

PROJECT REPORT

1. Group Information

Group Name: Rio

Group Member Names:

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2. Problem Description

Our project is an Automatic Rating System, which use star(s) to analysis a review.

3. Proposed Solution and Fully Implementation Details

3.1 Corpus

Collect 100 to 200 reviews and stars rating from yelp.com.

3.2 Baseline System (Naïve Strategy)

Look for certain keywords that are indicators of certain star(s) (from 1 star to 5 stars).

3.3 Improvement Strategy

3.3.1 Lexical Features

- **Word Tokens:** In baseline system, we focus on key words. By improvement strategy, we focus on all related words in a review.
Example: “I was not happy.” In this sentence, the word “happy” is a positive review, which may get higher star rating. “not happy”, however, makes the review worth 2 stars rating even 1 star.
- **Lemmatization:** To reduce inflectional forms and sometimes derivationally related forms of a word to a common base form.
Example: The word “hated” may not appear in the training set, however, after lemmatization, the word “hate” could be used to compute the probability of star(s) of review.

3.3.2 Syntactic Features

- **POS Tagging:** POS tags could be used for identifying and treating differently the different meaning of polysemous words.
Example: The word “loathing” has different tags. In “Fear and Loathing in Las Vegas”, “loathing” is a noun, which may not affect the probability of star(s) of review.
- **Dependency Parser:** Tell relationship between two words in a sentence based on the dependency relation (as opposed to the constituency relation).

Example: For the sentence “I love this movie”, we can get the following results: nsubj(love-2, I-1), root(ROOT-0, love-2), det(movie-4, this-3) and dobj(love-2, movie-4), which may affect the probability of star(s) of review.

3.3.3 Semantic Features

- **LESK:** Based on the assumption that words in a given "neighborhood" (section of text) will tend to share a common topic.

Example: The word “happy” has multiple meanings. We use LESK algorithm to find the correct meaning of “happy” in the sentence, which may affect the probability of star(s) of review.

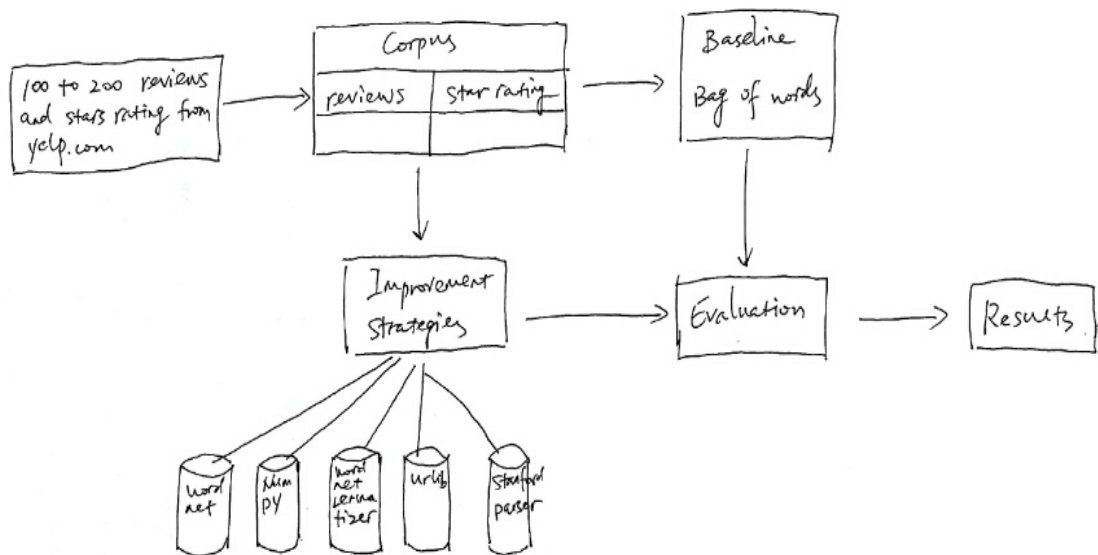
- **Semantic Relations:** Tokens in a sentence have same concept and relationship.

Example: Synonymy. The sentence “I love this movie” has the synonymy words “me like it film”, which may affect the probability of star(s) of review.

3.4 Programming Tools

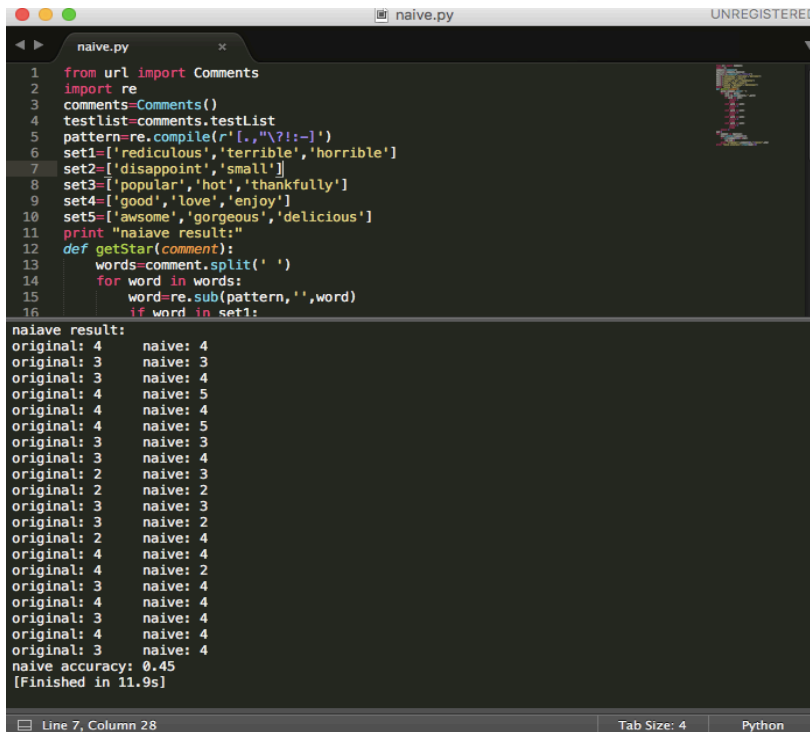
Python 2.7, NLTK (wordnet, wordnetlemmatizer), Numpy, urllib, urllib2, re, The Stanford Parser

3.5 Architecture Diagram



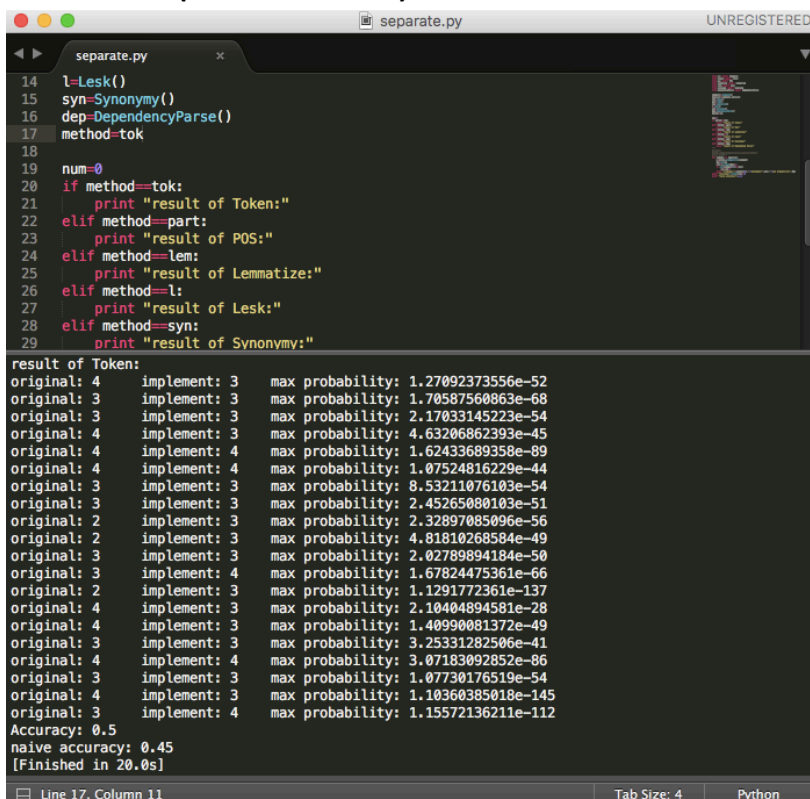
4. Results

4.1 Naive Implementation



```
naive.py
1 from url import Comments
2 import re
3 comments=Comments()
4 testlist=comments.testList
5 pattern=re.compile(r'[.,"\?!\-:]')
6 set1=['rediculous','terrible','horrible']
7 set2=['disappoint','small']
8 set3=['popular','hot','thankfully']
9 set4=['good','love','enjoy']
10 set5=['awesome','gorgeous','delicious']
11 print "naive result:"
12 def getStar(comment):
13     words=comment.split(' ')
14     for word in words:
15         word=re.sub(pattern,'',word)
16         if word in set1:
naive result:
original: 4      naive: 4
original: 3      naive: 3
original: 3      naive: 4
original: 4      naive: 5
original: 4      naive: 4
original: 4      naive: 5
original: 3      naive: 3
original: 3      naive: 4
original: 2      naive: 3
original: 2      naive: 2
original: 3      naive: 3
original: 3      naive: 2
original: 2      naive: 4
original: 4      naive: 4
original: 4      naive: 2
original: 3      naive: 4
original: 4      naive: 4
original: 3      naive: 4
original: 4      naive: 4
original: 3      naive: 4
naive accuracy: 0.45
[Finished in 11.9s]
```

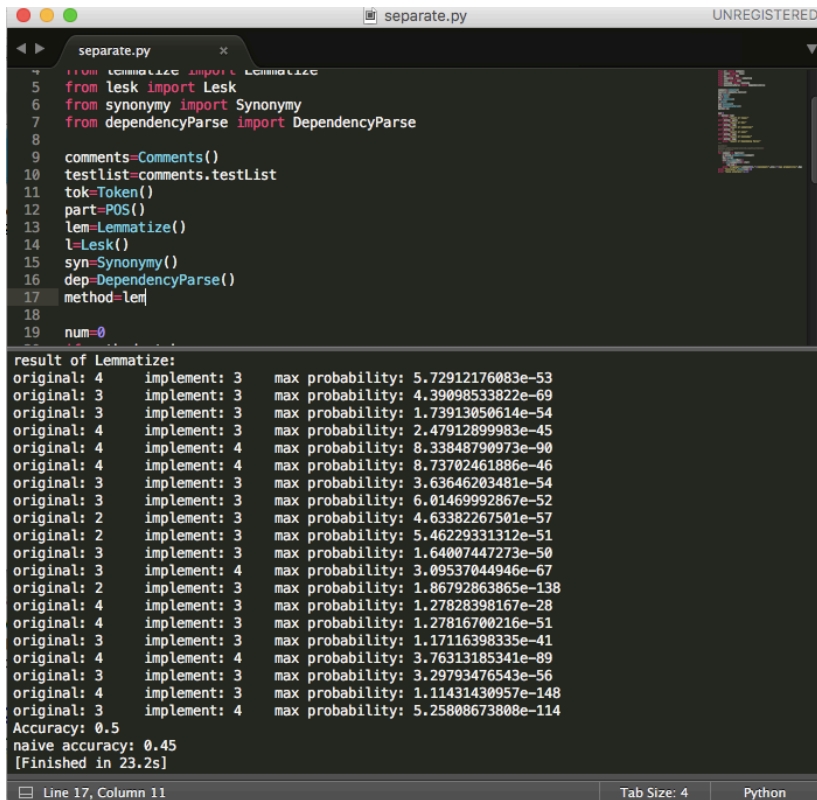
4.2 Word Token (Lexical Features)



```
separate.py
14 l=Lesk()
15 syn=Synonymy()
16 dep=DependencyParse()
17 method=tok
18
19 num=0
20 if method==tok:
21     print "result of Token:"
22 elif method==part:
23     print "result of POS:"
24 elif method==lem:
25     print "result of Lemmatize:"
26 elif method==l:
27     print "result of Lesk:"
28 elif method==syn:
29     print "result of Synonymy:"
result of Token:
original: 4      implement: 3      max probability: 1.27092373556e-52
original: 3      implement: 3      max probability: 1.70587560863e-68
original: 3      implement: 3      max probability: 2.17033145223e-54
original: 4      implement: 3      max probability: 4.63206862393e-45
original: 4      implement: 4      max probability: 1.62433689358e-89
original: 4      implement: 4      max probability: 1.07524816229e-44
original: 3      implement: 3      max probability: 8.53211076103e-54
original: 3      implement: 3      max probability: 2.45265080103e-51
original: 2      implement: 3      max probability: 2.32897085096e-56
original: 2      implement: 3      max probability: 4.81810268584e-49
original: 3      implement: 3      max probability: 2.02789894184e-50
original: 3      implement: 4      max probability: 1.67824475361e-66
original: 2      implement: 3      max probability: 1.1291772361e-137
original: 4      implement: 3      max probability: 2.10404894581e-28
original: 4      implement: 3      max probability: 1.40990081372e-49
original: 3      implement: 3      max probability: 3.25331282506e-41
original: 4      implement: 4      max probability: 3.07183092852e-86
original: 3      implement: 3      max probability: 1.07730176519e-54
original: 4      implement: 3      max probability: 1.10360385018e-145
original: 3      implement: 4      max probability: 1.15572136211e-112
Accuracy: 0.5
naive accuracy: 0.45
[Finished in 20.0s]
```

The accuracy of word token is 0.05 higher than naïve accuracy.

4.3 Lemmatization (Lexical Features)

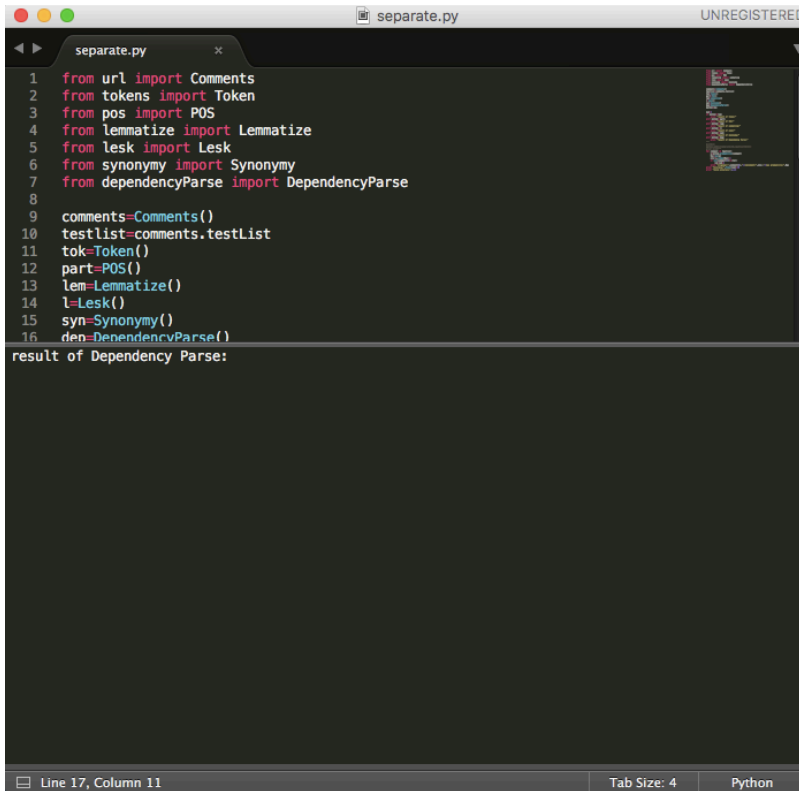


The screenshot shows a Python script named 'separate.py' in a code editor. The script imports 'Lemmatize' from 'lesk', 'Synonymy' from 'synonymy', and 'DependencyParse' from 'dependencyParse'. It then initializes several variables: 'comments=Comments()', 'testList=comments.testList', 'tok=Token()', 'part=POS()', 'lem=Lemmatize()', 'l=Lesk()', 'syn=Synonymy()', 'dep=DependencyParse()', and 'method=lem'. A loop runs from 'num=0' to 'num=19'. The output window displays the results of the lemmatization process, showing a table of original words, implemented words, and their maximum probabilities. The accuracy is 0.5, and the naive accuracy is 0.45. The process finished in 23.25 seconds.

```
separate.py
1 from lesk import Lemmatize
2
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5 from lesk import Lesk
6 from synonymy import Synonymy
7 from dependencyParse import DependencyParse
8
9 comments=Comments()
10 testList=comments.testList
11 tok=Token()
12 part=POS()
13 lem=Lemmatize()
14 l=Lesk()
15 syn=Synonymy()
16 dep=DependencyParse()
17 method=lem
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19 num=0
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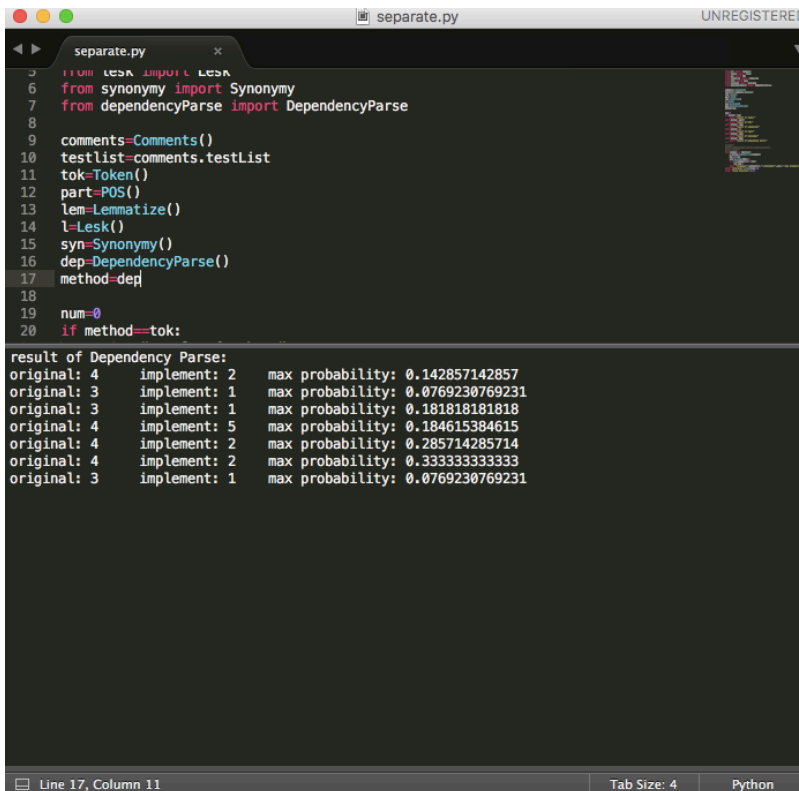
4.5 Dependency Parsing (Syntactic Features)



```
1 from url import Comments
2 from tokens import Token
3 from pos import POS
4 from lemmatize import Lemmatize
5 from lesk import Lesk
6 from synonymy import Synonymy
7 from dependencyParse import DependencyParse
8
9 comments=Comments()
10 testList=comments.testList
11 tok=Token()
12 part=POS()
13 lem=Lemmatize()
14 l=Lesk()
15 syn=Synonymy()
16 dep=DependencyParse()
result of Dependency Parse:
```

The screenshot shows a Python IDE window titled 'separate.py' with a dark theme. The code defines several classes and objects: Comments, Token, POS, Lemmatize, Lesk, Synonymy, and DependencyParse. It then instantiates these objects and assigns them to variables. The output area shows 'result of Dependency Parse:'.

After running Dependency Parsing for a period of time, we get the result as picture above.



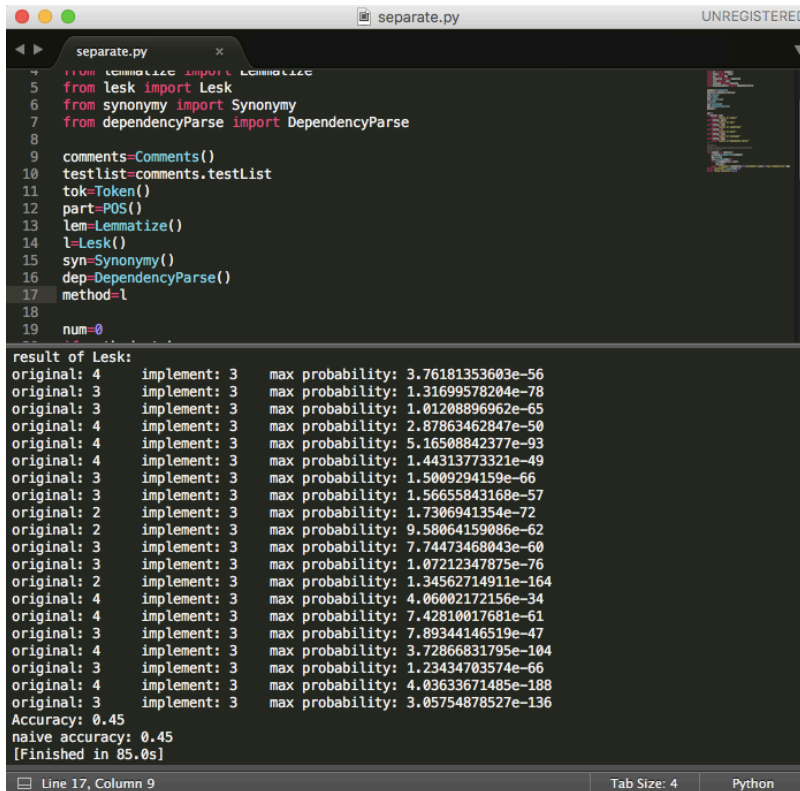
```
5 from lesk import Lesk
6 from synonymy import Synonymy
7 from dependencyParse import DependencyParse
8
9 comments=Comments()
10 testList=comments.testList
11 tok=Token()
12 part=POS()
13 lem=Lemmatize()
14 l=Lesk()
15 syn=Synonymy()
16 dep=DependencyParse()
17 method=dep
18
19 num=0
20 if method==tok:
result of Dependency Parse:
original: 4      implement: 2      max probability: 0.142857142857
original: 3      implement: 1      max probability: 0.0769230769231
original: 3      implement: 1      max probability: 0.181818181818
original: 4      implement: 5      max probability: 0.184615384615
original: 4      implement: 2      max probability: 0.285714285714
original: 4      implement: 2      max probability: 0.333333333333
original: 3      implement: 1      max probability: 0.0769230769231
```

The screenshot shows the same Python IDE window, but now the code has been executed. The output area displays a table of results for the dependency parsing process, showing original and implemented values along with their maximum probabilities.

After running a whole night, we get part of the answers that we want.

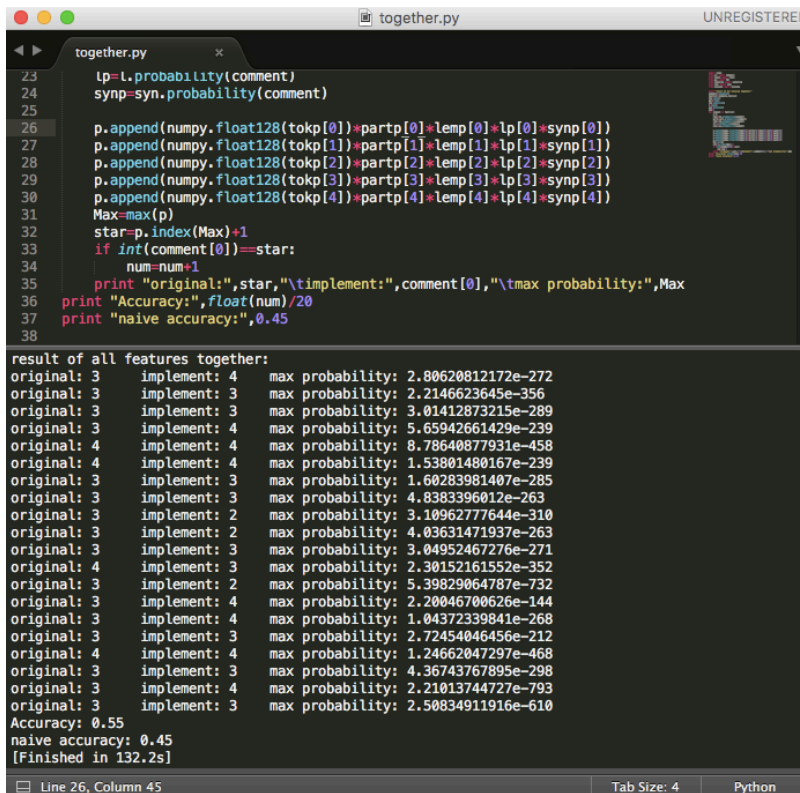
Therefore, we can finish dependency parsing but the running time is too large.

4.6 LESK (Semantic Features)



```
separate.py
1 from lesk import Lesk
2
3
4
5 from lesk import Lesk
6 from synonymy import Synonymy
7 from dependencyParse import DependencyParse
8
9 comments=Comments()
10 testlist=comments.testList
11 tok=Token()
12 part=POS()
13 lem=Lemmatize()
14 l=Lesk()
15 syn=Synonymy()
16 dep=DependencyParse()
17 method=l
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19 num=0
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4.8 Six Features Together



```
23 lp=l.probability(comment)
24 synp=syn.probability(comment)
25
26 p.append(numpy.float128(tokp[0])*partp[0]*lemp[0]*lp[0]*synp[0])
27 p.append(numpy.float128(tokp[1])*partp[1]*lemp[1]*lp[1]*synp[1])
28 p.append(numpy.float128(tokp[2])*partp[2]*lemp[2]*lp[2]*synp[2])
29 p.append(numpy.float128(tokp[3])*partp[3]*lemp[3]*lp[3]*synp[3])
30 p.append(numpy.float128(tokp[4])*partp[4]*lemp[4]*lp[4]*synp[4])
31 Max=max(p)
32 star=p.index(Max)+1
33 if int(comment[0])==star:
34     num=num+1
35 print "original:",star,"timplement:",comment[0],"tmax probability:",Max
36 print "Accuracy:",float(num)/20
37 print "naive accuracy:",0.45
38
```

result of all features together:

original	implement	max probability
3	4	2.80620812172e-272
3	3	2.2146623645e-356
3	3	3.01412873215e-289
3	4	5.65942661429e-239
4	4	8.78640877931e-458
4	4	1.53801480167e-239
3	3	1.60283981407e-285
3	3	4.8383396012e-263
3	2	3.10962777644e-310
3	2	4.03631471937e-263
3	3	3.04952467276e-271
4	3	2.30152161552e-352
3	2	5.39829064787e-732
3	4	2.20046700626e-144
3	4	1.04372339841e-268
3	3	2.72454046456e-212
4	4	1.24662047297e-468
3	3	4.36743767895e-298
3	4	2.21013744727e-793
3	3	2.50834911916e-610

Accuracy: 0.55
naive accuracy: 0.10
[Finished in 132.2s]

The accuracy of using all feature is 0.05 higher than naïve accuracy.

5. Problems Encountered

We meet several problem during the whole project. First is Unicode. We cannot use Unicode directly. Therefore, we encoded Unicode to utf-8. Second problem is out of memory. When we parsing dependency of reviews in testing set, a warning came out, which is out of memory. Thus, we split sentences as single sentence and try again, which avoid this problem successfully. Third, once we run the program several times, we cannot visit yelp.com because of robotic policy. At this time, we change another IP address to solve this problem. At last, the maximum probability may display 0 because of overflow. So we update 64-bit to 128-bit.

6. Pending issues

In this six features, some of them take a long period of time. Dependency Parser, which belongs to syntactic feature, spend the longest running time. Therefore, we cannot run this feature in limited time. However, we still finish coding this feature and maybe we could use a better parser to make it faster.

7. Potential improvements

In this program, we need to implement the running time of each feature. For an Automatic Rating System, it takes too much time to analysis a review.