList=%s" % sortedIntList)
# sortedIntList=[1, 2, 3, 4, 5]

reversedSortIntList = sorted(intList, reverse=True)
print("reversedSortIntList=%s" % reversedSortIntList)
# reversedSortIntList=[5, 4, 3, 2, 1]

intStrDict = {5: 'A', 1: 'D', 2: 'B', 4: 'E', 3: 'B'}
dictSortedIntList = sorted(intStrDict)
print("dictSortedIntList=%s" % dictSortedIntList)
# dictSortedIntList=[1, 2, 3, 4, 5]

normalStr = "Crifan Li best love language is Python"
strList = normalStr.split()
print("strList=%s" % strList)
sortedStrList = sorted(strList, key=str.lower)
print("sortedStrList=%s" % sortedStrList)
# strList=['Crifan', 'Li', 'best', 'love', 'language', 'is'
# sortedStrList=['best', 'Crifan', 'is', 'language', 'Li',

```

```

studentTupleList = [
    # name, grade, age
    ('Cindy', 'A', 15),
    ('Crifan', 'B', 12),
    ('Tony', 'B', 10),
]
sortedTupleList_lambda = sorted(studentTupleList, key=lambda student: student[2])
print("sortedTupleList_lambda=%s" % sortedTupleList_lambda)
# sortedTupleList_lambda=[('Tony', 'B', 10), ('Crifan', 'B', 12), ('Cindy', 'A', 15)]

# same as single function:
def getStudentAge(curStudentTuple):
    return curStudentTuple[2] # [2] is age
sortedTupleList_singleFunction = sorted(studentTupleList, key=getStudentAge)
print("sortedTupleList_singleFunction=%s" % sortedTupleList_singleFunction)
# sortedTupleList_singleFunction=[('Tony', 'B', 10), ('Crifan', 'B', 12), ('Cindy', 'A', 15)]

# same as operator itemgetter:
sortedTupleList_operator = sorted(studentTupleList, key=itemgetter(2))
print("sortedTupleList_operator=%s" % sortedTupleList_operator)
# sortedTupleList_operator=[('Tony', 'B', 10), ('Crifan', 'B', 12), ('Cindy', 'A', 15)]


class Student:
    def __init__(self, name, grade, age):
        self.name = name
        self.grade = grade
        self.age = age
    def __repr__(self):
        return repr((self.name, self.grade, self.age))

studentObjectList = [
    Student('john', 'A', 15),
    Student('jane', 'A', 15),
    Student('dave', 'A', 15),
]
sortedObjectList = sorted(studentObjectList, key=lambda student: student.age)
print("sortedObjectList=%s" % sortedObjectList)
# sortedObjectList=[('john', 'A', 15), ('jane', 'A', 15), ('dave', 'A', 15)]


# same as operator attrgetter:
sortedObjectList_operator = sorted(sortedObjectList, key=attrgetter('age'))
print("sortedObjectList_operator=%s" % sortedObjectList_operator)
# sortedObjectList_operator=[('john', 'A', 15), ('jane', 'A', 15), ('dave', 'A', 15)]

```

文件

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enum枚举

枚举基本用法

枚举定义

举例1：

```
from enum import Enum

class BatteryState(Enum):
    Unknown = 0
    Unplugged = 1
    Charging = 2
    Full = 3
```

举例2：

```
import enum

class ScreenshotQuality(enum.Enum):
    Original = 0
    Medium = 1
    Low = 2
```

举例3：

```
class SentenceInvalidReason(Enum):
    NONE = "none"
    UNKNOWN = "unknown"
    EMPTY = "empty"
    TOO_SHORT = "too short"
    TOO_LONG = "too long"
    TOO_MANY_INVALID_WORD = "contain too many invalid words"
```

初始化创建枚举值

直接传入对应的（此处是int）值即可：

```
batteryStateInt = 2
curBatttryStateEnum = BatteryState(batteryStateInt)
```

log输出是：

```
curBattrystateEnum=BatteryState.Charging
```

获取枚举的名称

```
curBattrystateName = curBattrystateEnum.name
```

输出: 'Charging'

获取枚举的值

```
curBattrystateValue = curBattrystateEnum.value
```

输出: 2

类似, 直接从定义中获取值:

```
gScreenQuality = ScreenshotQuality.Low.value # 2
```

枚举高级用法

给枚举中添加函数

```
class TipType(enum.Enum):
    NoTip = "NoTip"
    TenPercent = "TenPercent"
    FifthPercent = "FifthPercent"
    TwentyPercent = "TwentyPercent"

    # @property
    def getTipPercent(self):
        tipPercent = 0.0
        if self == TipType.NoTip:
            tipPercent = 0.0
        elif self == TipType.TenPercent:
            tipPercent = 0.10
        elif self == TipType.FifthPercent:
            tipPercent = 0.15
        elif self == TipType.TwentyPercent:
            tipPercent = 0.20
        gLog.debug("self=%s -> tipPercent=%s", self, tipPercent)
        return tipPercent
```

调用:

```
tipPercent = initiatorTipType.getTipPercent()  
# tipPercent=0.1
```

注意事项

字符串枚举定义最后不要加逗号

enum 定义期间不要加（多余的）逗号：

```
class ScreenshotQuality(enum.Enum):  
    Original = 0,  
    Medium = 1,  
    Low = 2,
```

否则 value 就是 tuple 元祖了：

```
gScreenQuality = ScreenshotQuality.Low.value # 实际上是 (2,)  
print("gScreenQuality=%s" % gScreenQuality) # gScreenQualit  
print("type(gScreenQuality)=%s" % type(gScreenQuality)) # 1
```

```
38  
39     class ScreenshotQuality(enum.Enum):  
40         ... Original = 0, # XCTImageQualityOriginal Original image quality, represented as a lossless PNG  
41         ... Medium = 1, # * XCTImageQualityMedium Medium image quality, represented as a high-quality lossy  
42         ... Low = 2, # XCTImageQualityLow Low image quality  
43  
44     gScreenQuality = ScreenshotQuality.Low.value # 2  
45     print("gScreenQuality=%s" % gScreenQuality)  
46     print("type(gScreenQuality)=%s" % type(gScreenQuality))
```

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collections集合

根据官网：

[collections --- 容器数据类型 — Python 3.8.1 文档](#)

介绍，集合有很多种，列出供了解：

- `namedtuple()` : 创建命名元组子类的工厂函数
- `deque` : 类似列表(list)的容器，实现了在两端快速添加(append)和弹出(pop)
- `ChainMap` : 类似字典(dict)的容器类，将多个映射集合到一个视图里面
- `Counter` : 字典的子类，提供了可哈希对象的计数功能
- `OrderedDict` : 字典的子类，保存了他们被添加的顺序
- `defaultdict` : 字典的子类，提供了一个工厂函数，为字典查询提供一个默认值
- `UserDict` : 封装了字典对象，简化了字典子类化
- `UserList` : 封装了列表对象，简化了列表子类化
- `UserString` : 封装了字符串对象，简化了字符串子类化

待以后用到了，再详细总结。

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附录

下面列出相关参考资料。

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参考资料

- 【已解决】AppStore自动安装iOS的app：逻辑优化加等待和多试几次
- 【已解决】Python中如何实现函数调用时多个可变数量的参数传递
- 【已解决】Python中如何合并2个dict字典变量的值
- 【已解决】Python中给Mac中文件加上可执行权限
- 【已解决】Python如何从二进制数据中生成Pillow的Image
- 【已解决】Python的Pillow如何从二进制数据中读取图像数据
- 【已解决】Python的requests中如何下载二进制数据保存为图片文件
- 【已解决】Python中用Pillow去缩小分辨率以及保持画质同时最大程度压缩图片
- 【已解决】Python中实现二进制数据的图片的压缩
- 【已解决】Python中如何解析mp3等音频文件得到时长信息
- 【已解决】用Python代码从视频中提取出音频mp3文件
- 【已解决】Python 3中通过二进制生成文件类型对象
- 【已解决】用ffmpeg从mp4视频中提取出整个mp3以及根据时间段去分割mp3
- 【已解决】python中从文件名后缀推断出MIME类型
- 【已解决】Python中从int值生成Enum枚举和获取枚举值的字符串或名字
- 【未解决】python的wda中调整appium的settings参数实现功能优化
- 【已解决】Python中实现类似touch创建一个空文件
- 【已解决】Python中根据key去对字典排序
- 【已解决】Python 3中如何把字符串str转换成字节码bytes
- 【已解决】Python的md5运行出错：发生异常AttributeError
builtin_function_or_method object has no attribute new
- 【已解决】Python 3中md5报错：Unicode-objects must be encoded before hashing
- 【已解决】Python 3中判断变量类型
- 【已解决】Python中删除字典dict中的键值
- 【已解决】Python中获取文件最后更新时间
- 【已解决】Python中获取OrderedDict中最后一个元素
-
- 【已解决】python中判断单个或多个单词是否是全部小写或首字母小写
- 【已解决】Python中如何让Enum的字符串输出字段的值而不带类型的前缀 – 在路上
- 【已解决】Python中给枚举添加内置函数或属性
- 【基本解决】Python中把wma、wav等格式音频转换为mp3 – 在路上
- 【已解决】Python中如何格式化大小为人类易读的效果
- 【已解决】Python中获取带毫秒的时间戳

- 【已解决】Python中实现dict的递归的合并更新
- 【已解决】Python中把list换成set
- 【整理】python中一次性创建多级文件夹，判断一个文件夹是否已经存在 – 在路上
- 【已解决】Python中如何递归的删除整个非空文件夹 – 在路上
-
- python - Correct way to write line to file? - Stack Overflow
- How do you do a simple "chmod +x" from within python? - Stack Overflow
- io.BytesIO.getvalue
- 排序指南 — Python 3.8.2 文档
- Python 常用指引 — Python 3.8.2 文档
- Built-in Functions — Python 3.8.2 documentation
- operator — Standard operators as functions — Python 3.8.2 documentation
- Python 常用指引 — Python 3.8.2 文档
- 3.8.2 Documentation
- 编程常见问题 — Python 3.8.2 文档
- 术语对照表 — Python 3.8.2 文档
- enum — Support for enumerations — Python 3.8.2 documentation
- enum --- 对枚举的支持 — Python 3.9.0a4 文档
- collections --- 容器数据类型 — Python 3.8.1 文档
- md5 not support in python 3.6 and django 1.10 - Stack Overflow
- list - Python: how to join entries in a set into one string? - Stack Overflow
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