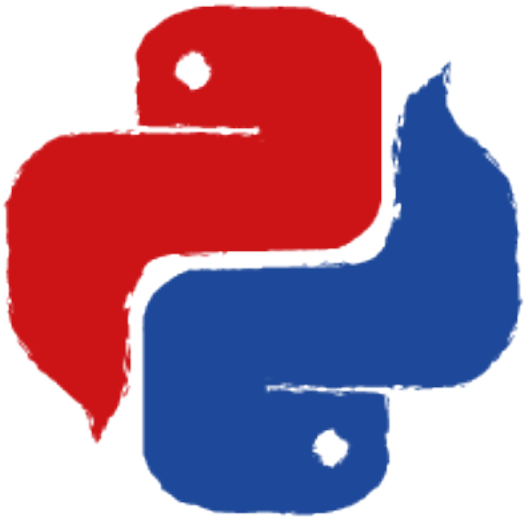

KoNLPy

KoNLPy Documentation

Release 0.4.2

Lucy Park

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Contents

(https://travis-ci.org/konlpy/konlpy) (https://readthedocs.org/projects/konlpy/?badge=latest) KoNLPy (pronounced *"ko en el PIE"*) is a Python package for natural language processing (NLP) of the Korean language. For installation directions, see *here* (page 6).

For users new to NLP, go to *Getting started* (page 5). For step-by-step instructions, follow the *User guide* (page 6). For specific descriptions of each module, go see the *API* (page 26) documents.

```
>>> from konlpy.tag import Kkma
>>> from konlpy.utils import pprint
>>> kkma = Kkma()
>>> pprint(kkma.sentences(u'네, 안녕하세요. 반갑습니다.'))
[네, 안녕하세요..,
 반갑습니다.]
>>> pprint(kkma.nouns(u'질문이나 건의사항은 깃헙 이슈 트래커에 남겨주세요.'))
[질문,
 건의,
 건의사항,
 사항,
 깃헙,
 이슈,
 트래커]
>>> pprint(kkma.pos(u'오류보고는 실행환경, 에러메세지와함께 설명을 최대한상세히!^^'))
[(오류, NNG),
 (보고, NNG),
 (는, JX),
 (실행, NNG),
 (환경, NNG),
 (,, SP),
 (에러, NNG),
 (메세지, NNG),
 (와, JKM),
 (함께, MAG),
 (설명, NNG),
 (을, JKO),
 (최대한, NNG),
 (상세히, MAG),
 (!, SF),
 (^^, EMO)]
```

CHAPTER 1

Standing on the shoulders of giants

Korean, the 13th most widely spoken language in the world (http://www.koreatimes.co.kr/www/news/nation/2014/05/116_157214.ht is a beautiful, yet complex language. Myriad *Korean morpheme analyzer tools* (page 23) were built by numerous researchers, to computationally extract meaningful features from the labyrinthine text.

KoNLPy is not just to create another, but to unify and build upon their shoulders, and see one step further. It is built particularly in the Python (programming) language (http://python.org), not only because of the language's simplicity and elegance, but also the powerful string processing modules and applicability to various tasks - including crawling, Web programming, and data analysis.

The three main philosophies of this project are:

- Keep it simple.
- Make it easy. For humans. [1]
- *"Democracy on the web works."* (page 4)

Please report (https://github.com/konlpy/konlpy/issues) when you think any have gone stale.

[1] With clear and brief (http://echojuliett.tumblr.com/post/32108001510/clarity-brevity) documents.

CHAPTER 2

License

KoNLPy is Open Source Software, and is released under the license below:

- GPL v3 or above (http://gnu.org/licenses/gpl.html) [1]

You are welcome to use the code under the terms of the license, however please acknowledge its use with a citation.

- Eunjeong L. Park, Sungzoon Cho. "KoNLPy: Korean natural language processing in Python (http://dmlab.snu.ac.kr/ lucypark/docs/2014-10-10-hclt.pdf)", Proceedings of the 26th Annual Conference on Human & Cognitive Language Technology, Chuncheon, Korea, Oct 2014.

Here is a BibTeX entry.:

```
@inproceedings{park2014konlpy,
  title={KoNLPy: Korean natural language processing in Python},
  author={Park, Eunjeong L. and Cho, Sungzoon},
  booktitle={Proceedings of the 26th Annual Conference on Human & Cognitive Language Technology},
  address={Chuncheon, Korea},
  month={October},
  year={2014}
}
```

[1] No, I'm not extremely fond of this either. However, some important depedencies - such as Hannanum, Kkma, MeCab-ko - are GPL licensed, and we want to honor their licenses. (It is also an inevitable choice. We hope things may change in the future.)

CHAPTER 3

Contribute

KoNLPy isn't perfect, but it will continuously evolve and you are invited to participate!

Found a bug? Have a good idea for improving KoNLPy? Visit the KoNLPy GitHub page (https://github.com/konlpy/konlpy) and suggest an idea (https://github.com/konlpy/konlpy/issues) or make a pull request (https://github.com/konlpy/konlpy/pulls).

You are also welcome to join the `#koreannlp` channel at the Ozinger IRC Network (http://ozinger.org), and the mailing list (https://groups.google.com/forum/#!forum/konlpy). The IRC channel is more focused on development discussions and the mailing list is a better place to ask questions, but nobody stops you from going the other way around.

Please note that *asking questions through these channels is also a great contribution*, because it gives the community feedback as well as ideas. Don't hesitate to ask.

CHAPTER 4

Getting started

4.1 What is NLP?

NLP (Natural Language Processing) is a set of techniques for analyzing and extracting, and understanding meaningful information text.

We have various NLP applications in our lives. For example:

- Text summarization (ex: Summly (http://www.summly.com/index.html))
- Question answering (ex: Wolfram Alpha (http://www.wolframalpha.com/input/?i=what+is+the+meaning+of+life&lk=4&num
- Dialogue systems (ex: Apple Siri (https://www.apple.com/ios/siri/))
- Machine translation (ex: Google Translate (http://translate.google.com))

And obviously information retrieval systems such as Web search engines. For a better understanding of NLP techniques, consider referring the so-called "bibles":

- Jurafsky et al., Speech and Language Processing (https://www.goodreads.com/book/show/908048), 2nd Edition, 2008.
- Manning and Schutze, Foundations of Statistical Natural Language Processing (https://www.goodreads.com/book/show/776349), 1999.

KoNLPy will help you to actually carry out some fundamental NLP tasks with Korean text. In case you're interested in handling English text, check out NLTK (http://nltk.org).

4.2 What do I need to get started?

You have some prerequisites to use KoNLPy.

1. Deep interest in natural languages and some familiarity with the Korean language
2. Understanding of basic Python programming [1]
3. A "good" text editor and terminal (or Python IDE) [2]
4. A Python installation (https://wiki.python.org/moin/BeginnersGuide/Download)
5. pip (https://pypi.python.org/pypi/pip), the Python package manager

Got 'em all? Then let's go.

[1] If you're new to Python, this tutorial should get you through in minutes: http://learnxinyminutes.com/docs/python/. If you're up to putting in some more time, try The Hitchhiker's Guide (http://docs.python-guide.org/en/latest/) or Learn Python the hard way (http://learnpythonthehardway.org/book/).

[2] Many use Sublime Text 2 (http://www.sublimetext.com/) for Python programming. Some others use Vim and Terminal. But other than these, there are numerous great text editors (http://tutorialzine.com/2012/07/battle-of-the-tools-which-is-the-best-code-editor/) and Python IDEs (http://pedrokroger.net/choosing-best-python-ide/) out there, so take your pick!

CHAPTER 5

User guide

5.1 Installation

Note: For troubleshooting information, see these pages: Linux (https://github.com/konlpy/konlpy/issues?q=label%3Alinux). Mac OS (https://github.com/konlpy/konlpy/issues?q=label%3A"mac+os"). Windows (https://github.com/konlpy/konlpy/issues?q=label%3Awindows). Please record a "New Issue" (https://github.com/konlpy/konlpy/issues/new) if you have an error that is not listed. You can also see testing logs here (https://docs.google.com/spreadsheets/d/1Ii_L9NF9gSLbsJOGqsf-zfqTtyhhthmJWNC2kgUDIsU/edit#gid=0).

5.1.1 Ubuntu

1. From the command prompt, install KoNLPy.

```
$ sudo apt-get install python-dev g++ openjdk-7-jdk
$ pip install konlpy     # Python 2.x
$ sudo apt-get install python3-dev
$ pip3 install konlpy    # Python 3.x
```

2. Install MeCab (*optional*)

```
$ sudo apt-get install curl
$ bash <(curl -s https://raw.githubusercontent.com/konlpy/konlpy/master/scripts/mecab.sh)
```

5.1.2 Mac OS

1. From the command prompt, install KoNLPy.

```
$ pip install konlpy      # Python 2.x
$ pip3 install konlpy     # Python 3.x
```

2. Install MeCab (*optional*)

```
$ bash <(curl -s https://raw.githubusercontent.com/konlpy/konlpy/master/scripts/mecab.sh)
```

5.1.3 Windows

1. Do you have Java 1.7+ installed?
2. Set JAVA_HOME (http://docs.oracle.com/cd/E19182-01/820-7851/inst_cli_jdk_javahome_t/index.html).

3. Download and install JPype1 (http://www.lfd.uci.edu/ gohlke/pythonlibs/#jpype) (>=0.5.7). [1] You may have to upgrade your *pip* version in order to install the downloaded *.whl* file.

```
> pip install --upgrade pip
> pip install JPype1-0.5.7-cp27-none-win_amd64.whl
```

4. From the command prompt, install KoNLPy.

```
> pip install konlpy
```

Warning:
- KoNLPy's `Mecab()` class is not supported on Windows machines.

5.2 Morphological analysis and POS tagging

Morphological analysis is the identification of the structure of morphemes and other linguistic units, such as root words, affixes, or parts of speech.

POS (part-of-speech) tagging is the process of marking up morphemes in a phrase, based on their definitions and contexts. For example.:

가방에 들어가신다 -> 가방/NNG + 에/JKM + 들어가/VV + 시/EPH + ㄴ다/EFN

5.2.1 POS tagging with KoNLPy

In KoNLPy, there are several different options you can choose for POS tagging. All have the same input-output structure; the input is a phrase, and the output is a list of tagged morphemes.

For detailed usage instructions see the *tag Package* (page 26).

See also:

Korean POS tags comparison chart (https://docs.google.com/spreadsheets/d/1OGAjUvalBuX-oZvZ_-9tEfYD2gQe7hTGsgUpiiBSXI8/edit#gid=0)

Compare POS tags between several Korean analytic projects. (In Korean)

5.2.2 Comparison between POS tagging classes

Now, we do time and performation analysis for executing the `pos` method for each of the classes in the *tag Package* (page 26). The experiments were carried out on a Intel i7 CPU with 4 cores, Python 2.7, and KoNLPy 0.4.1.

Time analysis [2]

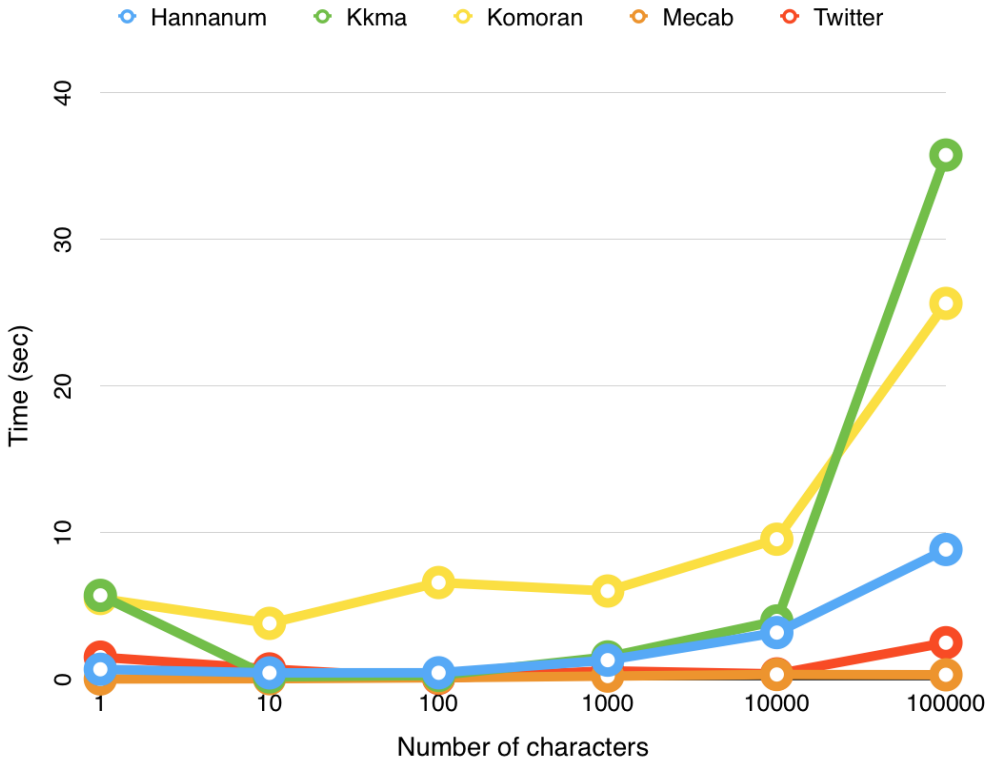
1. *Loading time*: Class loading time, including dictionary loads.
   - `Kkma` (page 27): 5.6988 *secs*
   - `Komoran` (page 27): 5.4866 *secs*
   - `Hannanum` (page 26): 0.6591 *secs*
   - `Twitter` (page 28): 1.4870 *secs*
   - `Mecab` (page 28): 0.0007 *secs*

[1] *win-amd64* for 64-bit Windows, *win32* for 32-bit Windows.
[2] Please note that these are comparisons among KoNLPy classes, and not the original distributions.

2. *Execution time*: Time for executing the `pos` method for each class, with 100K characters.

    - `Kkma` (page 27): 35.7163 *secs*
    - `Komoran` (page 27): 25.6008 *secs*
    - `Hannanum` (page 26): 8.8251 *secs*
    - `Twitter` (page 28): 2.4714 *secs*
    - `Mecab` (page 28): 0.2838 *secs*

    If we test among a various number of characters, all classes' execution times increase in an exponential manner.



Performance analysis

The performance evaluation is replaced with result comparisons for several sample sentences.

1. *"아버지가방에들어가신다"*

    We can check the spacing algorithm through this example. Desirably, an analyzer would parse this sentence to "아버지가 방에 들어가신다" (My father enters the room), rather than "아버지 가방에 들어가신다" (My father goes in the bag). `Hannanum` (page 26) and `Komoran` (page 27) are careful in spacing uncertain terms, and defaults the whole phrase to nouns. `Kkma` (page 27) is more confident, but gets undesirable results. For this result, `Mecab` (page 28) shows the best results.

Hannanum	Kkma	Komoran	Mecab	Twitter
아버지가방에들어가 / N 이 / J 시ㄴ다 / E	아버지 / NNG 가방 / NNG 에 / JKM 들어가 / VV 시 / EPH ㄴ다 / EFN	아버지가방에들어가신다 / NNP	아버지 / NNG 가 / JKS 방 / NNG 에 / JKB 들어가 / VV 신다 / EP+EC	아버지 / Noun 가방 / Noun 에 / Josa 들어가신 / Verb 다 / Eomi

2. *"나는 밥을 먹는다" vs "하늘을 나는 자동차"*

   If we focus on "나는" in both sentences, we can see whether an analyzer considers the context of words. "나는" in the first sentence should be "나/N + 는/J", and in the second sentence "나(-ㄹ다)/V + 는/E". Kkma (page 27) properly understands the latter "나는" as a verb, wheras the rest observe it as nouns.

Hannanum	Kkma	Komoran	Mecab	Twitter
나 / N	나 / NP	나 / NP	나 / NP	나 / Noun
는 / J	는 / JX	는 / JX	는 / JX	는 / Josa
밥 / N	밥 / NNG	밥 / NNG	밥 / NNG	밥 / Noun
을 / J	을 / JKO	을 / JKO	을 / JKO	을 / Josa
먹 / P	먹 / VV	먹 / VV	먹 / VV	먹는 / Verb
는다 / E	는 / EPT	는다 / EC	는다 / EC	다 / Eomi
	다 / EFN			

Hannanum	Kkma	Komoran	Mecab	Twitter
하늘 / N	하늘 / NNG	하늘 / NNG	하늘 / NNG	하늘 / Noun
을 / J	을 / JKO	을 / JKO	을 / JKO	을 / Josa
나 / N	날 / VV	나 / NP	나 / NP	나 / Noun
는 / J	는 / ETD	는 / JX	는 / JX	는 / Josa
자동차 / N	자동차 / NNG	자동차 / NNG	자동차 / NNG	자동차 / Noun

3. *"아이폰 기다리다 지쳐 애플공홈에서 언락폰질러버렸다 6+ 128기가실버ㅋ"*

   How do each of the analyzers deal with slang, or terms that are not included in the dictionary?

Hannanum	Kkma	Komoran	Mecab	Twitter
아이폰 / N	아이 / NNG	아이폰 / NNP	아이폰 / NNP	아이폰 / Noun
기다리 / P	폰 / NNG	기다리 / VV	기다리 / VV	기다리 / Verb
다 / E	기다리 / VV	다 / EC	다 / EC	다 / Eomi
지치 / P	다 / ECS	지치 / VV	지쳐 / VV+EC	지쳐 / Verb
어 / E	지치 / VV	어 / EC	애플 / NNP	애플 / Noun
애플공홈 / N	어 / ECS	애플 / NNP	공 / NNG	공홈 / Noun
에서 / J	애플 / NNP	공 / NNG	홈 / NNG	에서 / Josa
언락폰질러버렸다 / N	공 / NNG	홈 / NNG	에서 / JKB	언락폰 / Noun
6+ / N	홈 / NNG	에서 / JKB	언락 / NNG	질 / Verb
128기가실벜 / N	에서 / JKM	언 / NNG	폰 / NNG	러 / Eomi
	언락 / NNG	락 / NNG	질러버렸 / VV+EC+VX+EP	버렸 / Verb
	폰 / NNG	폰 / NNG	다 / EC	다 / Eomi
	질르 / VV	지르 / VV	6 / SN	6 / Number
	어 / ECS	어 / EC	+ / SY	+ / Punctuation
	버리 / VXV	버리 / VX	128 / SN	128 / Number
	었 / EPT	었 / EP	기 / NNG	기 / Noun
	다 / ECS	다 / EC	가 / JKS	가 / Josa
	6 / NR	6 / SN	실버 / NNP	실버 / Noun
	+ / SW	+ / SW	ㅋ / UNKNOWN	ㅋ / KoreanParticle
	128 / NR	128기가실벜 / NA		
	기가 / NNG			
	실버 / NNG			
	ㅋ / UN			

5.3 Data

5.3.1 Corpora

The following corpora are currently available:

1. **kolaw: Korean law corpus.**
    - constitution.txt
2. **kobill: Korean National Assembly bill corpus. The file ID corresponds to the bill number.**
    - 1809890.txt - 1809899.txt

For more detailed usage of the corpora, see the *corpus Package* (page 29).

```
>>> from konlpy.corpus import kolaw
>>> c = kolaw.open('constitution.txt').read()
>>> print c[:10]
대한민국 헌법

유구한 역사와
>>> from konlpy.corpus import kobill
>>> d = kobill.open('1809890.txt').read()
>>> print d[:15]
지방공무원법 일부개정법률안
```

5.3.2 Dictionaries

Dictionaries are used for *Morphological analysis and POS tagging* (page 7), and are built with *Corpora* (page 25).

Hannanum *system dictionary*

A dictionary created with the KAIST corpus. (4.7MB)

Located at `./konlpy/java/data/kE/dic_system.txt`. Part of this file is shown below.:

```
...
나라경제        ncn
나라기획        nqq
나라기획회장    ncn
나라꽃  ncn
나라님  ncn
나라도둑        ncn
나라따르        pvg
나라링링프로덕션        ncn
나라말  ncn
나라망신        ncn
나라박물관      ncn
나라발전        ncpa
나라별  ncn
나라부동산      nqq
나라사랑        ncn
나라살림        ncpa
나라시  nqq
나라시마        ncn
...
```

You can add your own terms, modify `./konlpy/java/data/kE/dic_user.txt`.

`Kkma` *system dictionary*

A dictionary created with the Sejong corpus. (32MB)

It is included within the Kkma `.jar` file, so in order to see dictionary files, check out the KKMA's mirror (https://github.com/e9t/kkma/tree/master/dic). Part of `kcc.dic` is shown below.:

```
아니/IC
후우/IC
그래서/MAC
그러나/MAC
그러니까/MAC
그러면/MAC
그러므로/MAC
그런데/MAC
그리고/MAC
따라서/MAC
하지만/MAC
...
```

`Mecab` *system dictionary*

A CSV formatted dictionary created with the Sejong corpus. (346MB)

The compiled version is located at `/usr/local/lib/mecab/dic/mecab-ko-dic` (or the path you assigned during installation), and you can see the original files in the source code (https://bitbucket.org/eunjeon/mecab-ko-dic/src/ce04f82ab0083fb24e4e542e69d9e88a672c3325/seed/?at=master). Part of `CoinedWord.csv` is shown below.:

```
가오티,0,0,0,NNG,*,F,가오티,*,*,*,*,*
갑툭튀,0,0,0,NNG,*,F,갑툭튀,*,*,*,*,*
강퇴,0,0,0,NNG,*,F,강퇴,*,*,*,*,*
개드립,0,0,0,NNG,*,T,개드립,*,*,*,*,*
갠소,0,0,0,NNG,*,F,갠소,*,*,*,*,*
고퀄,0,0,0,NNG,*,T,고퀄,*,*,*,*,*
광삭,0,0,0,NNG,*,T,광삭,*,*,*,*,*
광탈,0,0,0,NNG,*,T,광탈,*,*,*,*,*
굉천,0,0,0,NNG,*,T,굉천,*,*,*,*,*
국을,0,0,0,NNG,*,T,국을,*,*,*,*,*
귀요미,0,0,0,NNG,*,F,귀요미,*,*,*,*,*
...
```

To add your own terms, see here (https://bitbucket.org/eunjeon/mecab-ko-dic/src/ce04f82ab0083fb24e4e542e69d9e88a672c3325/final/user-dic/?at=master).

Note: You can add new words either to the system dictionaries or user dictionaries. However, there is a slight difference in the two choices.:

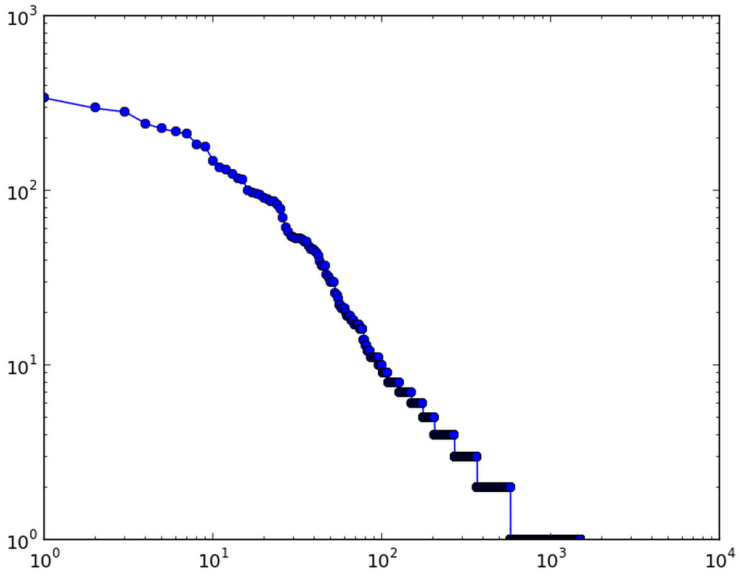
- *Adding to the system dictionary*: When dictionary updates are not frequent, when you do not want to drop the analysis speed.
- *Adding to the user dictionary*: When dictionary updates are frequent, when you do not have `root` access.

5.4 Examples

Below are a set of example tasks using KoNLPy.

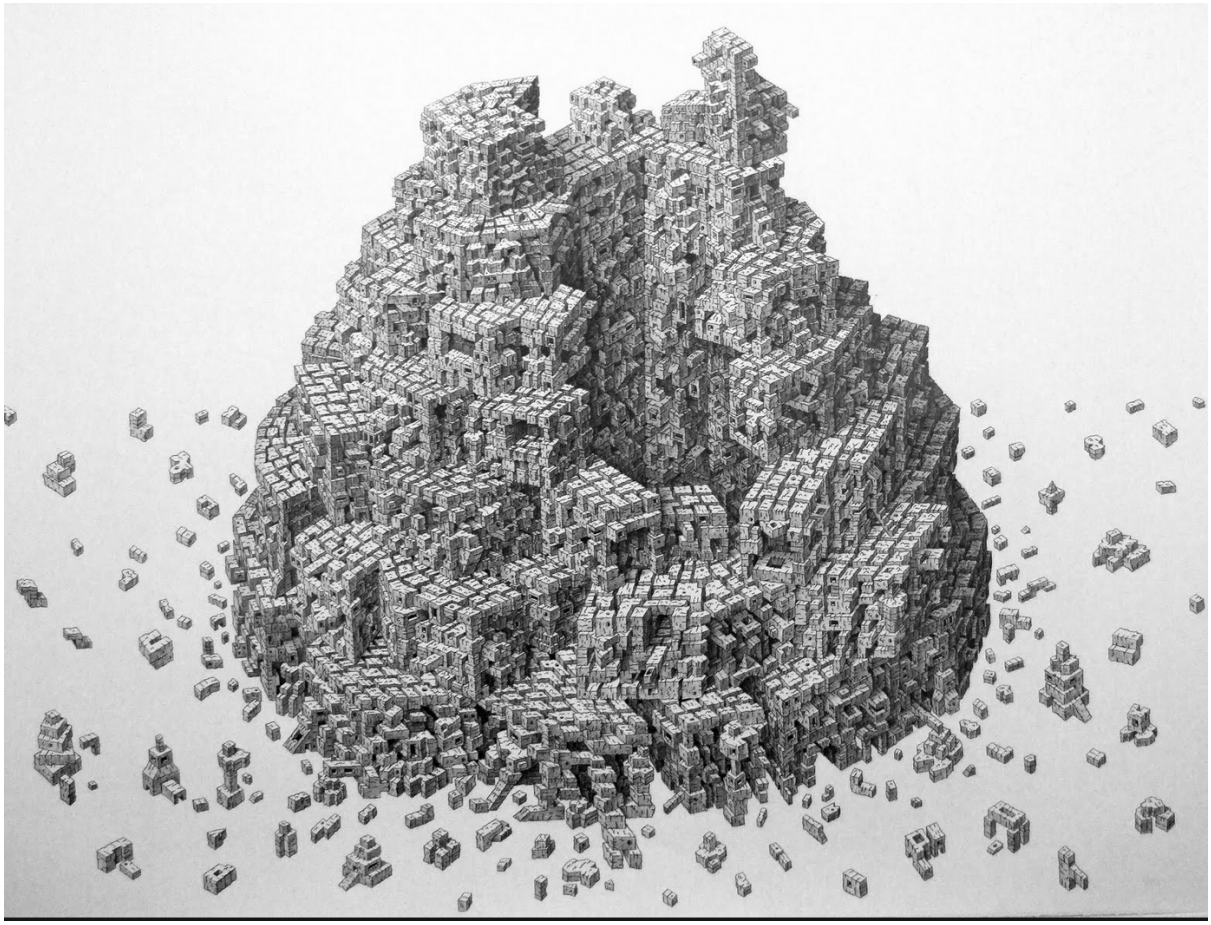
Exploring a document (page 13)

Finding collocations (page 16)


10^3
10^2
10^1
10^0
10^0
10^1
10^2
10^3
10^4

Chunking (page 17)

Generating random text (page 18)



Drawing a word cloud (page 20)

Multithreading with KoNLPy (page 21)

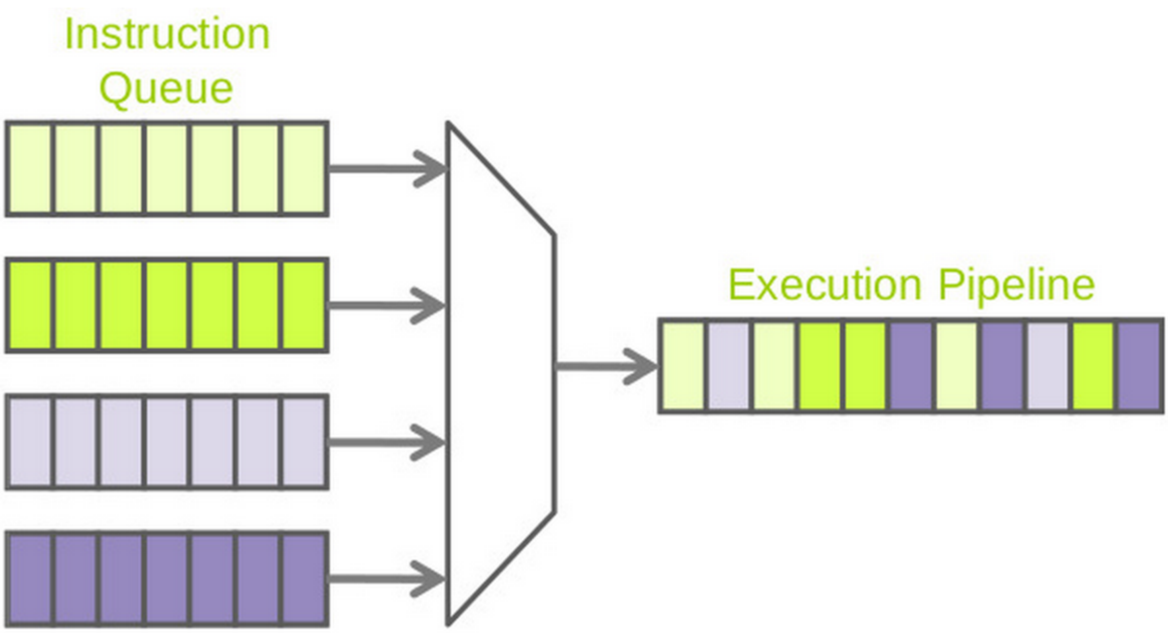
5.4.1 Contents

Exploring a document

Exploring a document can consist of various components:

- Counts (characters, words, etc.)
- Checking Zipf's laws: $fr = k$
- Concordances


행위
동물
학대
인터넷
판매 · 전시 · 전달 · 상영
영상물
신설
고통
다음
게재
금지
개정법률안
굶주림
정당
현행법
제1항부터
과태료
홍보
위반
동물보호법
제47조(과태료)
제8조제5항
동물보호
질병
표시
의식
적절
활동
목적
누구
일부
일체
방치
신체
제8조
고양시
말
때
제외
한
이
사
치
키
발
것


Instruction Queue
Execution Pipeline

```
#! /usr/bin/python2.7
# -*- coding: utf-8 -*-

from collections import Counter

from konlpy.corpus import kolaw
from konlpy.tag import Hannanum
from konlpy.utils import concordance, pprint
from matplotlib import pyplot


def draw_zipf(count_list, filename, color='blue', marker='o'):
    sorted_list = sorted(count_list, reverse=True)
    pyplot.plot(sorted_list, color=color, marker=marker)
    pyplot.xscale('log')
    pyplot.yscale('log')
    pyplot.savefig(filename)


doc = kolaw.open('constitution.txt').read()
pos = Hannanum().pos(doc)
cnt = Counter(pos)

print('nchars  :', len(doc))
print('ntokens :', len(doc.split()))
print('nmorphs :', len(set(pos)))
print('\nTop 20 frequent morphemes:'); pprint(cnt.most_common(20))
print('\nLocations of "대한민국" in the document:')
concordance(u'대한민국', doc, show=True)

draw_zipf(cnt.values(), 'zipf.png')
```

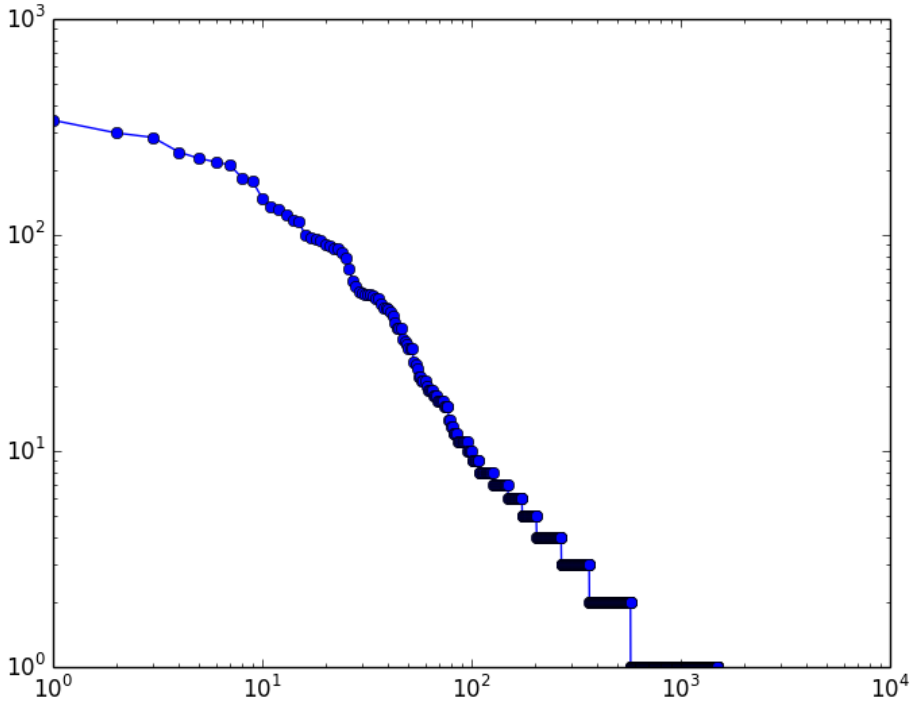
- Console:

```
nchars  : 19240
ntokens : 4178
nmorphs : 1501

Top 20 frequent morphemes:
[((의, J), 398),
 ((., S), 340),
 ((하, X), 297),
 ((에, J), 283),
 ((ㄴ다, E), 242),
 ((ㄴ, E), 226),
 ((이, J), 218),
 ((을, J), 211),
 ((은, J), 184),
 ((어, E), 177),
 ((를, J), 148),
 ((ㄹ, E), 135),
 ((/, S), 131),
 ((하, P), 124),
 ((는, J), 117),
 ((법률, N), 115),
 ((,, S), 100),
 ((는, E), 97),
 ((있, P), 96),
 ((되, X), 95)]

Locations of "대한민국" in the document:
0 대한민국헌법 유구한 역사와
9 대한국민은 3·1운동으로 건립된 대한민국임시정부의 법통과 불의에
```

```
98 총강 제1조 ① 대한민국은 민주공화국이다. ②대한민국의
100 ① 대한민국은 민주공화국이다. ②대한민국의 주권은 국민에게
110 나온다. 제2조 ① 대한민국의 국민이 되는
126 의무를 진다. 제3조 대한민국의 영토는 한반도와
133 부속도서로 한다. 제4조 대한민국은 통일을 지향하며,
147 추진한다. 제5조 ① 대한민국은 국제평화의 유지에
787 군무원이 아닌 국민은 대한민국의 영역안에서는 중대한
1836 파견 또는 외국군대의 대한민국 영역안에서의 주류에
3620 경제 제119조 ① 대한민국의 경제질서는 개인과
```



- **zipf.png:**

Finding collocations

We can find collocations with the help of NLTK (http://nltk.org).

In order to find trigram collocations, replace *BigramAssocMeasures* with *TrigramAssocMeasures*, and *BigramCollocationFinder* with *TrigramCollocationFinder*.

```
#! /usr/bin/python2.7
# -*- coding: utf-8 -*-

from konlpy.tag import Kkma
from konlpy.corpus import kolaw
from konlpy.utils import pprint
from nltk import collocations


measures = collocations.BigramAssocMeasures()
doc = kolaw.open('constitution.txt').read()

print('\nCollocations among tagged words:')
tagged_words = Kkma().pos(doc)
finder = collocations.BigramCollocationFinder.from_words(tagged_words)
pprint(finder.nbest(measures.pmi, 10)) # top 5 n-grams with highest PMI
```

```
print('\nCollocations among words:')
words = [w for w, t in tagged_words]
ignored_words = [u'안녕']
finder = collocations.BigramCollocationFinder.from_words(words)
finder.apply_word_filter(lambda w: len(w) < 2 or w in ignored_words)
finder.apply_freq_filter(3) # only bigrams that appear 3+ times
pprint(finder.nbest(measures.pmi, 10))

print('\nCollocations among tags:')
tags = [t for w, t in tagged_words]
finder = collocations.BigramCollocationFinder.from_words(tags)
pprint(finder.nbest(measures.pmi, 5))
```

- Console:

```
Collocations among tagged words:
[((가부, NNG), (동수, NNG)),
 ((강제, NNG), (노역, NNG)),
 ((경자, NNG), (유전, NNG)),
 ((고, ECS), (채취, NNG)),
 ((공무, NNG), (담임, NNG)),
 ((공중, NNG), (도덕, NNG)),
 ((과반, NNG), (수가, NNG)),
 ((교전, NNG), (상태, NNG)),
 ((그러, VV), (나, ECE)),
 ((기본적, NNG), (인권, NNG))]

Collocations among words:
[(현행, 범인),
 (형의, 선고),
 (내부, 규율),
 (정치적, 중립성),
 (누구, 든지),
 (회계, 연도),
 (지체, 없이),
 (평화적, 통일),
 (형사, 피고인),
 (지방, 자치)]

Collocations among tags:
[(XR, XSA),
 (JKC, VCN),
 (VCN, ECD),
 (ECD, VX),
 (ECD, VXV)]
```

Chunking

After *tagging a sentence with part of speech* (page 7), we can segment it into several higher level multitoken sequences, or "chunks".

Here we demonstrate a way to easily chunk a sentence, and find noun, verb and adjective phrases in Korean text, using `nltk.chunk.regexp.RegexpParser` (http://nltk.org/api/nltk.chunk.html#nltk.chunk.regexp.RegexpParser).

```
#! /usr/bin/python2.7
# -*- coding: utf-8 -*-

import konlpy
import nltk

# POS tag a sentence
```

```
sentence = u'만 6세 이하의 초등학교 취학 전 자녀를 양육하기 위해서는'
words = konlpy.tag.Twitter().pos(sentence)

# Define a chunk grammar, or chunking rules, then chunk
grammar = """
NP: {<N.*>*<Suffix>?}   # Noun phrase
VP: {<V.*>*}            # Verb phrase
AP: {<A.*>*}            # Adjective phrase
"""
parser = nltk.RegexpParser(grammar)
chunks = parser.parse(words)
print("# Print whole tree")
print(chunks.pprint())

print("\n# Print noun phrases only")
for subtree in chunks.subtrees():
    if subtree.label()=='NP':
        print(' '.join((e[0] for e in list(subtree))))
        print(subtree.pprint())

# Display the chunk tree
chunks.draw()
```

According to the chunk grammer defined above, we have three rules to extracted phrases from our sentence. First, we have a rule to extract noun phrases (NP), where our chunker finds a serial of nouns, followed with an optional Suffix. (Note that these rules can be modified for your purpose, and that they should differ for each morphological analyzer.) Then we have two more rules, each defining verb phrases (VP) and adjective phrases (AP).

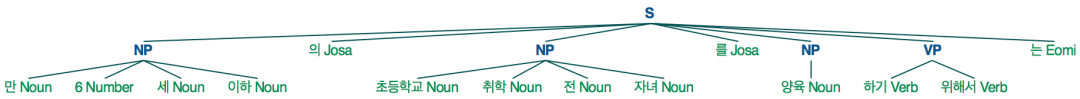
The result is a tree, which we can print on the console, or display graphically as follows.

- Console:

```
# Print whole tree
(S
  (NP 만/Noun 6/Number 세/Noun 이하/Noun)
  의/Josa
  (NP 초등학교/Noun 취학/Noun 전/Noun 자녀/Noun)
  를/Josa
  (NP 양육/Noun)
  (VP 하기/Verb 위해서/Verb)
  는/Eomi)

# Print noun phrases only
# Print noun phrases only
만 6 세 이하
(NP 만/Noun 6/Number 세/Noun 이하/Noun)
초등학교 취학 전 자녀
(NP 초등학교/Noun 취학/Noun 전/Noun 자녀/Noun)
양육
(NP 양육/Noun)
```

- **chunking.png**



Generating random text

Say you want to generate random text in Korean. How would you do it?

The easiest way would probably be to have your cat walk across your keyboard which would result in something like this:

ㅕ키ㅖ츄ㅑㅋ응아 ㄲㄴㅇ 쿄ㅛㅍㄹㅎ튜허ㅓㅎㅠㅅㄴ마

However a sequence of random letters like this does not make any sense. Normally, Korean text is formed with a sequence of words, formed by a sequence of syllables, which are each formed with two to three types of the keyboard, each uniquely called choseong, jungseong, jongseong [3]. (though in casual chatting, just one type of the keyboard is common as well, ex: "ㅋ ㅋ ㅋ") So now we educate our cat to type syllables:

로켁불됴약 니앙굷 췡바이뀋노기

Then we notice that in Korean, the syllable '이' is more frequently used than '앙' and definitely much more than '뀋' or '굷'. If our cat knew that, he would have typed something like this:

다이는가 고다하에지 요그이데습

But then, this still doesn't make any sense because the syllables don't form words. Rather than generating each syllable independently, we can generate a syllable base on its precedent so that after '하' follows '다', and after '그' we get '리' and '고'. In mathematical terms, this process is better known as a Markov chain (http://en.wikipedia.org/wiki/Markov_chain):

국의의하되고인정부가는 요구한 대통령은 2조 사면 기밀과 헌법률로 위하의 위하며

Our "sentence" above was generated with "bigrams", or "2-grams". If we wish to make more sense out of it, we could try "3-grams" (better known as trigrams) or "4-grams". Or, we could extend the same idea to longer sequences of letters, such as morphemes. Let's try this with actual code.

Warning: The code below works with Python3, and not with Python2! You can run the code by typing *python3 generate.py* on your terminal.

```
#! /usr/bin/python3
# -*- coding: utf-8 -*-

import bisect
import itertools
import random

import nltk
from konlpy.corpus import kolaw
from konlpy.tag import Mecab # MeCab tends to reserve the original form of morphemes


def generate_sentence(cfdist, word, num=15):
    sentence = []

    # Generate words until we meet a period
    while word!='.':
        sentence.append(word)

        # Generate the next word based on probability
        choices, weights = zip(*cfdist[word].items())
        cumdist = list(itertools.accumulate(weights))
        x = random.random() * cumdist[-1]
        word = choices[bisect.bisect(cumdist, x)]

    return ' '.join(sentence)


def calc_cfd(doc):
    # Calculate conditional frequency distribution of bigrams
    words = [w for w, t in Mecab().pos(doc)]
    bigrams = nltk.bigrams(words)
```

[3] Please refer to the Hangul Jamo in Unicode character code charts (http://www.unicode.org/charts/).

```
    return nltk.ConditionalFreqDist(bigrams)


if __name__=='__main__':
    nsents = 5 # Number of sentences
    initstr = u'국가' # Try replacing with u'국가', u'대통령', etc

    doc = kolaw.open('constitution.txt').read()
    cfd = calc_cfd(doc)

    for i in range(nsents):
        print('%d. %s' % (i, generate_sentence(cfd, initstr)))
```

- Console:

```
0. 국민 은 법률 로 인한 배상 은 특별 한 영장 을 청구 할 수 있 어서 최고 득표자 가 제출 한 유일 한 때 에 의하 여
1. 국민 투표 의 범죄 에 의하 여 발언 하 지 아니한 회의 는 요건 은 1988 년 으로 대통령 이 의결 한다
2. 국민 경제 자문 기구 를 타파 하 기 위하 여 긴급 한 형태 로 정한다
3. 국민 은 이 정하 는 헌법 시행 당시 의 심사 할 수 있 다
4. 국민 의 기본 질서 를 진다
```

Well, that's a lot better than the random string typed by our cat! The sentences look a bit ugly because there are whitespaces between all morphemes, whereas in actual Korean text, they would be stuck together. Also note that this text generation model was built from a single document. If you were to build a model with a much larger corpus, you wouldn't even have to do morpheme analysis because you would have enough data for any potential *initstr*. Other than that, there are much more ways to improve this model! Feel free to experiment.

For more on generating text, you can refer to Jon Bently's Programming Pearls (Section 15.3) (http://www.cs.bell-labs.com/cm/cs/pearls/sec153.html).

Furthermore, if you use language models (http://en.wikipedia.org/wiki/Language_model), you can evaluate your random texts and figure out whether they actually make sense in a statistical point of view.

Drawing a word cloud

Below shows a code example that crawls a National Assembly bill from the web, extract nouns and draws a word cloud - from head to tail in Python.

You can change the bill number (i.e., `bill_num`), and see how the word clouds differ per bill. (ex: '1904882', '1904883', 'ZZ19098', etc)

```
#! /usr/bin/python2.7
# -*- coding: utf-8 -*-

from collections import Counter
import urllib
import random
import webbrowser

from konlpy.tag import Hannanum
from lxml import html
import pytagcloud # requires Korean font support
import sys

if sys.version_info[0] >= 3:
    urlopen = urllib.request.urlopen
else:
    urlopen = urllib.urlopen


r = lambda: random.randint(0,255)
color = lambda: (r(), r(), r())
```

```
def get_bill_text(billnum):
    url = 'http://pokr.kr/bill/%s/text' % billnum
    response = urlopen(url).read().decode('utf-8')
    page = html.fromstring(response)
    text = page.xpath(".//div[@id='bill-sections']/pre/text()")[0]
    return text

def get_tags(text, ntags=50, multiplier=10):
    h = Hannanum()
    nouns = h.nouns(text)
    count = Counter(nouns)
    return [{ 'color': color(), 'tag': n, 'size': c*multiplier }\
                for n, c in count.most_common(ntags)]

def draw_cloud(tags, filename, fontname='Noto Sans CJK', size=(800, 600)):
    pytagcloud.create_tag_image(tags, filename, fontname=fontname, size=size)
    webbrowser.open(filename)


bill_num = '1904882'
text = get_bill_text(bill_num)
tags = get_tags(text)
print(tags)
draw_cloud(tags, 'wordcloud.png')
```

Note: The PyTagCloud (https://pypi.python.org/pypi/pytagcloud) installed in PyPI may not be sufficient for drawing wordclouds in Korean. You may add eligible fonts - that support the Korean language - manually, or install the Korean supported version here (https://github.com/e9t/PyTagCloud).

Multithreading with KoNLPy

Sometimes it gets boring to wait for tagging jobs to end. How about using some concurrency tricks? Python supports multithreading and multiprocessing out-of-the-box, and you can use them with KoNLPy as well. Here's an example using multithreading.

```
#! /usr/bin/python2.7
# -*- coding: utf-8 -*-

from konlpy.tag import Kkma
from konlpy.corpus import kolaw
from threading import Thread
import jpype

def do_concurrent_tagging(start, end, lines, result):
    jpype.attachThreadToJVM()
    l = [k.pos(lines[i]) for i in range(start, end)]
    result.append(l)
    return

if __name__=="__main__":
    import time

    print('Number of lines in document:')
    k = Kkma()
    lines = kolaw.open('constitution.txt').read().splitlines()
    nlines = len(lines)
    print(nlines)

    print('Batch tagging:')
    s = time.clock()
    result = []
    l = [k.pos(line) for line in lines]
    result.append(l)
    t = time.clock()
    print(t - s)

    print('Concurrent tagging:')
    result = []
    t1 = Thread(target=do_concurrent_tagging, args=(0, int(nlines/2), lines, result))
    t2 = Thread(target=do_concurrent_tagging, args=(int(nlines/2), nlines, lines, result))
    t1.start(); t2.start()
    t1.join(); t2.join()

    m = sum(result, []) # Merge results
    print(time.clock() - t)
```

- Console:

```
Number of lines in document:
356
Batch tagging:
37.758173
Concurrent tagging:
8.037602
```

Check out how much faster it gets!

Note:

- **Some useful references on concurrency with Python:**
  - 장혜식, "파이썬은 멀티코어 쥐도 쓰잘데기가 없나요?"에 대한 파이썬 2.6의 대답 (http://openlook.org/blog/2008/06/28/python-multiprocessing/), 2008.
  - 하용호, 파이썬으로 클라우드 하고 싶어요 (http://www.slideshare.net/devparan/h3-2011-c6-python-and-cloud), 2011.

5.5 Running tests

KoNLPy has tests to evaulate its quality. To perform a test, use the code below.

```
$ pip install pytest
$ cd konlpy
$ python -m pytest test/* # for Python 2.x
$ python3 -m pytest test/* # for Python 3.x
```

Note: To see testing logs on KoNLPy, see here (https://docs.google.com/spreadsheets/d/1Ii_L9NF9gSLbsJOGqsf-zfqTtyhhthmJWNC2kgUDIsU/edit?usp=sharing).

Note: To see known bugs/issues, see here (https://github.com/konlpy/konlpy/labels/bug).

5.6 References

Note: Please modify this document (https://github.com/konlpy/konlpy/blob/master/docs/references.rst) if anything is erroneous or not included. Last updated at February 27, 2015.

5.6.1 Korean morpheme analyzer tools

When you're analyzing Korean text, the most basic task you need to perform is morphological analysis. There are several libraries in various programming languages to achieve this:

C/C++

- **KTS (http://wiki.kldp.org/wiki.php/KTS) (1995) GPL v2**
  - By 이상호, 서정연, 오영환 (KAIST & 서강대)
  - code (https://github.com/suapapa/kts)
- **MACH (http://cs.sungshin.ac.kr/ shim/demo/mach.html) (2002) custom**
  - By Prof. Kwangseob Shim (성신여대)
- **MeCab-ko (https://bitbucket.org/eunjeon/mecab-ko/) (2013) GPL LGPL BSD**
  - By Yong-woon Lee and Youngho Yoo

Java

- **Arirang (http://cafe.naver.com/korlucene) (2009) Apache v2**
  - By SooMyung Lee
  - code (http://sourceforge.net/projects/lucenekorean)
- **Hannanum (http://semanticweb.kaist.ac.kr/home/index.php/HanNanum) (1999) GPL v3**
  - By Prof. Key-Sun Choi Key's research team (KAIST)
  - code (http://kldp.net/projects/hannanum/src), docs (http://semanticweb.kaist.ac.kr/research/hannanum/j/javadoc/)
- **KKMA (http://kkma.snu.ac.kr) (2010) GPL v2**
  - By Prof. Sang-goo Lee's research team (서울대)
  - Generates morpheme candidates using dynamic programming

  - Tags morphemes by checking neighbors, and employing some heuristics and HMM models
  - Developer blog: Dongjoo Lee (http://therocks.tistory.com)
- **KOMORAN (http://shineware.tistory.com/tag/KOMORAN) (2013) Apache v2**
  - By *shineware*

Python

- **KoNLPy (http://konlpy.org) (2014) GPL v3**
  - By Lucy Park (서울대)
- **UMorpheme (https://pypi.python.org/pypi/UMorpheme) (2014) MIT**
  - By Kyunghoon Kim (UNIST)

R

- **KoNLP (https://github.com/haven-jeon/KoNLP) (2011) GPL v3**
  - By Heewon Jeon

Others

- K-LIWC (http://k-liwc.ajou.ac.kr/) (아주대)
- **KRISTAL-IRMS (http://www.kristalinfo.com/) (KISTI)**
  - Development history (http://spasis.egloos.com/9507)
- Korean XTAG (http://www.cis.upenn.edu/ xtag/koreantag/) (UPenn)
- HAM (http://nlp.kookmin.ac.kr/HAM/kor/ham-intr.html) (국민대)
- POSTAG/K (http://nlp.postech.ac.kr/ project/DownLoad/k_api.html) (포스텍)
- Speller (http://speller.cs.pusan.ac.kr/) (부산대)
- UTagger (http://203.250.77.242:5900/) (울산대)
- (No name) (http://cl.korea.ac.kr/Demo/dglee/index.html) (고려대)

5.6.2 Other NLP tools

- **Hangulize (http://www.hangulize.org/) - By Heungsub Lee Python**
  - Hangul transcription tool to 38+ languages
- **Hanja (https://github.com/suminb/hanja) - By Sumin Byeon Python**
  - Hanja to hangul transcriptor
- **Jamo (http://github.com/JDong820/python-jamo) - By Joshua Dong Python**
  - Hangul syllable decomposition and synthesis
- **KoreanParser (http://semanticweb.kaist.ac.kr/home/index.php/KoreanParser) - By DongHyun Choi, Jungyeul Park, K**
  - Language parser
- **Korean (http://pythonhosted.org/korean) - By Heungsub Lee Python**
  - Package for attaching particles (josa) in sentences

5.6.3 Corpora

- **Yonsei Corpus, 연세대, 1987.**
  - 42M tokens of Korean since the 1960s
- **Korea University Korean Corpus, 1995.**
  - 10M tokens of Korean of 1970-90s
- **HANTEC 2.0 (http://www.kristalinfo.com/download/#hantec), KISTI & 충남대, 1998-2003.**
  - 120,000 test documents (237MB)
  - 50 TREC-type questions for QA (48KB)
- **HKIB-40075 (http://www.kristalinfo.com/TestCollections/readme_hkib.html), KISTI & 한국일보, 2002.**
  - 40,075 test documents for text categorization (88MB)
- KAIST Corpus (http://semanticweb.kaist.ac.kr/home/index.php/KAIST_Corpus), KAIST, 1997-2005.
- Sejong Corpus (http://www.sejong.or.kr/), National Institute of the Korean Language, 1998-2007.

5.6.4 General NLP resources

- Google NLP publications (http://research.google.com/pubs/NaturalLanguageProcessing.html)
- Lingpipe (http://alias-i.com/lingpipe/)
- Microsoft NLP group (Redmond) (http://research.microsoft.com/en-us/groups/nlp/)
- 부산대 NLP 관련사이트 목록 (http://borame.cs.pusan.ac.kr/ai_home/site/site1.html)
- Sejong semantic search system (http://sejong21.org)
- 한글 및 한국어 정보처리 학술대회 (http://cs.kangwon.ac.kr/ hclt2014/)

CHAPTER 6

API

6.1 konlpy Package

6.1.1 Subpackages

tag Package

Note: Initial runs of each class method may require some time to load dictionaries (< 1 *min*). Second runs should be faster.

`Hannanum` Class

class konlpy.tag._hannanum.**Hannanum**(*jvmpath=None*)

Wrapper for JHannanum (http://semanticweb.kaist.ac.kr/home/index.php/HanNanum).

JHannanum is a morphological analyzer and POS tagger written in Java, and developed by the Semantic Web Research Center (SWRC) (http://semanticweb.kaist.ac.kr/) at KAIST since 1999.

```
>>> from konlpy.tag import Hannanum
>>> hannanum = Hannanum()
>>> print(hannanum.analyze(u'롯데마트의 흑마늘 양념 치킨이 논란이 되고 있다.'))
[[[('롯데마트', 'ncn'), ('의', 'jcm')], [('롯데마트의', 'ncn')], [('롯데마트', 'nqq'), ('의', 'jcm'
>>> print(hannanum.morphs(u'롯데마트의 흑마늘 양념 치킨이 논란이 되고 있다.'))
['롯데마트', '의', '흑마늘', '양념', '치킨', '이', '논란', '이', '되', '고', '있', '다', '.']
>>> print(hannanum.nouns(u'다람쥐 헌 쳇바퀴에 타고파'))
['다람쥐', '쳇바퀴', '타고파']
>>> print(hannanum.pos(u'웃으면 더 행복합니다!'))
[('웃', 'P'), ('으면', 'E'), ('더', 'M'), ('행복', 'N'), ('하', 'X'), ('ㅂ니다', 'E'), ('!', 'S')
```

Parameters **jvmpath** – The path of the JVM passed to `init_jvm()` (page 31).

analyze(*phrase*)

Phrase analyzer.

This analyzer returns various morphological candidates for each token. It consists of two parts: 1) Dictionary search (chart), 2) Unclassified term segmentation.

morphs(*phrase*)

Parse phrase to morphemes.

nouns(*phrase*)

Noun extractor.

pos (*phrase*, *ntags=9*, *flatten=True*)
POS tagger.

This tagger is HMM based, and calculates the probability of tags.

Parameters

- **ntags** – The number of tags. It can be either 9 or 22.
- **flatten** – If False, preserves eojeols.

Kkma Class

class konlpy.tag._kkma.**Kkma** (*jvmpath=None*)
Wrapper for Kkma (http://kkma.snu.ac.kr).

Kkma is a morphological analyzer and natural language processing system written in Java, developed by the Intelligent Data Systems (IDS) Laboratory at SNU (http://snu.ac.kr).

```
>>> from konlpy.tag import Kkma
>>> kkma = Kkma()
>>> print(kkma.morphs(u'공부를 하면할수록 모르는게 많다는 것을 알게 됩니다.'))
['공부', '를', '하', '면', '하', 'ㄹ수록', '모르', '는', '것', '이', '많', '다는', '것', '을', '알',
>>> print(kkma.nouns(u'대학에서 DB, 통계학, 이산수학 등을 배웠지만...'))
['대학', '통계학', '이산', '이산수학', '수학', '등']
>>> print(kkma.pos(u'다 까먹어버렸네요?ㅋㅋ'))
[('다', 'MAG'), ('까먹', 'VV'), ('어', 'ECD'), ('버리', 'VXV'), ('었', 'EPT'), ('네요', 'EFN'),
>>> print(kkma.sentences(u'그래도 계속 공부합니다. 재밌으니까!'))
['그래도 계속 공부합니다.', '재밌으니까!']
```

Parameters **jvmpath** – The path of the JVM passed to `init_jvm()` (page 31).

morphs (*phrase*)
Parse phrase to morphemes.

nouns (*phrase*)
Noun extractor.

pos (*phrase*, *flatten=True*)
POS tagger.

Parameters **flatten** – If False, preserves eojeols.

sentences (*phrase*)
Sentence detection.

Komoran Class

class konlpy.tag._komoran.**Komoran** (*jvmpath=None*, *dicpath=None*)
Wrapper for KOMORAN (http://shineware.tistory.com/entry/KOMORAN-ver-24).

KOMORAN is a relatively new open source Korean morphological analyzer written in Java, developed by Shineware (http://shineware.co.kr), since 2013.

```
>>> from konlpy.tag import Komoran
>>> komoran = Komoran()
>>> print(komoran.morphs(u'우왕 코모란도 오픈소스가 되었어요'))
['우왕', '코', '모란', '도', '오픈소스', '가', '되', '었', '어요']
>>> print(komoran.nouns(u'오픈소스에 관심 많은 멋진 개발자님들!'))
['오픈소스', '관심', '개발자']
>>> print(komoran.pos(u'원칙이나 기체 설계와 엔진·레이더·항법장비 등'))
[('원칙', 'NNG'), ('이나', 'JC'), ('기체', 'NNG'), ('설계', 'NNG'), ('와', 'JC'), ('엔진', 'NNG'),
```

Parameters

- **jvmpath** – The path of the JVM passed to `init_jvm()` (page 31).
- **dicpath** – The path of dictionary files. The KOMORAN system dictionary is loaded by default.

morphs (*phrase*)
Parse phrase to morphemes.

nouns (*phrase*)
Noun extractor.

pos (*phrase*, *flatten=True*)
POS tagger.

Parameters **flatten** – If False, preserves eojeols.

`Mecab` Class

Warning: `Mecab()` is not supported on `Windows 7`.

class `konlpy.tag._mecab.`**Mecab** (*dicpath='/usr/local/lib/mecab/dic/mecab-ko-dic'*)
Wrapper for MeCab-ko morphological analyzer.

MeCab (https://code.google.com/p/mecab/), originally a Japanese morphological analyzer and a POS tagger developed by the Graduate School of Informatics in Kyoto University, was modified to MeCab-ko by the Eunjeon Project (http://eunjeon.blogspot.kr/) to adapt to the Korean language.

In order to use MeCab-ko within KoNLPy, follow the directions in *optional-installations*.

```
>>> # MeCab installation needed
>>> from konlpy.tag import Mecab
>>> mecab = Mecab()
>>> print(mecab.morphs(u'영등포구청역에 있는 맛집 좀 알려주세요.'))
['영등포구', '청역', '에', '있', '는', '맛집', '좀', '알려', '주', '세요', '.']
>>> print(mecab.nouns(u'우리나라에는 무릎 치료를 잘하는 정형외과가 없는가!'))
['우리', '나라', '무릎', '치료', '정형외과']
>>> print(mecab.pos(u'자연주의 쇼핑몰은 어떤 곳인가?'))
[('자연', 'NNG'), ('주', 'NNG'), ('의', 'JKG'), ('쇼핑몰', 'NNG'), ('은', 'JX'), ('어떤', 'MM'),
```

Parameters **dicpath** – The path of the MeCab-ko dictionary.

morphs (*phrase*)
Parse phrase to morphemes.

nouns (*phrase*)
Noun extractor.

pos (*phrase*, *flatten=True*)
POS tagger.

Parameters **flatten** – If False, preserves eojeols.

`Twitter` Class

class `konlpy.tag._twitter.`**Twitter** (*jvmpath=None*)
Wrapper for Twitter Korean Text (https://github.com/twitter/twitter-korean-text).

Twitter Korean Text is an open source Korean tokenizer written in Scala, developed by Will Hohyon Ryu.

```
>>> from konlpy.tag import Twitter
>>> twitter = Twitter()
>>> print(twitter.morphs(u'단독입찰보다 복수입찰의 경우'))
['단독', '입찰', '보다', '복수', '입찰', '의', '경우', '가']
>>> print(twitter.nouns(u'유일하게 항공기 체계 종합개발 경험을 갖고 있는 KAI는'))
['유일하', '항공기', '체계', '종합', '개발', '경험']
>>> print(twitter.phrases(u'날카로운 분석과 신뢰감 있는 진행으로'))
['분석', '분석과 신뢰감', '신뢰감', '분석과 신뢰감 있는 진행', '신뢰감 있는 진행', '진행', '신뢰']
>>> print(twitter.pos(u'이것도 되나욬ㅋㅋ'))
[('이', 'Determiner'), ('것', 'Noun'), ('도', 'Josa'), ('되나욬', 'Noun'), ('ㅋㅋ', 'KoreanParti
>>> print(twitter.pos(u'이것도 되나욬ㅋㅋ', norm=True))
[('이', 'Determiner'), ('것', 'Noun'), ('도', 'Josa'), ('되', 'Verb'), ('나요', 'Eomi'), ('ㅋㅋ'
>>> print(twitter.pos(u'이것도 되나욬ㅋㅋ', norm=True, stem=True))
[('이', 'Determiner'), ('것', 'Noun'), ('도', 'Josa'), ('되다', 'Verb'), ('ㅋㅋ', 'KoreanPartic
```

Parameters **jvmpath** – The path of the JVM passed to `init_jvm()` (page 31).

morphs (*phrase*)
Parse phrase to morphemes.

nouns (*phrase*)
Noun extractor.

phrases (*phrase*)
Phrase extractor.

pos (*phrase*, *norm=False*, *stem=False*)
POS tagger. In contrast to other classes in this subpackage, this POS tagger doesn't have a *flatten* option, but has *norm* and *stem* options. Check the parameter list below.

Parameters

- **norm** – If True, normalize tokens.
- **stem** – If True, stem tokens.

See also:

Korean POS tags comparison chart (https://docs.google.com/spreadsheets/d/1OGAjUvalBuX-oZvZ_-9tEfYD2gQe7hTGsgUpiiBSXI8/edit#gid=0)

Compare POS tags between several Korean analytic projects. (In Korean)

corpus Package

class konlpy.corpus.**CorpusLoader**(*name=None*)
Loader for corpora. For a complete list of corpora available in KoNLPy, refer to *Corpora* (page 25).

```
>>> from konlpy.corpus import kolaw
>>> fids = kolaw.fileids()
>>> fobj = kolaw.open(fids[0])
>>> print fobj.read(140)
대한민국헌법

유구한 역사와 전통에 빛나는 우리 대한국민은 3·1운동으로 건립된 대한민국임시정부의 법통과 불의에 항거한 4·19민주이
```

abspath (*filename=None*)
Absolute path of corpus file. If `filename` is *None*, returns absolute path of corpus.

Parameters **filename** – Name of a particular file in the corpus.

fileids()
List of file IDs in the corpus.

open(*filename*)
Method to open a file in the corpus. Returns a file object.

Parameters **filename** – Name of a particular file in the corpus.

6.1.2 data Module

konlpy.data.**find**(*resource_url*)
Find the path of a given resource URL by searching through directories in konlpy.data.path. If the given resource is not found, raise a LookupError, whose message gives a pointer to the installation instructions for konlpy.download().

Parameters **resource_url** (*str* (http://docs.python.org/library/functions.html#str)) – The URL of the resource to search for. URLs are posix-style relative path names, such as corpora/kolaw. In particular, directory names should always be separated by the forward slash character (i.e., '/'), which will be automatically converted to a platform-appropriate path separator by KoNLPy.

konlpy.data.**load**(*resource_url*, *format='auto'*)
Load a given resource from the KoNLPy data package. If no format is specified, load() will attempt to determine a format based on the resource name's file extension. If that fails, load() will raise a ValueError exception.

Parameters

- **resource_url** (*str* (http://docs.python.org/library/functions.html#str)) – A URL specifying where the resource should be loaded from.
- **format** – Format type of resource.

konlpy.data.**path = ['/home/docs/konlpy_data', '/usr/share/konlpy_data', '/usr/local/share/konlpy_data', '/usr/lib/konl**
A list of directories where the KoNLPy data package might reside. These directories will be checked in order when looking for a resource. Note that this allows users to substitute their own versions of resources.

class konlpy.data.**FileSystemPathPointer**(*path*)
Bases: konlpy.data.PathPointer (page 30), str (http://docs.python.org/library/functions.html#str)

A path pointer that identifies a file by an absolute path.

file_size()

open(*encoding='utf-8'*)

class konlpy.data.**PathPointer**
Bases: object (http://docs.python.org/library/functions.html#object)

An abstract base class for path pointers. One subclass exists: 1. FileSystemPathPointer: Identifies a file by an absolute path.

file_size()

open(*encoding='utf-8'*)

6.1.3 downloader Module

class konlpy.downloader.**Downloader**(*download_dir=None*)
Bases: object (http://docs.python.org/library/functions.html#object)

A class used to access the KoNLPy data server, which can be used to download packages.

INDEX_URL = 'http://konlpy.github.io/konlpy-data/index.json'

INSTALLED = 'installed'

NOT_INSTALLED = 'not installed'

PACKAGE_URL = 'http://konlpy.github.io/konlpy-data/packages/%s.%s'

SCRIPT_URL = 'http://konlpy.github.io/konlpy-data/packages/%s.sh'

STALE = 'corrupt or out of date'

download(*id=None*, *download_dir=None*)
The KoNLPy data downloader. With this module you can download corpora, models and other data packages that can be used with KoNLPy.

Individual packages can be downloaded by passing a single argument, the package identifier for the package that should be downloaded:

```
>>> download('corpus/kobill')
[konlpy_data] Downloading package 'kobill'...
[konlpy_data]   Unzipping corpora/kobill.zip.
```

To download all packages, simply call `download` with the argument 'all':

```
>>> download('all')
[konlpy_data] Downloading package 'kobill'...
[konlpy_data]   Unzipping corpora/kobill.zip.
...
```

status(*info_or_id=None*, *download_dir=None*)

konlpy.downloader.**default_download_dir**()
Returns the directory to which packages will be downloaded by default. This value can be overriden using the constructor, or on a case-by-case basis using the `download_dir` argument when calling `download()`.

On Windows, the default download directory is `PYTHONHOME/lib/konlpy`, where *PYTHONHOME* is the directory containing Python e.g., `C:\Python27`.

On all other platforms, the default directory is the first of the following which exists or which can be created with write permission: `/usr/share/konlpy_data`, `/usr/local/share/konlpy_data`, `/usr/lib/konlpy_data`, `/usr/local/lib/konlpy_data`, `~/konlpy_data`.

6.1.4 jvm Module

konlpy.jvm.**init_jvm**(*jvmpath=None*)
Initializes the Java virtual machine (JVM).

Parameters **jvmpath** – The path of the JVM. If left empty, inferred by `jpype.getDefaultJVMPath()`.

6.1.5 utils Module

class konlpy.utils.**UnicodePrinter**(*indent=1*, *width=80*, *depth=None*, *stream=None*)
Bases: `pprint.PrettyPrinter` (http://docs.python.org/library/pprint.html#pprint.PrettyPrinter)

format(*object*, *context*, *maxlevels*, *level*)
Overrided method to enable Unicode pretty print.

konlpy.utils.**char2hex**(*c*)
Converts a unicode character to hex.

```
>>> char2hex(u'음')
'0xc74c'
```

konlpy.utils.**concordance**(*phrase*, *text*, *show=False*)
Find concordances of a phrase in a text.

The farmost left numbers are indices, that indicate the location of the phrase in the text (by means of tokens). The following string, is part of the text surrounding the phrase for the given index.

Parameters

- **phrase** – Phrase to search in the document.
- **text** – Target document.
- **show** – If `True`, shows locations of the phrase on the console.

```
>>> from konlpy.corpus import kolaw
>>> from konlpy.tag import Mecab
>>> from konlpy import utils
>>> constitution = kolaw.open('constitution.txt').read()
>>> idx = utils.concordance(u'대한민국', constitution, show=True)
0       대한민국헌법 유구한 역사와
9       대한국민은 3·1운동으로 건립된 대한민국임시정부의 법통과 불의에
98      총강 제1조 ① 대한민국은 민주공화국이다. ②대한민국의
100     ① 대한민국은 민주공화국이다. ②대한민국의 주권은 국민에게
110     나온다. 제2조 ① 대한민국의 국민이 되는
126     의무를 진다. 제3조 대한민국의 영토는 한반도와
133     부속도서로 한다. 제4조 대한민국은 통일을 지향하며,
147     추진한다. 제5조 ① 대한민국은 국제평화의 유지에
787     군무원이 아닌 국민은 대한민국의 영역안에서는 중대한
1836    파견 또는 외국군대의 대한민국 영역안에서의 주류에
3620    경제 제119조 ① 대한민국의 경제질서는 개인과
>>> idx
[0, 9, 98, 100, 110, 126, 133, 147, 787, 1836, 3620]
```

konlpy.utils.**csvread**(*f*, *encoding=u'utf-8'*)

Reads a csv file.

Parameters **f** – File object.

```
>>> from konlpy.utils import csvread
>>> with open('some.csv', 'r') as f:
        print csvread(f)
[[u'이 / NR', u'차 / NNB'], [u'나가 / VV', u'네 / EFN']]
```

konlpy.utils.**csvwrite**(*data*, *f*)

Writes a csv file.

Parameters **data** – A list of list.

```
>>> from konlpy.utils import csvwrite
>>> d = [[u'이 / NR', u'차 / NNB'], [u'나가 / VV', u'네 / EFN']]
>>> with open('some.csv', 'w') as f:
        csvwrite(d, f)
```

konlpy.utils.**hex2char**(*h*)

Converts a hex character to unicode.

```
>>> print hex2char('c74c')
음
>>> print hex2char('0xc74c')
음
```

konlpy.utils.**load_txt**(*filename*, *encoding=u'utf-8'*)

Text file loader. To read a file, use ‘‘read_txt()‘‘instead.

konlpy.utils.**partition**(*list_*, *indices*)

Partitions a list to several parts using indices.

Parameters

- **list** – The target list.
- **indices** – Indices to partition the target list.

konlpy.utils.**pprint**(*obj*)
Unicode pretty printer.

```
>>> import pprint, konlpy
>>> pprint.pprint([u"Print", u"유니코드", u"easily"])
[u'Print', u'유니코드', u'easily']
>>> konlpy.utils.pprint([u"Print", u"유니코드", u"easily"])
['Print', '유니코드', 'easily']
```

konlpy.utils.**read_txt**(*filename*, *encoding=u'utf-8'*)
Text file reader.

konlpy.utils.**select**(*phrase*)
Replaces some ambiguous punctuation marks to simpler ones.

CHAPTER 7

Indices and tables

- *genindex*
- *modindex*
- *search*
- `changelog`

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