# GoT

November 15, 2015

## 1 Introduction to Python

### 1.1 Biostats Computing Workshop

#### 1.1.1 Motivational Example

```
In [5]:  ## SO MANY LIBRARIES
         from bs4 import BeautifulSoup as bs ## Importing an Object!
         import urlparse
         from urllib2 import urlopen ## Importing some functions!
         from urllib import urlretrieve
         import unicodedata
         import os
         import sys
         from __future__ import division ## Oddity with division
```

```
In [9]: URL = "http://www.readbooksvampire.com/George_R.R._Martin/A_Game_of_Thrones.html" ## CAPS = GLO
```

```
In [10]: soup = bs(urlopen(URL)) ### Creating a 'bs' object here
```

```
In [11]: parsed = list(urlparse.urlparse(URL)) ## list is the Python ordered array data structure
```

```
In [12]: i = 0
         # chapters = []
         for link in soup.find_all('a'): ## This is what a 'for loop' looks like in python
             if "George_R.R._Martin/A_Game_of_Thrones/" in link.get('href'): # some if statements!
                 print(link.get('href'))
                 # chapters.append(link.get('href'))
                 i+=1
             if i > 6:
                 break
```

```
/George_R.R._Martin/A_Game_of_Thrones/01.html
/George_R.R._Martin/A_Game_of_Thrones/02.html
/George_R.R._Martin/A_Game_of_Thrones/03.html
/George_R.R._Martin/A_Game_of_Thrones/04.html
/George_R.R._Martin/A_Game_of_Thrones/05.html
/George_R.R._Martin/A_Game_of_Thrones/06.html
/George_R.R._Martin/A_Game_of_Thrones/07.html
```

### 1.2 OOOOOO LIST COMPREHENSION

```
In [13]: chapters = [ link.get('href') for link in soup.find_all('a')
                      if "George_R.R._Martin/A_Game_of_Thrones/" in link.get('href')]
         chapters[:5]
```

```
Out[13]: ['/George_R.R._Martin/A_Game_of_Thrones/01.html',
          '/George_R.R._Martin/A_Game_of_Thrones/02.html',
          '/George_R.R._Martin/A_Game_of_Thrones/03.html',
          '/George_R.R._Martin/A_Game_of_Thrones/04.html',
          '/George_R.R._Martin/A_Game_of_Thrones/05.html']

In [14]: ## lets check this out for chapter 1
         chapter1_url = URL[:-5] + chapters[0][len(chapters[0])-8:] ## look at this fancy string slicin

URL[:-5] ## gets everything but the last five characters in the string
http://www.readbooksvampire.com/George_R.R._Martin/A_Game_of_Thrones     .html

chapters[0][len(chapters[0])-8:] ## lets break this down one piece at a time

chapters[0] ## this is the object holding the text string for the first chapter
>>/George_R.R._Martin/A_Game_of_Thrones/01.html'

## I'm now accessing a string object, but now I only want the last 8 characters!
len(chapters[0]) ## gives me the entire length of the string
len(chapters[0])-8 ## Length of string minus 8
chapters[0][len(chapters[0])-8:]
#Gives me the entire string of the first chapter url, starting 8 characters back
>>/01.html

URL[:-5] + chapters[0][len(chapters[0])-8:] ## I stick the two strings together with the '+' sign!

In [15]: chapter1_url

Out[15]: 'http://www.readbooksvampire.com/George_R.R._Martin/A_Game_of_Thrones/01.html'

In [16]: soup_1 = bs(urlopen(chapter1_url)) ## Creating a Soup Object!

In [80]: # soup_1.get_text()
```

## 1.3 lets get the whole book

**What would this look like in a for loop?**

```
In [15]: chapter_num = 1
         for chapter in chapters: ## notice the arbitrary indexing -- this is a property called __iter_
             chapter_num_url = URL[:-5] + chapters[0][len(chapter)-8:]
             bs(urlopen(chapter_num_url)).get_text()
```

### 1.3.1 Lets be cool and use a list comprehension

```
In [29]: def get_GoT(chapter):
             """
             Returns all the GoT text within the parameter chapter
             P.S. Docstrings are great for making sure other people
             who read your code know what you're doing with your
             custom functions and objects
             """
             chapter_num_url = URL[:-5] + chapter[len(chapter)-8:]
             return bs(urlopen(chapter_num_url)).get_text()

In [30]: GoT = [get_GoT(chapter) for chapter in chapters] ## takes a couple minutes
```

### 1.3.2 Not always wise to do this, servers and their admins will be upset if you make a lot of requests in a short amount of time

```
In [31]: len(GoT),len(chapters)
```

```
Out[31]: (72, 72)
```

```
In [32]: GoT[0][:100]
```

```
Out[32]: u'\n\nA Game of Thrones(Song of Ice and Fire Book 1) by George R.R. Martin | Chapter One | Reac
```

```
In [33]: GoT[71][:100] ## zero indexed arrays/lists
```

```
Out[33]: u'\n\nA Game of Thrones(Song of Ice and Fire Book 1) by George R.R. Martin | Chapter Seventy-tw
```

```
In [34]: type(GoT[0]),type(unicodedata.normalize('NFKD', GoT[0]).encode('ascii','ignore'))
```

```
Out[34]: (unicode, str)
```

```
In [35]: GoT = [unicodedata.normalize('NFKD',chapter).encode('ascii','ignore') for chapter in GoT] ## A
```

```
In [102]: !mkdir GoT
```

```
In [16]: os.chdir("GoT")
```

```
In [122]: for chapter_num in range(1,73):
              with open("Chapter "+str(chapter_num) + ".txt","w") as chap: ## file access!
                  chap.write(GoT[chapter_num-1])
```

```
In [36]: book_string = ""
         for chapter in GoT:
             book_string += chapter
```

```
In [37]: len(book_string)
```

```
Out[37]: 1616629
```

```
In [38]: with open("GoT_bookone.txt","w") as book:
             book.write(book_string)
```

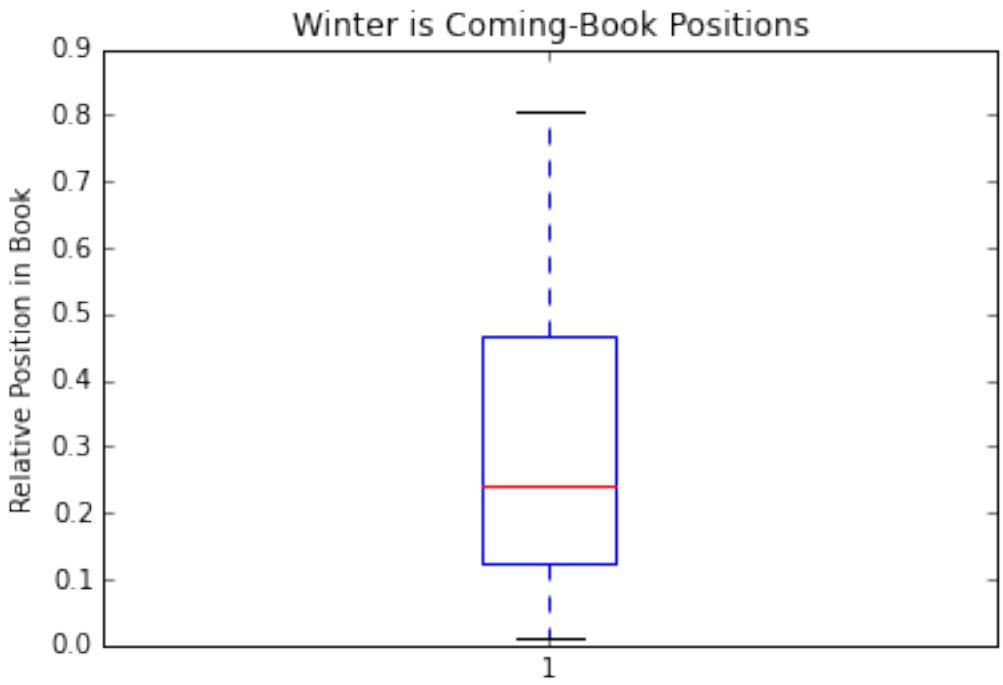
```
In [39]: !ls
```

```
GoT                             Python_Reference.aux
GoT.ipynb                       Python_Reference.log
GoT_bookone.txt                 Python_Reference.out
PythonIntroduction.ipynb        Python_Reference.pdf
PythonIntroduction.slides.html  Python_Reference.synctex.gz
Python_Exercises                Python_Reference.tex
Python_Exercises.aux            README.md
Python_Exercises.log            Slideshow Support.ipynb
Python_Exercises.out            hello_world.png
Python_Exercises.pdf            rpython.png
Python_Exercises.synctex.gz     texput.log
Python_Exercises.tex
```

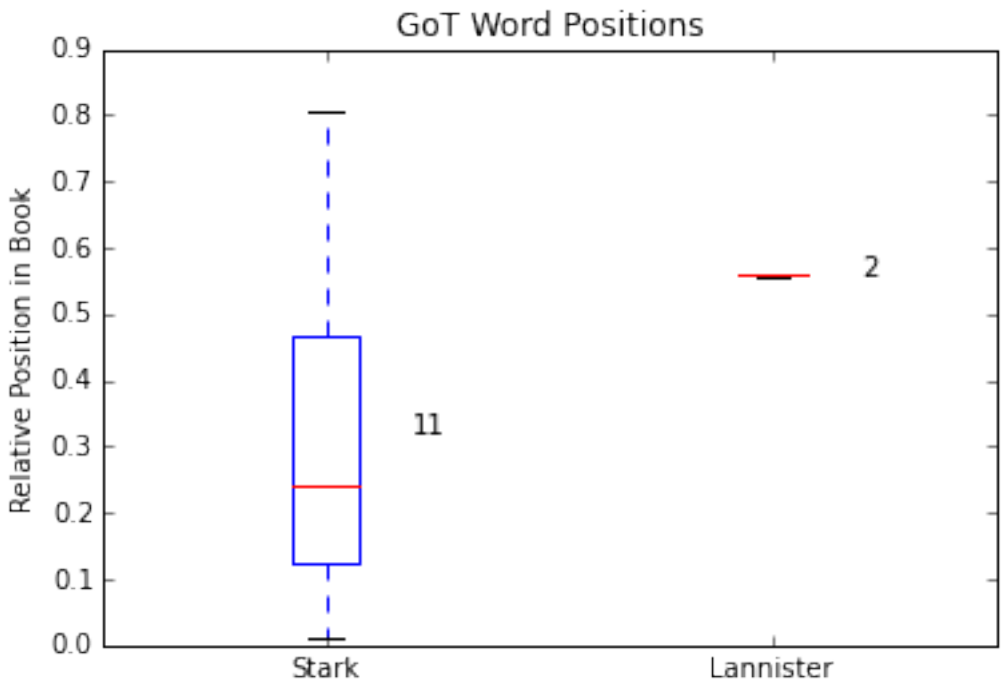
```
In [22]: import re ## regular expressions library
```

```
In [40]: wic = re.findall("[Ww][Ii][Nn][Tt][Ee][Rr] [Ii][Ss] [Cc][Oo][Mm][Ii][Nn][Gg]",book_string)
         wic,len(wic)
```

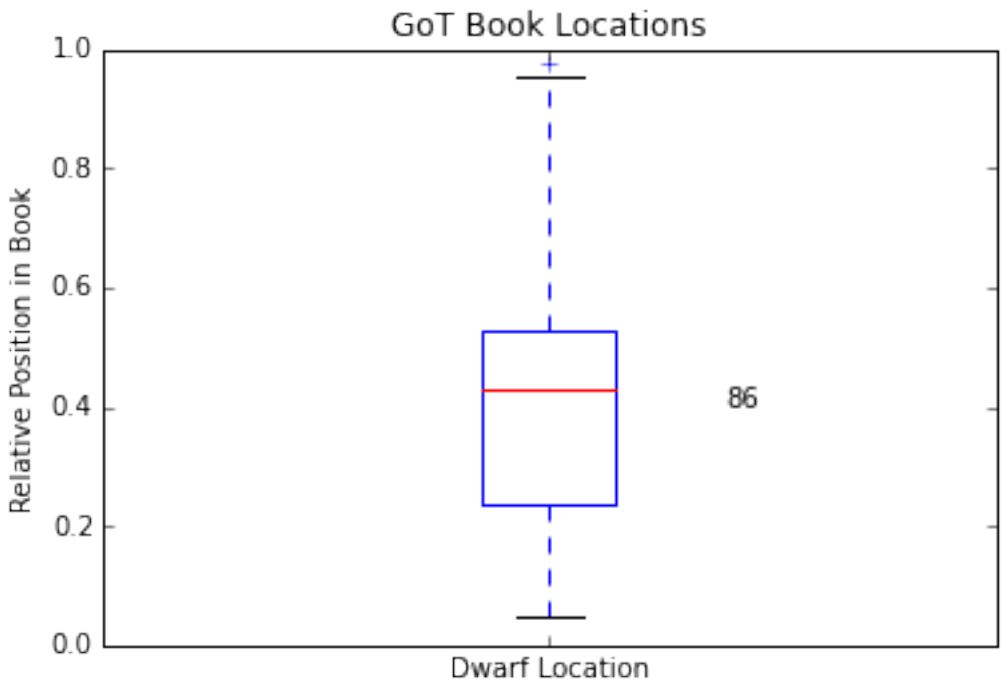
```
Out[40]: (['winter is coming',
           'Winter is coming',
           'Winter is coming',
           'winter is coming',
           'Winter is coming',
           'Winter is coming',
           'Winter is coming',
           'Winter is coming',
           'Winter is coming',
           'winter is coming',
           'Winter is coming'],
          11)

In [41]: Starks= "[Ww][Ii][Nn][Tt][Ee][Rr] [Ii][Ss] [Cc][Oo][Mm][Ii][Nn][Gg]"
         Lannisters = "[Aa] [Ll]annister [Aa]lways [Pp]ays [Hh]is debts"
         Lannister_actual = "[Hh]ear [Mm]e [Rr]oar!"

In [42]: search_string = re.compile(Starks)
         find = search_string.search(book_string)

In [43]: find.span()

Out[43]: (21266, 21282)

In [44]: for position in search_string.finditer(book_string):
             print position.start()

21266
21561
103321
300227
313673
392475
420761
730895
780740
1299233
1299288

In [45]: Stark_Positions = [position.start()/len(book_string) for position in search_string.finditer(boo

In [46]: from matplotlib import pyplot as plt
         import numpy as np
         %matplotlib inline

In [49]: plt.boxplot(Stark_Positions)
         plt.title("Winter is Coming-Book Positions")
         plt.ylabel("Relative Position in Book")
         plt.show()
```




```
In [88]: search_string = re.compile(Lannisters)
         Lannister_positions = [position.start()/len(book_string) for position in search_string.finditer
         plt.boxplot([Stark_Positions,Lannister_positions])
         plt.title("GoT Word Positions")
         plt.xticks([1,2],["Stark","Lannister"])
         plt.text(1.2,np.mean(Stark_Positions),str(len(Stark_Positions)))
         plt.text(2.2,np.mean(Lannister_positions),str(len(Lannister_positions)))
         plt.ylabel("Relative Position in Book")
         plt.show()
```




```
In [98]: search_string = re.compile("[Dd]warf")
         dwarf_pos = [position.start()/len(book_string) for position in search_string.finditer(book_str
         plt.boxplot([dwarf_pos])
         plt.title("GoT Book Locations")
         plt.xticks([1],["Dwarf Location"])
         plt.text(1.2,np.mean(dwarf_pos),str(len(dwarf_pos)))
         plt.ylabel("Relative Position in Book")
         plt.show()
```


GoT Book Locations
Relative Position in Book
1.0
0.8
0.6
0.4
0.2
0.0
86
Dwarf Location