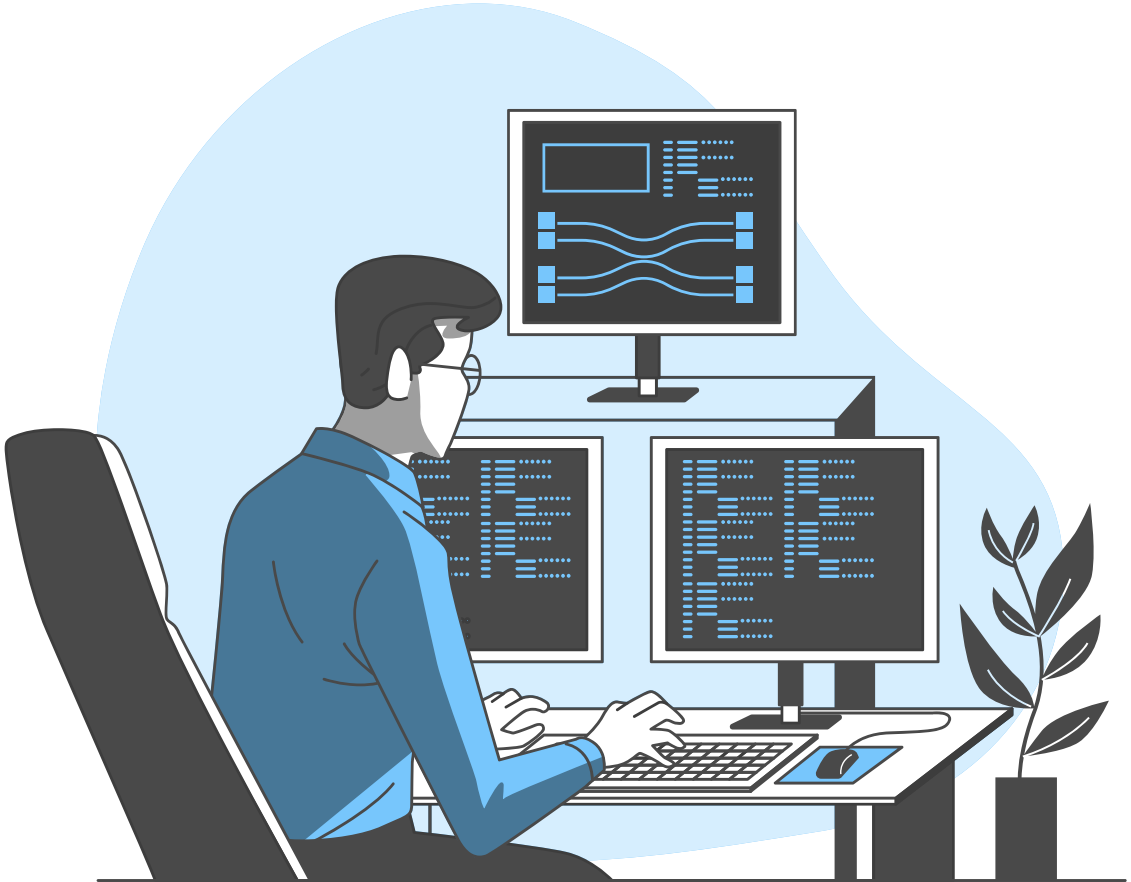


spaCy

2023/03/02

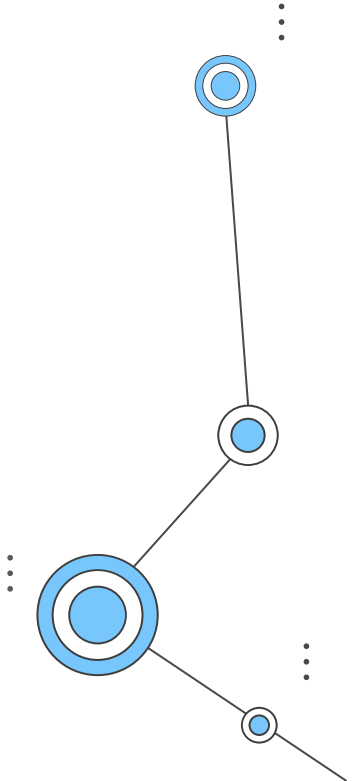
spaCy Intro

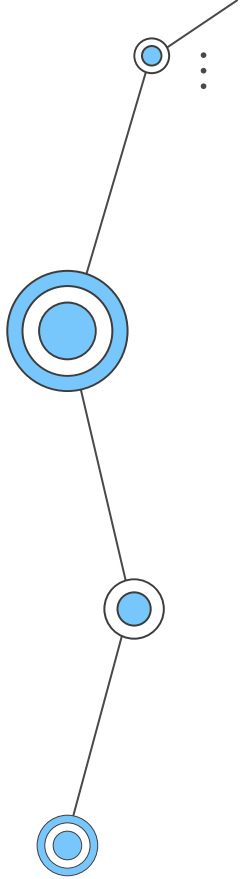
Features & Pipeline

spaCy & Models

Models

Conclusion





01 Quick Introduction

Why do we use spaCy?

Models & Languages · spaCy Usage Documentation

Feature comparison

Here's a quick comparison of the functionalities offered by spaCy, NLTK and CoreNLP.

	SPACY	NLTK	CORENLP
Programming language	Python	Python	Java / Python
Neural network models	✓	✗	✓
Integrated word vectors	✓	✗	✗
Multi-language support	✓	✓	✓
Tokenization	✓	✓	✓
Part-of-speech tagging	✓	✓	✓
Sentence segmentation	✓	✓	✓
Dependency parsing	✓	✗	✓
Entity recognition	✓	✓	✓
Entity linking	✓	✓	✗
Coreference resolution	✗	✗	✓

- To install spaCy

```
$ pip install spacy
```

- To install spaCy in one specific version of python

```
$ pip3.5 install spacy
```

- To install spaCy with conda

```
$ conda install -c conda-forge spacy
```

- To install spaCy on macOS/OS X

```
$ xcode-select -install
```

- To download language model

```
$ python -m spacy download en
$ python -m spacy download de
$ python -m spacy download fr
```

- Or you can choose what model you want to download

```
$ python -m spacy download en_core_web_md
```

- Now you can import spaCy, load model, and parse text

```
$ pip install spacy
$ python -m spacy download en
 import spacy
 nlp = spacy.load('en_core_web_md')
 doc = nlp('I have a ginger cat.')
```

```
$ pip install spacy
$ python -m spacy download en_core_web_md
 import spacy
 nlp = spacy.load('en_core_web_md')
 doc = nlp('I have a ginger cat.')
```

spaCy linguistic features

Tokenization
Lemmatization

Cf. stemming

POS tagging

Dependency Parsing

Sentence structure displayed via dependencies among the tokens.

NER

Rule-Based Matching

E.g. Hashtag and emoji

Vectorization

slido

Which one of the following is not a token?

ⓘ Start presenting to display the poll results on this slide.

slido

Not "lemma"?

ⓘ Start presenting to display the poll results on this slide.

spaCy linguistic features

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Sentence structure displayed via dependencies among the tokens.

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Rule-Based Matching

E.g. Hashtag and emoji

Vectorization

Chinese NLP pipeline in spaCy

01 Tokenization

02 POS tagging

03 Dependency parsing

04 NER

```
# load language model
nlp = spacy.load('zh_core_web_lg')
```

```
# parse text
doc1 = nlp("我最喜歡自然語言處理了")
doc2 = nlp("我最喜歡自然語言處理了。所以秒選謝舒凱老師的課！")
```

```
# doc 2

print(doc2.text)
print(doc2[1])
sen = list(doc2.sents)
print(sen)
print(doc2.ents)
```

Chinese NLP pipeline in spaCy

01 Tokenization

02 POS tagging

03 Dependency parsing

04 NER

```
doc = nlp("我最喜歡自然語言處理了")

for token in doc:
    print(token.text, token.pos_,
```

```
我 PRON PN nsubj True
最 ADV AD advmod True
喜歡 VERB VV ROOT False
自然 NOUN NN compound:nn False
語言 NOUN NN nsubj False
處理 VERB VV ccomp False
了 PART AS aux:asp True
```

Chinese NLP pipeline in spaCy

01 Tokenization

02 POS tagging

03 Dependency parsing

04 NER

```
下課 NOUN noun NT temporal noun
我 PRON pronoun PN pronoun
要 VERB verb VV other verb
知道 VERB verb VC 是 (copula)
寶雅 PROPN proper noun NR proper noun
屈臣氏 PROPN proper noun NR proper noun
他們 PRON pronoun PN pronoun
```

token.pos_:
coarse-grained pos

token.tag_:
fine-grained pos

Chinese NLP pipeline in spaCy

01 Tokenization

02 POS tagging

03 **Dependency parsing**

04 NER

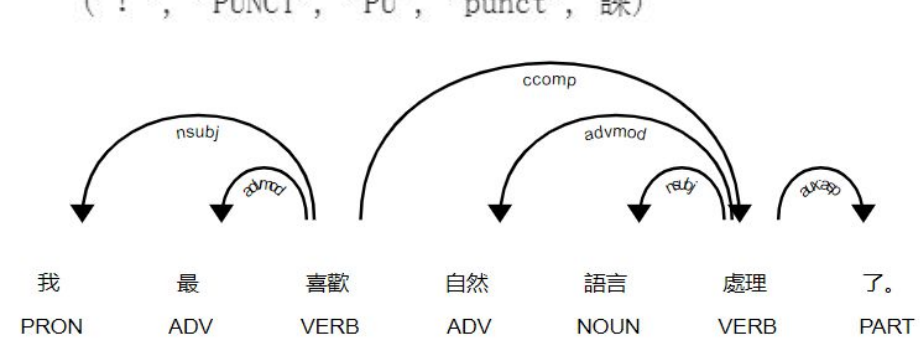
```
('我', 'PRON', 'PN', 'nsubj', 喜歡)
('最', 'ADV', 'AD', 'advmod', 喜歡)
('喜歡', 'VERB', 'VV', 'ROOT', 喜歡)
('自然', 'ADV', 'AD', 'advmod', 處理)
('語言', 'NOUN', 'NN', 'nsubj', 處理)
('處理', 'VERB', 'VV', 'ccomp', 喜歡)
('了', 'PART', 'SP', 'aux:asp', 處理)
('。', 'PUNCT', 'PU', 'punct', 喜歡)
('所以', 'ADV', 'AD', 'advmod', 課)
('秒選', 'PROPN', 'NR', 'name', 謝)
('謝', 'PROPN', 'NR', 'dep', 課)
('舒凱', 'PROPN', 'NR', 'compound:nn', 老師)
('老師', 'NOUN', 'NN', 'nmod:assmod', 課)
('的', 'PART', 'DEG', 'case', 老師)
('課', 'NOUN', 'NN', 'ROOT', 課)
('！', 'PUNCT', 'PU', 'punct', 課)
```

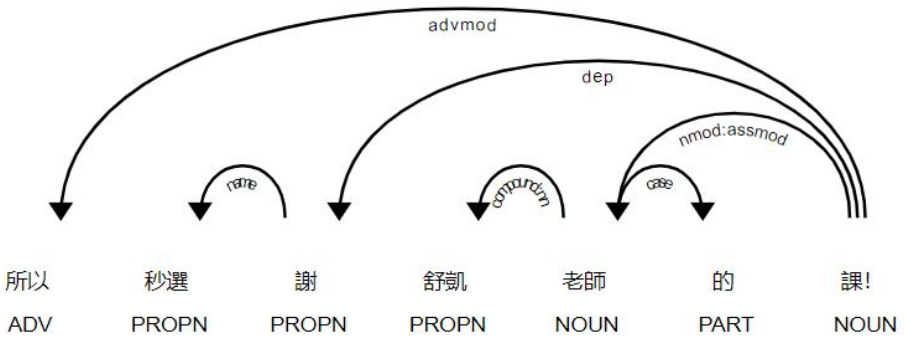
Chinese NLP pipeline in spaCy

03 Dependency parsing

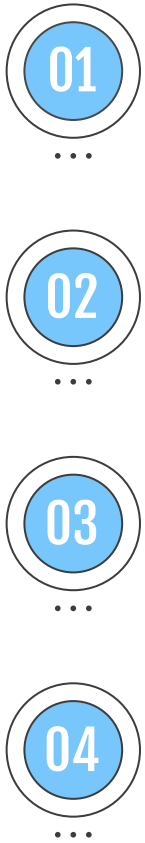
```
('我', 'PRON', 'PN', 'nsubj', 喜歡)
('最', 'ADV', 'AD', 'advmod', 喜歡)
('喜歡', 'VERB', 'VV', 'ROOT', 喜歡)
('自然', 'ADV', 'AD', 'advmod', 處理)
('語言', 'NOUN', 'NN', 'nsubj', 處理)
('處理', 'VERB', 'VV', 'ccomp', 喜歡)
('了', 'PART', 'SP', 'aux:asp', 處理)
('。', 'PUNCT', 'PU', 'punct', 喜歡)
('所以', 'ADV', 'AD', 'advmod', 課)
('秒選', 'PROPN', 'NR', 'name', 謝)
('謝', 'PROPN', 'NR', 'dep', 課)
('舒凱', 'PROPN', 'NR', 'compound:nn', 老師)
('老師', 'NOUN', 'NN', 'nmod:assmod', 課)
('的', 'PART', 'DEG', 'case', 老師)
('課', 'NOUN', 'NN', 'ROOT', 課)
('！', 'PUNCT', 'PU', 'punct', 課)
```

token 對這個 head 有這樣的依存關係





Chinese NLP pipeline in spaCy



Tokenization

POS tagging

Dependency parsing

NER

```
for  ent  in  doc3.ents:
    print(((
        ent.text,
        ent.start_char,
        ent.end_char,
        ent.label_
    )))
```

```
('spacy', 0, 5, 'PERSON')
('屈臣氏', 10, 13, 'ORG')
('寶雅', 14, 16, 'ORG')
('家樂福', 18, 21, 'ORG')
```

Chinese NLP pipeline in spaCy

01 Tokenization

02 POS tagging

03 Dependency parsing

04 NER

```
('賓雅', 13, 15, 'ORG', 'Companies, agencies, institutions, etc.')
('屈臣氏比較', 21, 26, 'ORG', 'Companies, agencies, institutions, etc.')
('他們', 29, 31, 'PERSON', 'People, including fictional')
```

02

spaCy and Models

Vectorization

01 Gensim word2vec/ fasttext pretrained model (Chinese wiki)

02 spaCy 3.0 - transformers (bert-base-chinese as example)

```
tokens = nlp("防疫就要宅在家")

for token in tokens:
    print(token.text, token.has_vector, token.vector_norm, token.is_oov, token.vector)
```

```
防疫 True 37.577972 False [ 1.3487   -0.69083   1.8575    0.03564   2.132     2.8709
  0.60342  -4.8321    1.1779    1.6164   -0.54163   1.8831   -1.4367
```

calculate similarity: doc1.similarity(doc2)

Vectorization

01

Gensim word2vec/ fasttext pretrained model (Chinese wiki)

02

spaCy 3.0 - transformers (bert-base-chinese as example)

```
[ ]  import spacy
     nlp = spacy.load("zh_core_web_trf")
```

```
[ ]  doc = nlp("防疫就要宅在家")
     for token in doc:
         print(token.text, token.vector, token.dep_, token.pos_)
```

```
防疫 [] nsubj VERB
就要 [] dep VERB
宅 [] ROOT VERB
在家 [] advmod:rcomp VERB
```

```
doc2 = nlp("沐浴球全台康是美，寶雅，tomad's以及各大通路都買得到")
for ent in doc2.ents:
    print([ent.text, ent.start_char, ent.end_char, ent.label_])
```

```
['沐', 0, 1, 'PRODUCT']
['浴球', 1, 3, 'PRODUCT']
['台康', 4, 6, 'GPE']
['是', 6, 7, 'PRODUCT']
['美', 7, 8, 'ORG']
['寶雅', 9, 11, 'ORG']
['to', 12, 14, 'ORG']
["mad's", 14, 19, 'ORG']
```

Conclusion

:)

Clear & nice pipelines for different languages

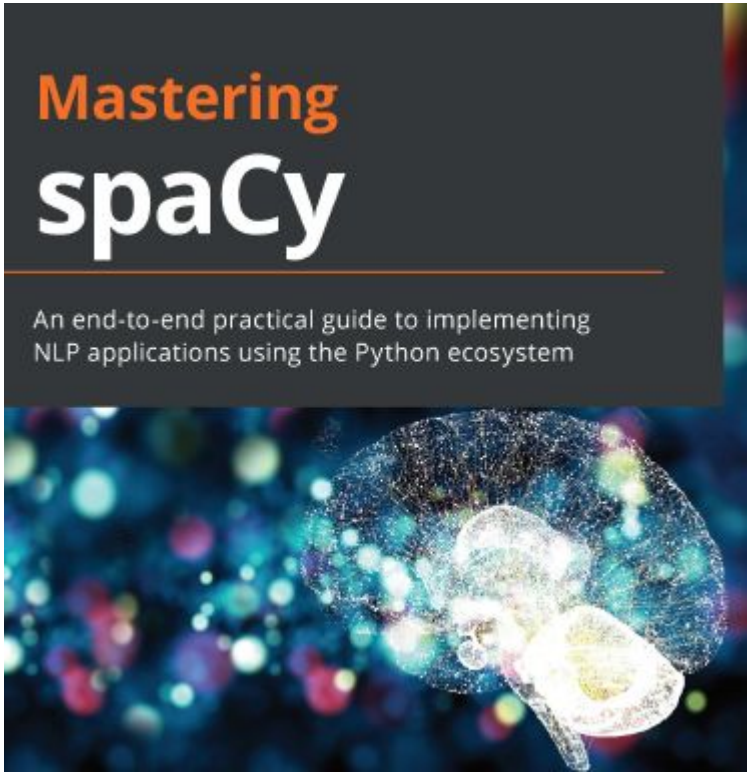
:)

Faster operation without GPU device

:(

Limited performances in Chinese models (unable to be customized)

Reference


Mastering
spaCy
An end-to-end practical guide to implementing
NLP applications using the Python ecosystem