

# Natural Language Processing with SpaCy

# What even is it?

Natural Language Processing (NLP) is a tool similar to regex, but allows us to take our text analytics to entirely new levels

# What even is it?

Regex	NLP
Create patterns to match in text	Identify the structure of text and use that to refine information
Used to verify or find data	Used to analyze data
Applies user-defined rules	Relies heavily on ML-based (or other) models

## But also...

NLP	LLMs (Like ChatGPT)
Used to <b>process</b> text	Used to <b>generate</b> text
Part of the data cleaning pipeline	Not usually part of the pipeline, but is more of a partner in the coding process
Usually invisible to end-users	Usually a product intended for end-users

# Tasks we can complete with NLP

- Identify parts of speech
- Iterate over sentences
- Find words used to describe various nouns (or anything else!)
- Visualize semantic relationships
- Filter text for analysis
- Conduct sentiment analysis

**NLP is not the analysis itself, it's a tool to prepare text for quantitative or qualitative analysis**

# Getting Started

We will use `spacy`. Let's go to the website to find installation instructions.

<https://spacy.io/>

A corpus is the body of knowledge that our NLP library ( `spacy` ) needs in order to be able to process the english language. We will use the smallest english corpus for now.

The `web` part means that it was trained on web content, and will perform best when applied to similar material.

# Get some text!

```
import requests

jane = requests.get("https://github.com/dustywhite7/Econ8320/  
raw/master/AssignmentData/janeEyreCh1to3.txt").text
```

This file contains chapters 1 to 3 of Jane Eyre

(Lots of fun texts to play with at [Project Gutenberg](#))

# Rev the NLP engines!

```
import spacy  
  
nlp = spacy.load("en_core_web_sm")  
doc = nlp(jane)
```

Here, we are pointing to the language file we want to use, and then parsing our text



# Important attributes

Our new parsed document ( `doc` in this case), has some important **attributes**:

- `sents` - a generator function to iterate over each sentence in the document
- `tokens` - each individual element of the document
  - Elements exist at the word/punctuation level
  - Access via `for i in doc` -style loops

## [Some] Attributes of tokens

- `lemma_` - the "root word" from which a token/word is derived
- `pos_` - the part of speech of a token/word
- `dep_` - the relationship of dependent tokens to the parent token (adjectives to nouns, etc.)
- `like_email` / `like_num` / `like_url` - check if a token is like an email, number, or url (unlikely in Jane Eyre)

# Doing NLP

```
[i.lemma_ for i in doc if (not i.is_punct) and (not i.is_space)][:100]
```

```
['chapter',  
 'I',  
 'there',  
 'be',  
 'no',  
 'possibility',  
 'of',  
 'take',  
 'a',  
 'walk',  
 'that',  
 ...]
```

What is happening here??

# Lemmatization

When we have words with many forms (verbs, plurals, etc.), we want to work with the **lemma** of that word, so that we can recognize that all forms are actually the same word being used in different ways.

"Ran" --> "run"

"Are" --> "be"

# Noun chunks

Sometimes, you want to be able to see a "complete" noun, and noun chunks are the tool to use!

```
[i for i in doc.noun_chunks]
```

Noun chunks include all of the modifiers for a given noun, and make it easier to build a more complete understanding of the references being made.

# Mapping a sentence

```
from spacy import displacy  
  
sent = [i for i in doc.sents][100]  
displacy.render(sent, style="dep")
```

# Illustrating a sentence

```
from spacy import displacy  
  
sent = [i for i in doc.sents][2]  
displacy.render(sent, style="ent", jupyter=True)
```

# Sentiment Analysis

Here, we are going to use `spacytextblob` to increase the functionality of our NLP model. Install with the following command:

```
! pip install pip install spacytextblob
```

**Note:** only use the `!` characters if installing from inside of jupyter notebook or other python interpreter (not when installing from shell/command prompt)



# spacytextblob for sentiment analysis

```
import spacy
from spacytextblob.spacytextblob import SpacyTextBlob
import requests

jane = requests.get(
    "https://github.com/dustywhite7/Econ8320/raw/master \
    /AssignmentData/janeEyreCh1to3.txt").text

nlp = spacy.load('en_core_web_sm')
nlp.add_pipe('spacytextblob')
blob = nlp(jane)

for sentence in blob.sents:
    print("Polarity: {0:3.2f}, \
    Subjectivity: {1:3.2f}".format(
        sentence._.blob.polarity,
        sentence._.blob.subjectivity))
```

**Lab Time!**