Bag-of-words

SENTIMENT ANALYSIS IN PYTHON

Violeta Misheva
Data Scientist

What is a bag-of-words (BOW) ?

- Describes the occurrence of words within a document or a collection of documents (corpus)
- Builds a vocabulary of the words and a measure of their presence

Amazon reviews data

	score	review
0	1	Stuning even for the non-gamer: This sound tr...
1	1	The best soundtrack ever to anything.: I'm re...
2	1	Amazing!: This soundtrack is my favorite musi...
3	1	Excellent Soundtrack: I truly like this sound...
4	1	Remember, Pull Your Jaw Off The Floor After H...
5	1	an absolute masterpiece: I am quite sure any ...
6	0	Buyer beware: This is a self-published book, ...
7	1	Glorious story: I loved Whisper of the wicked...
8	1	A FIVE STAR BOOK: I just finished reading Whi...
9	1	Whispers of the Wicked Saints: This was a eas...

Sentiment analysis with BOW: Example

> This is the best book ever. I loved the book and highly recommend it!!!

```
{‘This’: 1, ‘is’: 1, ‘the’: 2 , ‘best’: 3 , ’book’: 2,
‘ever’: 1, ‘I’:1 , ‘loved’:1 , ‘and’: 1  , ‘highly’: 1,
‘recommend’: 1 , ‘it’: 1 }
```

- Lose word order and grammar rules!

BOW end result

- The output will look something like this:

	10	100	12	15	1984	20	30	40	451	50	...	wrong	wrote	year	years	yes	yet	you	young	your	yourself
0	0	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0	1	0
1	0	0	0	0	0	0	0	0	0	0	...	0	0	0	1	0	0	1	0	0	0
2	0	0	0	0	0	0	0	0	0	0	...	0	0	0	1	0	0	2	0	0	0
3	0	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	...	0	1	0	0	0	0	3	0	1	0

CountVectorizer function

```
import pandas as pd
from sklearn.feature_extraction.text import CountVectorizer
```

```
vect = CountVectorizer(max_features=1000)
vect.fit(data.review)
X = vect.transform(data.review)
```

CountVectorizer output

```
X
```

```
<10000x1000 sparse matrix of type '<class 'numpy.int64'>'
  with 406668 stored elements in Compressed Sparse Row format>
```

Transforming the vectorizer

```
# Transform to an array
my_array = X.toarray()
```

```
# Transform back to a dataframe, assign column names
X_df = pd.DataFrame(my_array, columns=vect.get_feature_names())
```

Let's practice!

SENTIMENT ANALYSIS IN PYTHON

Getting granular with n-grams

SENTIMENT ANALYSIS IN PYTHON

Violeta Misheva
Data Scientist

Context matters

> I am *happy*, **not sad**.
>
> I am *sad*, **not happy**.

- Putting 'not' in front of a word (negation) is one example of how context matters.

Capturing context with a BOW

- **Unigrams** : single tokens
- **Bigrams**: pairs of tokens
- **Trigrams**: triples of tokens
- **n-grams**: sequence of n-tokens

Capturing context with BOW

> The weather today is wonderful.

- **Unigrams** : { The, weather, today, is wonderful }
- **Bigrams**: {The weather, weather today, today is, is wonderful}
- **Trigrams**: {The weather today, weather today is, today is wonderful}

n-grams with the CountVectorizer

```
from sklearn.feature_extraction.text import CountVectorizer
```

```
vect = CountVectorizer(ngram_range=(min_n, max_n))
```

```
# Only unigrams
ngram_range=(1, 1)
```

```
# Uni- and bigrams
ngram_range=(1, 2)
```

What is the best n?

Longer sequence of tokens

- Results in more features
- Higher precision of machine learning models
- Risk of overfitting

Specifying vocabulary size

```
CountVectorizer(max_feature, max_df, min_df)
```

- **max_features**: if specified, it will include only the top most frequent words in the vocabulary
  - If max_features = None, all words will be included
- **max_df**: ignore terms with higher than specified frequency
  - If it is set to integer, then absolute count; if a float, then it is a proportion
  - Default is 1.0, which means it does not ignore any terms
- **min_df**: ignore terms with lower than specified frequency
  - If it is set to integer, then absolute count; if a float, then it is a proportion
  - Default is 1.0, which means it does not ignore any terms

Let's practice!

SENTIMENT ANALYSIS IN PYTHON

Build new features from text

SENTIMENT ANALYSIS IN PYTHON

Violeta Misheva
Data Scientist

Goal of the video

> Goal : Enrich the existing dataset with features related to the text column (capturing the sentiment)

Product reviews data

```
reviews.head()
```

	score	review
0	1	Stuning even for the non-gamer: This sound tr...
1	1	The best soundtrack ever to anything.: I'm re...
2	1	Amazing!: This soundtrack is my favorite musi...
3	1	Excellent Soundtrack: I truly like this sound...
4	1	Remember, Pull Your Jaw Off The Floor After H...

Features from the review column

- How long is each review?
- How many sentences does it contain?
- What parts of speech are involved?
- How many punctuation marks?

Tokenizing a string

```
from nltk import word_tokenize
```

```
anna_k = 'Happy families are all alike, every unhappy family is unhappy in its own way.'
```

```
word_tokenize(anna_k)

['Happy','families','are', 'all','alike',',',
 'every','unhappy', 'family', 'is','unhappy','in',
 'its','own','way','.']
```

Tokens from a column

```
# General form of list comprehension
[expression for item in iterable]
```

```
word_tokens = [word_tokenize(review) for review in reviews.review]
type(word_tokens)
```

```
list
```

```
type(word_tokens[0])
```

```
list
```

Tokens from a column

```
len_tokens = []

# Iterate over the word_tokens list
for i in range(len(word_tokens)):
    len_tokens.append(len(word_tokens[i]))
```

```
# Create a new feature for the length of each review
reviews['n_tokens'] = len_tokens
```

Dealing with punctuation

- We did not address it but you can exclude it
- A feature that measures the number of punctuation signs
  - A review with many punctuation signs could signal a very emotionally charged opinion

Reviews with a feature for the length

```
reviews.head()
```

	score	review	n_tokens
0	1	Stuning even for the non-gamer: This sound tr...	87
1	1	The best soundtrack ever to anything.: I'm re...	109
2	1	Amazing!: This soundtrack is my favorite musi...	165
3	1	Excellent Soundtrack: I truly like this sound...	145
4	1	Remember, Pull Your Jaw Off The Floor After H...	109

Let's practice!

SENTIMENT ANALYSIS IN PYTHON

Can you guess the language?

SENTIMENT ANALYSIS IN PYTHON

Violeta Misheva
Data Scientist

Language of a string in Python

```
from langdetect import detect_langs
foreign = 'Este libro ha sido uno de los mejores libros que he leido.'
```

```
detect_langs(foreign)
```

```
[es:0.9999945352697024]
```

Language of a column

- Problem: Detect the language of each of the strings and capture the most likely language in a new column

```
from langdetect import detect_langs
reviews = pd.read_csv('product_reviews.csv')
```

```
reviews.head()
```

	score	review
0	1	Stuning even for the non-gamer: This sound tr...
1	1	The best soundtrack ever to anything.: I'm re...
2	1	Amazing!: This soundtrack is my favorite musi...
3	1	Excellent Soundtrack: I truly like this sound...
4	1	Remember, Pull Your Jaw Off The Floor After I...

Building a feature for the language

```
languages = []
```

```
for row in range(len(reviews)):
    languages.append(detect_langs(reviews.iloc[row, 1]))
```

```
languages
[it:0.9999982541301151],
[es:0.9999954153640488],
[es:0.7142833997345875, en:0.2857160465706441],
[es:0.9999942365605781],
[es:0.9999979560490055] ...
```

Building a feature for the language

```
# Transform the first list to a string and split on a colon
str(languages[0]).split(':')
['[es', '0.9999954153640488]']
```

```
str(languages[0]).split(':')[0]
'[es'
```

```
str(languages[0]).split(':')[0][1:]
'es'
```

Building a feature for the language

```
languages = [str(lang).split(':')[0][1:] for lang in languages]
```

```
reviews['language'] = languages
```

Let's practice!

SENTIMENT ANALYSIS IN PYTHON