Two minutes NLP — SpaCy sheet

POS tagging, dependency parsing, NER, and senter

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SpaCy is a free, open-source library for advanced Natural Language Processing in Python. It is designed specifically for production use and helps build applications that process and understand large volumes of text. It can be used for a multitude of use cases, such as information extraction, natural language understanding systems or to pre-process text for deep learning.

List of spaCy tasks

Here's a list of NLP tasks that spaCy can perform.

NAME	DESCRIPTION
Tokenization	Segmenting text into words, punctuations marks etc.
Part-of-speech (POS) **Tagging**	Assigning word types to tokens, like verb or noun.
Dependency Parsing	Assigning syntactic dependency labels, describing the relations between individual tokens, like subject or object.
Lemmatization	Assigning the base forms of words. For example, the lemma of “was” is “be”, and the lemma of “rats” is “rat”.
Sentence Boundary Detection (SBD)	Finding and segmenting individual sentences.
Named Entity Recognition (NER)	Labelling named “real-world” objects, like persons, companies or locations.
Entity Linking (EL)	Disambiguating textual entities to unique identifiers in a knowledge base.
Similarity	Comparing words, text spans and documents and how similar they are to each other.
Text Classification	Assigning categories or labels to a whole document, or parts of a document.
Rule-based Matching	Finding sequences of tokens based on their texts and linguistic annotations, similar to regular expressions.
Training	Updating and improving a statistical model’s predictions.
Serialization	Saving objects to files or byte strings.

List of tasks that spaCy can perform. Image from https://spacy.io/usage/spacy-101.

While some of spaCy’s features work independently, others require trained pipelines to be loaded. SpaCy currently offers trained pipelines for a variety of languages, which can be installed as individual Python modules. Here’s an example where we download the trained pipeline *en_core_web_sm*.

```
python -m spacy download en_core_web_sm
```

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The trained pipeline you choose always depends on your use case and the texts you’re working with. For a general-purpose use case, the small, default pipelines (i.e. the ones ending in `sm`) are always a good start.

Tokenization

Tokenization consists in segmenting text into words, punctuations marks, etc. This is done by applying rules specific to each language.

```python
import spacy

nlp = spacy.load("en_core_web_sm")
doc = nlp("The cat is on the table")
for token in doc:
    print(token.text)

# The
# cat
# is
# on
# the
# table
```

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POS Tagging

POS (Part of Speech) Tagging refers to categorizing words in a text in correspondence with a particular part of speech, depending on the definition of the word and its context.

```python
import spacy

nlp = spacy.load("en_core_web_sm")
doc = nlp("The cat is on the table")
for token in doc:
    print(f"{token.text} --- POS: {token.pos_}, {token.tag_}")

# The --- POS: DET, DT
# cat --- POS: NOUN, NN
# is --- POS: AUX, VBZ
# on --- POS: ADP, IN
# the --- POS: DET, DT
# table --- POS: NOUN, NN
```

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The `pos_` attribute contains the simple UPOS part-of-speech tag, whereas the `tag_` attribute contains the detailed POS tag.

Dependency Parsing

Dependency Parsing consists in assigning syntactic dependency labels, describing the relations between individual tokens, like subject or object.

```python
import spacy

nlp = spacy.load("en_core_web_sm")
doc = nlp("The cat is on the table")
for token in doc:
    print(f"{token.text} --- dependency label: {token.dep_}")

# The --- dependency label: det
# cat --- dependency label: nsubj
# is --- dependency label: ROOT
# on --- dependency label: prep
# the --- dependency label: det
# table --- dependency label: pobj
```

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Stopwords

Stopwords are the most common words of a language, which are often ignored in NLP tasks as they usually carry little meaning to the sentences.

```python
import spacy

nlp = spacy.load("en_core_web_sm")
doc = nlp("The cat is on the table")
for token in doc:
    print(f"{token.text} --- is stopword: {token.is_stop}")

# The --- is stopword: True
# cat --- is stopword: False
# is --- is stopword: True
# on --- is stopword: True
# the --- is stopword: True
# table --- is stopword: False
```

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Lemmatization

Lemmatization assigns the base forms of words. For example, the lemma of “was” is “be”, and the lemma of “dogs” is “dog”.

```python
import spacy

nlp = spacy.load("en_core_web_sm")
doc = nlp("The cat is on the table")
for token in doc:
    print(f"{token.text} --- lemma: {token.lemma_}")

# The --- lemma: the
# cat --- lemma: cat
# is --- lemma: be
# on --- lemma: on
# the --- lemma: the
# table --- lemma: table
```

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Named Entity Recognition (NER)

Named Entity Recognition refers to labeling named “real-world” objects in texts, like persons, companies, or locations.

```python
import spacy

nlp = spacy.load("en_core_web_sm")
doc = nlp("Elon Musk cofounded the electronic-payment firm PayPal and formed SpaceX.")

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

# Elon Musk 0 9 PERSON
# PayPal 48 54 ORG
```

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Word embeddings

A word embedding is a learned representation (usually a vector of numbers) for text where words that have the same meaning have a similar

representation.

To make them compact and fast, spaCy's small pipeline packages (all packages that end in `sm`) don't ship with word vectors and only include context-sensitive tensors. This means you can still use the `similarity()` methods to compare sentences and words, but the result won't be as good, and individual tokens won't have any vectors assigned. So in order to use real word vectors, you need to download a larger pipeline package.

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

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This is how you get word embeddings with spaCy.

```
import spacy

nlp = spacy.load("en_core_web_md")
tokens = nlp("cat is on the aofafgag")

vectors = []
for token in tokens:
    print(token.text, token.has_vector, token.is_oov)
    vectors.append(token.vector)

# The True False
# cat True False
# is True False
# on True False
# the True False
# aofafgag False True

print(vectors[0])

# [ 2.7204e-01 -6.2030e-02 -1.8840e-01  2.3225e-02 -1.8158e-02  6.7192e-03
# -1.3877e-01  1.7708e-01  1.7709e-01  2.5882e+00 -3.5179e-01 -1.7312e-01
#  4.3285e-01 -1.0708e-01  1.5006e-01 -1.9982e-01 -1.9093e-01  1.1871e+00
#  ...
```

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Sentence similarity

With spaCy, you can compute similarities between sentences. This is done by averaging the word embeddings of the words in each sentence and then computing similarity with a similarity measure.

```python
import spacy

nlp = spacy.load("en_core_web_md")  # make sure to use larger package!
doc1 = nlp("I like salty fries and hamburgers.")
doc2 = nlp("Fast food tastes very good.")
doc3 = nlp("Where is the cat.")

# Similarity of doc1 and doc2
print(doc1.similarity(doc2))

# 0.7799485853415737

# Similarity of doc1 and doc3
print(doc1.similarity(doc3))

# 0.6210606690259671
```

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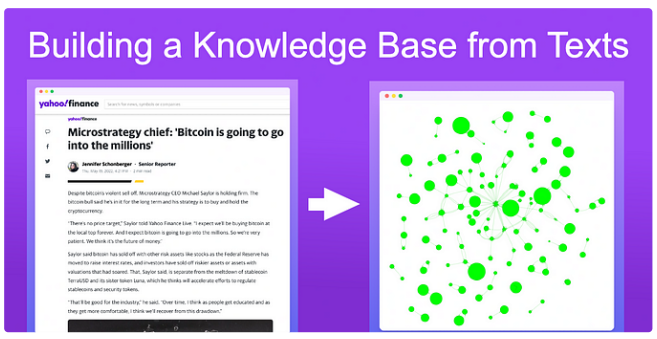

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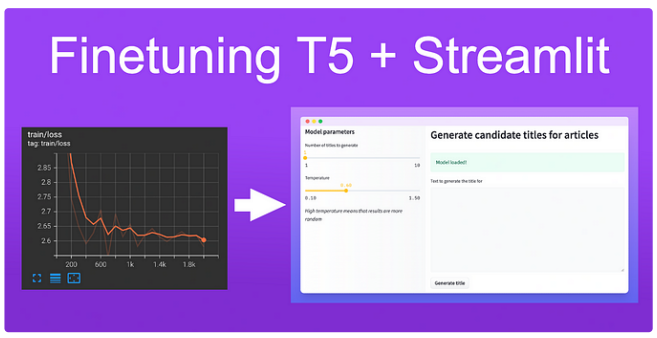

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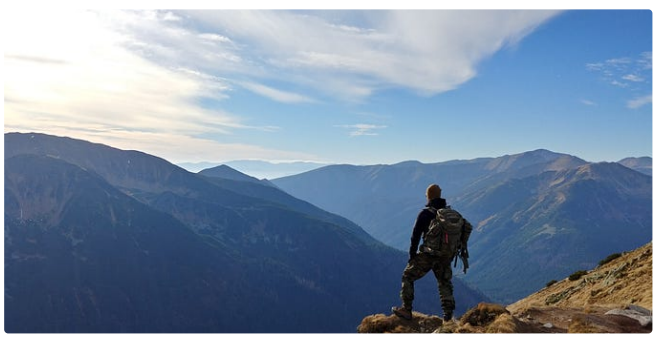

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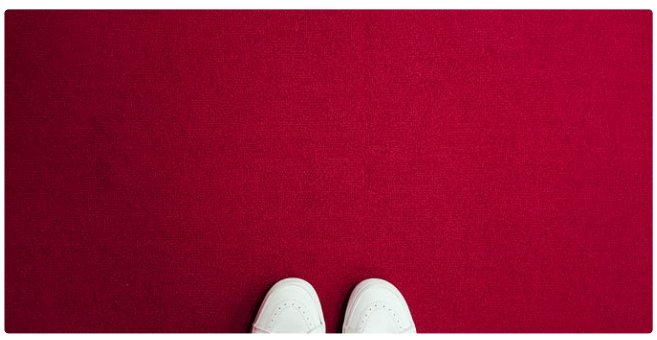

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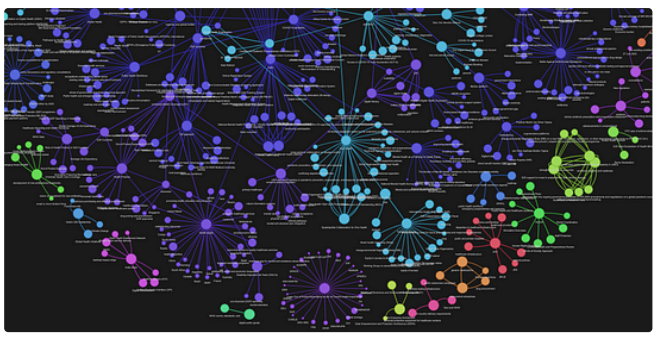

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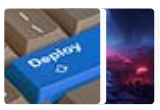

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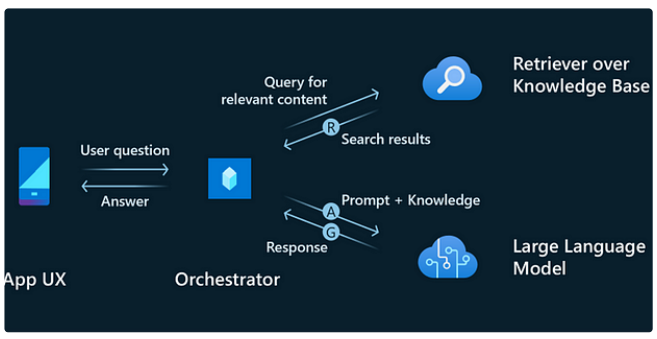

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