

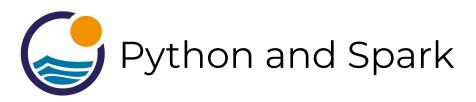
Natural Language Processing

Let's learn something!





- Let's now learn about the basics of Natural Language Processing!
- This is the field of machine learning that focuses on creating models from a text data source (straight from articles of words).



 The NLP section of the course will just contain a single custom code along example because the documentation doesn't really have a full example and the custom code along is a larger multi-step process.





 This is a very large field of machine learning with its own unique challenges and sets of algorithms and features, so what we cover here will be scratching just the surface!



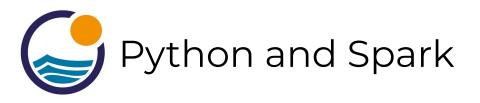
- Optional Reading Suggestions:
 - Wikipedia Article on NLP
 - NLTK Book (separate Python library)
 - Foundations of Statistical Natural Language Processing (Manning)





- Examples of NLP
 - Clustering News Articles
 - Suggesting similar books
 - Grouping Legal Documents
 - Analyzing Consumer Feedback
 - Spam Email Detection





- Our basic process for NLP:
 - Compile all documents (Corpus)
 - Featurize the words to numerics
 - Compare features of documents



- A standard way of doing this is through the use of what is known as "TF-IDF" methods.
- TF-IDF stands for Term Frequency -Inverse Document Frequency
- Let's explain how it works!





Simple Example:

- You have 2 documents:
 - "Blue House"
 - "Red House"
- Featurize based on word count:
 - "Blue House" -> (red,blue,house) -> (0,1,1)
 - "Red House" -> (red,blue,house) -> (1,0,1)





- A document represented as a vector of word counts is called a "Bag of Words"
 - "Blue House" -> (red,blue,house) -> (0,1,1)
 - "Red House" -> (red,blue,house) -> (1,0,1)
- These are now vectors in an N-dimensional space, we can compare vectors with cosine similarity:

$$sim(A, B) = cos(\theta) = \frac{A \cdot B}{\|A\| \|B\|}$$



- We can improve on Bag of Words by adjusting word counts based on their frequency in corpus (the group of all the documents)
- We can use TF-IDF (Term Frequency
 - Inverse Document Frequency)





- Term Frequency Importance of the term within that document
 - TF(x,y) = Number of occurrences of term x in document y
- Inverse Document Frequency Importance of the term in the corpus
 - \circ IDF(t) = log(N/dfx) where
 - N = total number of documents
 - dfx = number of documents with the





Mathematically, TF-IDF is then expressed:

$$w_{x,y} = tf_{x,y} \times log(\frac{N}{df_x})$$

 $tf_{x,y}$ = frequency of x in y df_x = number of documents containing xN = total number of documents





- Spark has a lot of pyspark.ml.feature tools to help out with this entire process and make it all easy for you!
- Let's jump to a custom code along example!



Tools for NLP Part One





- Before we jump into the code along project, let's explore a few of the tools
 Spark has for dealing with text data.
- Then we'll be able to use them easily in our project!



Tools for NLP Part Two





NLP Code Along





- Let's work through building a spam detection filter using Python and Spark!
- Our data set consists of volunteered text messages from a study in Singapore and some spam texts from a UK reporting site.
- Let's get started

