## 1. Representing Text (Flipped)

DS-GA 1015, Text as Data Arthur Spirling

February 9, 2021

1 Section has began! Make sure you attend.

- 1 Section has began! Make sure you attend.
- 2 Materials—recordings, slides—now on Classes website.

- 1 Section has began! Make sure you attend.
- 2 Materials—recordings, slides—now on Classes website.
- 3 Federal engagement requirement: do the online form in lab (or email). Or we have to report you are "unengaged".
- 4 Cohort B next week.

In many (most?) social science applications of text as data, we are trying to make an inference about a *latent variable*.

In many (most?) social science applications of text as data, we are trying to make an inference about a *latent variable*.

What is a latent variable?

In many (most?) social science applications of text as data, we are trying to make an inference about a *latent variable*.

What is a latent variable?

→ something which we cannot observe directly but which we can make inferences about from things we can observe.

In many (most?) social science applications of text as data, we are trying to make an inference about a *latent variable*.

What is a latent variable?

→ something which we cannot observe directly but which we can make inferences about from things we can observe. Examples include ideology, ambition, narcissism, propensity to vote etc.

In many (most?) social science applications of text as data, we are trying to make an inference about a *latent variable*.

What is a latent variable?

→ something which we cannot observe directly but which we can make inferences about from things we can observe. Examples include ideology, ambition, narcissism, propensity to vote etc.

The corpus is made up of the documents within it,

The corpus is made up of the documents within it, but these may be a sample of the total population of documents available.

The corpus is made up of the documents within it, but these may be a sample of the total population of documents available.

We sample for reasons of time, resources or (legal) necessity.

The corpus is made up of the documents within it, but these may be a sample of the total population of documents available.

We sample for reasons of time, resources or (legal) necessity.

e.g. Twitter gives you  $\sim 1\%$  of all their tweets,

The corpus is made up of the documents within it, but these may be a sample of the total population of documents available.

We sample for reasons of time, resources or (legal) necessity.

e.g. Twitter gives you  $\sim$  1% of all their tweets, but it would presumably be prohibitively expensive to store 100%.

The corpus is made up of the documents within it, but these may be a sample of the total population of documents available.

We sample for reasons of time, resources or (legal) necessity.

e.g. Twitter gives you  $\sim$  1% of all their tweets, but it would presumably be prohibitively expensive to store 100%.

Often,

The corpus is made up of the documents within it, but these may be a sample of the total population of documents available.

We sample for reasons of time, resources or (legal) necessity.

e.g. Twitter gives you  $\sim 1\%$  of all their tweets, but it would presumably be prohibitively expensive to store 100%.

Often, authors claim to have the universe of cases in their corpus: *all* press releases,

The corpus is made up of the documents within it, but these may be a sample of the total population of documents available.

We sample for reasons of time, resources or (legal) necessity.

e.g. Twitter gives you  $\sim$  1% of all their tweets, but it would presumably be prohibitively expensive to store 100%.

Often, authors claim to have the universe of cases in their corpus: *all* press releases, *all* treaties,

The corpus is made up of the documents within it, but these may be a sample of the total population of documents available.

We sample for reasons of time, resources or (legal) necessity.

e.g. Twitter gives you  $\sim$  1% of all their tweets, but it would presumably be prohibitively expensive to store 100%.

Often, authors claim to have the universe of cases in their corpus: *all* press releases, *all* treaties, *all* debate speeches.

The corpus is made up of the documents within it, but these may be a sample of the total population of documents available.

We sample for reasons of time, resources or (legal) necessity.

- e.g. Twitter gives you  $\sim$  1% of all their tweets, but it would presumably be prohibitively expensive to store 100%.
  - Often, authors claim to have the universe of cases in their corpus: *all* press releases, *all* treaties, *all* debate speeches.
  - → depending on your philosophical position,

The corpus is made up of the documents within it, but these may be a sample of the total population of documents available.

We sample for reasons of time, resources or (legal) necessity.

- e.g. Twitter gives you  $\sim$  1% of all their tweets, but it would presumably be prohibitively expensive to store 100%.
  - Often, authors claim to have the universe of cases in their corpus: *all* press releases, *all* treaties, *all* debate speeches.
  - → depending on your philosophical position, you still need to think about sampling error

The corpus is made up of the documents within it, but these may be a sample of the total population of documents available.

We sample for reasons of time, resources or (legal) necessity.

- e.g. Twitter gives you  $\sim$  1% of all their tweets, but it would presumably be prohibitively expensive to store 100%.
  - Often, authors claim to have the universe of cases in their corpus: *all* press releases, *all* treaties, *all* debate speeches.
  - → depending on your philosophical position, you still need to think about sampling error. This is because there exists a superpopulation of populations from which the universe you observed came from.

()

The corpus is made up of the documents within it, but these may be a sample of the total population of documents available.

We sample for reasons of time, resources or (legal) necessity.

- e.g. Twitter gives you  $\sim$  1% of all their tweets, but it would presumably be prohibitively expensive to store 100%.
  - Often, authors claim to have the universe of cases in their corpus: *all* press releases, *all* treaties, *all* debate speeches.
  - → depending on your philosophical position, you still need to think about sampling error. This is because there exists a superpopulation of populations from which the universe you observed came from.

Random error may not be the only concern:

()

The corpus is made up of the documents within it, but these may be a sample of the total population of documents available.

We sample for reasons of time, resources or (legal) necessity.

- e.g. Twitter gives you  $\sim$  1% of all their tweets, but it would presumably be prohibitively expensive to store 100%.
  - Often, authors claim to have the universe of cases in their corpus: *all* press releases, *all* treaties, *all* debate speeches.
  - → depending on your philosophical position, you still need to think about sampling error. This is because there exists a superpopulation of populations from which the universe you observed came from.
    - Random error may not be the only concern: corpus should be representative in some well defined sense for inferences to be meaningful.





You are consulting for a company who want to know what the world thinks of their product, a shampoo that slows balding in men.



You are consulting for a company who want to know what the world thinks of their product, a shampoo that slows balding in men. They tell you to scrape Facebook data (timelines) as your corpus, and to analyze who is using it, and what they think of it.

()



You are consulting for a company who want to know what the world thinks of their product, a shampoo that slows balding in men. They tell you to scrape Facebook data (timelines) as your corpus, and to analyze who is using it, and what they think of it.

Excluding any technical issues with the scraping,



You are consulting for a company who want to know what the world thinks of their product, a shampoo that slows balding in men. They tell you to scrape Facebook data (timelines) as your corpus, and to analyze who is using it, and what they think of it.

Q Excluding any technical issues with the scraping, give three concerns about the validity of inferences from such a project.

-()

## II. Reducing Complexity

# II. Reducing Complexity

• language is extraordinarily complex,

## II. Reducing Complexity

• language is extraordinarily complex, and involves great subtlety and nuanced interpretation.

 language is extraordinarily complex, and involves great subtlety and nuanced interpretation.

but remarkably, we can do very well by simplifying, and representing documents as straightforward mathematical objects.

 language is extraordinarily complex, and involves great subtlety and nuanced interpretation.

but remarkably, we can do very well by simplifying, and representing documents as straightforward mathematical objects.

Q What do we mean by this?

 language is extraordinarily complex, and involves great subtlety and nuanced interpretation.

but remarkably, we can do very well by simplifying, and representing documents as straightforward mathematical objects.

- Q What do we mean by this?
- → makes the modeling problem much more tractable.

 language is extraordinarily complex, and involves great subtlety and nuanced interpretation.

but remarkably, we can do very well by simplifying, and representing documents as straightforward mathematical objects.

- Q What do we mean by this?
- $\rightarrow$  makes the modeling problem much more tractable.
- by 'do very well', we mean that much more complicated representations add (almost) nothing to the quality of our inferences,

- language is extraordinarily complex, and involves great subtlety and nuanced interpretation.
- but remarkably, we can do very well by simplifying, and representing documents as straightforward mathematical objects.
  - Q What do we mean by this?
  - $\rightarrow$  makes the modeling problem much more tractable.
  - by 'do very well', we mean that much more complicated representations add (almost) nothing to the quality of our inferences, our ability to predict outcomes,

- language is extraordinarily complex, and involves great subtlety and nuanced interpretation.
- but remarkably, we can do very well by simplifying, and representing documents as straightforward mathematical objects.
  - Q What do we mean by this?
  - → makes the modeling problem much more tractable.
  - by 'do very well', we mean that much more complicated representations add (almost) nothing to the quality of our inferences, our ability to predict outcomes, and the fit of our models.

- language is extraordinarily complex, and involves great subtlety and nuanced interpretation.
- but remarkably, we can do very well by simplifying, and representing documents as straightforward mathematical objects.
  - Q What do we mean by this?
  - → makes the modeling problem much more tractable.
  - by 'do very well', we mean that much more complicated representations add (almost) nothing to the quality of our inferences, our ability to predict outcomes, and the fit of our models.

• collect raw text in machine readable/electronic form. Decide what constitutes a document.

- collect raw text in machine readable/electronic form. Decide what constitutes a document.
- 2 strip away 'superfluous' material: HTML tags, capitalization, punctuation, stop words etc.

- collect raw text in machine readable/electronic form. Decide what constitutes a document.
- Strip away 'superfluous' material: HTML tags, capitalization, punctuation, stop words etc.
- out document up into useful elementary pieces: tokenization.

- collect raw text in machine readable/electronic form. Decide what constitutes a document.
- 2 strip away 'superfluous' material: HTML tags, capitalization, punctuation, stop words etc.
- out document up into useful elementary pieces: tokenization.
- add descriptive annotations that preserve context: tagging.

- collect raw text in machine readable/electronic form. Decide what constitutes a document.
- 2 strip away 'superfluous' material: HTML tags, capitalization, punctuation, stop words etc.
- Ocut document up into useful elementary pieces: tokenization.
- add descriptive annotations that preserve context: tagging.
- map tokens back to common form: lemmatization, stemming.

- collect raw text in machine readable/electronic form. Decide what constitutes a document.
- strip away 'superfluous' material: HTML tags, capitalization, punctuation, stop words etc.
- 3 cut document up into useful elementary pieces: tokenization.
- add descriptive annotations that preserve context: tagging.
- map tokens back to common form: lemmatization, stemming.

operate/model.

- collect raw text in machine readable/electronic form. Decide what constitutes a document.
- strip away 'superfluous' material: HTML tags, capitalization, punctuation, stop words etc.
- Ocut document up into useful elementary pieces: tokenization.
- add descriptive annotations that preserve context: tagging.
- map tokens back to common form: lemmatization, stemming.
  - operate/model.
- Q What do we call the creation/curation of features before we model?

What is a type?

What is a type? a unique sequence of characters that are grouped together in some meaningful way.

What is a type? a unique sequence of characters that are grouped together in some meaningful way. Mostly a word (for us),

What is a type? a unique sequence of characters that are grouped together in some meaningful way. Mostly a word (for us), but might also be a word plus punctuation,

What is a type? a unique sequence of characters that are grouped together in some meaningful way. Mostly a word (for us), but might also be a word plus punctuation, or a number etc.

What is a type? a unique sequence of characters that are grouped together in some meaningful way. Mostly a word (for us), but might also be a word plus punctuation, or a number etc.

e.g. 'France', 'American Revolution', '1981'

What is a type? a unique sequence of characters that are grouped together in some meaningful way. Mostly a word (for us), but might also be a word plus punctuation, or a number etc.

e.g. 'France', 'American Revolution', '1981'

What is a token?

What is a type? a unique sequence of characters that are grouped together in some meaningful way. Mostly a word (for us), but might also be a word plus punctuation, or a number etc.

e.g. 'France', 'American Revolution', '1981'

What is a token ? particular instance of type.

What is a type? a unique sequence of characters that are grouped together in some meaningful way. Mostly a word (for us), but might also be a word plus punctuation, or a number etc.

e.g. 'France', 'American Revolution', '1981'

What is a token? particular instance of type.

e.g. "Dog eat dog world",

What is a type? a unique sequence of characters that are grouped together in some meaningful way. Mostly a word (for us), but might also be a word plus punctuation, or a number etc.

e.g. 'France', 'American Revolution', '1981'

What is a token? particular instance of type.

e.g. "Dog eat dog world", contains three types,

What is a type? a unique sequence of characters that are grouped together in some meaningful way. Mostly a word (for us), but might also be a word plus punctuation, or a number etc.

e.g. 'France', 'American Revolution', '1981'

What is a token ? particular *instance* of type.

e.g. "Dog eat dog world", contains three types, but four tokens (for most purposes).

What is a type? a unique sequence of characters that are grouped together in some meaningful way. Mostly a word (for us), but might also be a word plus punctuation, or a number etc.

e.g. 'France', 'American Revolution', '1981'

What is a token? particular instance of type.

e.g. "Dog eat dog world", contains three types, but four tokens (for most purposes).

What is a term ?

What is a type? a unique sequence of characters that are grouped together in some meaningful way. Mostly a word (for us), but might also be a word plus punctuation, or a number etc.

e.g. 'France', 'American Revolution', '1981'

What is a token? particular *instance* of type.

e.g. "Dog eat dog world", contains three types, but four tokens (for most purposes).

What is a term? a type that is part of the system's 'dictionary' (i.e. what the quantitative analysis technique recognizes as a type to be recorded etc). Could be different from the tokens, but often closely related.

What is a type? a unique sequence of characters that are grouped together in some meaningful way. Mostly a word (for us), but might also be a word plus punctuation, or a number etc.

e.g. 'France', 'American Revolution', '1981'

What is a token ? particular instance of type.

e.g. "Dog eat dog world", contains three types, but four tokens (for most purposes).

What is a term? a type that is part of the system's 'dictionary' (i.e. what the quantitative analysis technique recognizes as a type to be recorded etc). Could be different from the tokens, but often closely related.

e.g. stemmed word like 'treasuri', which doesn't appear in the document itself.

February 8, 2021

Q Mostly we use whitespace to define subunits for tokenization, but this doesn't work in some applications and some languages. Explain why, give an example.

- Q Mostly we use whitespace to define subunits for tokenization, but this doesn't work in some applications and some languages. Explain why, give an example.
- Q We talked about some common stop words.

- Q Mostly we use whitespace to define subunits for tokenization, but this doesn't work in some applications and some languages. Explain why, give an example.
- Q We talked about some common stop words. Give an example of a stop word you would add to the list for an application in your field.

Consider these elements of a document. Suppose we change all punctuation to whitespace, de-capitalize, remove stop words, and stem what remains.

#### Exercise

Consider these elements of a document. Suppose we change all punctuation to whitespace, de-capitalize, remove stop words, and stem what remains. What do we get?

#### Exercise

Consider these elements of a document. Suppose we change all punctuation to whitespace, de-capitalize, remove stop words, and stem what remains. What do we get? Is the original meaning intact?

### Exercise

Consider these elements of a document. Suppose we change all punctuation to whitespace, de-capitalize, remove stop words, and stem what remains. What do we get? Is the original meaning intact?

- 1 The mountains are beautiful in Ore. and Wash.
- 2 http://www.wsj.com/articles/son-of-saul-not-about-the-survivors-1449590175
- 3 I can't go with him to Beijing.

What is bag of words?

What is bag of words? Why does it make storing the information in our documents easy?

What is bag of words? Why does it make storing the information in our documents easy?

How could we retain word order if we wanted it?

What is bag of words? Why does it make storing the information in our documents easy?

How could we retain word order if we wanted it?

What is a bigram?

What is bag of words? Why does it make storing the information in our documents easy?

How could we retain word order if we wanted it?

What is a bigram? What is a trigram? What would they be for the following passage?

What is bag of words? Why does it make storing the information in our documents easy?

How could we retain word order if we wanted it?

What is a bigram? What is a trigram? What would they be for the following passage? Do any of them have a frequency > 1?

What is bag of words? Why does it make storing the information in our documents easy?

How could we retain word order if we wanted it?

What is a bigram? What is a trigram? What would they be for the following passage? Do any of them have a frequency > 1?

This is America's day. This is democracy's day. A day of history and hope.

Removing punctuation (leave 's) but no other preprocessing, what would be the vector space representation of this passage?

Removing punctuation (leave 's) but no other preprocessing, what would be the vector space representation of this passage?

This is America's day. This is democracy's day. A day of history and hope.

Removing punctuation (leave 's) but no other preprocessing, what would be the vector space representation of this passage?

This is America's day. This is democracy's day. A day of history and hope.

Solution

Removing punctuation (leave 's) but no other preprocessing, what would be the vector space representation of this passage?

This is America's day. This is democracy's day. A day of history and hope.

#### Solution

sort A America's and day day democracy's history hope is is of This This

then (1,1,1,3,1,1,1,2,1,2)

•  $tf_{dw}$ , term frequency: number of times word w appears in document d

- $tf_{dw}$ , term frequency: number of times word w appears in document d
- df<sub>w</sub>, document frequency: number of documents in the collection of documents that contain word w

- $tf_{dw}$ , term frequency: number of times word w appears in document d
- df<sub>w</sub>, document frequency: number of documents in the collection of documents that contain word w

- tf<sub>dw</sub>, term frequency: number of times word w appears in document d
- df<sub>w</sub>, document frequency: number of documents in the collection of documents that contain word w
- $\ln \frac{|D|}{df_w}$ , inverse document frequency: (natural) log of the total size of the corpus |D| divided by the number of documents in the collection of documents that contain word w.

- tf<sub>dw</sub>, term frequency: number of times word w appears in document d
- df<sub>w</sub>, document frequency: number of documents in the collection of documents that contain word w
- In  $\frac{|D|}{df_w}$ , inverse document frequency: (natural) log of the total size of the corpus |D| divided by the number of documents in the collection of documents that contain word w. When the word is common in the corpus,

- tf<sub>dw</sub>, term frequency: number of times word w appears in document d
- df<sub>w</sub>, document frequency: number of documents in the collection of documents that contain word w
- In  $\frac{|D|}{df_w}$ , inverse document frequency: (natural) log of the total size of the corpus |D| divided by the number of documents in the collection of documents that contain word w. When the word is common in the corpus, this will be a small number. When the word is rare,

- $tf_{dw}$ , term frequency: number of times word w appears in document d
- df<sub>w</sub>, document frequency: number of documents in the collection of documents that contain word w
- In  $\frac{|D|}{df_w}$ , inverse document frequency: (natural) log of the total size of the corpus |D| divided by the number of documents in the collection of documents that contain word w. When the word is common in the corpus, this will be a small number. When the word is rare, this will be a large number.

- tf<sub>dw</sub>, term frequency: number of times word w appears in document d
- df<sub>w</sub>, document frequency: number of documents in the collection of documents that contain word w
- In  $\frac{|D|}{df_w}$ , inverse document frequency: (natural) log of the total size of the corpus |D| divided by the number of documents in the collection of documents that contain word w. When the word is common in the corpus, this will be a small number. When the word is rare, this will be a large number.

 $tf_{dw} \cdot \ln \frac{|D|}{df_{uv}}$ , term frequency-inverse document frequency: tf-idf.

- tf<sub>dw</sub>, term frequency: number of times word w appears in document d
- df<sub>w</sub>, document frequency: number of documents in the collection of documents that contain word w
- In  $\frac{|D|}{df_w}$ , inverse document frequency: (natural) log of the total size of the corpus |D| divided by the number of documents in the collection of documents that contain word w. When the word is common in the corpus, this will be a small number. When the word is rare, this will be a large number.

 $tf_{dw} \cdot \ln \frac{|D|}{df_{uv}}$ , term frequency-inverse document frequency: tf-idf.

### Suppose

	features										
	senator	hatfield	mr	chief	justice	president	vice	bush			
1981	2	1	3	1	1	5	2	1			
1985	4	0	0	1	1	3	1	1			
1989	2	0	6	1	2	6	1	0			

#### Suppose

features										
	senator	hatfield	mr	chief	justice	president	vice	bush		
1981	2	1	3	1	1	5	2	1		
1985	4	0	0	1	1	3	1	1		
1989	2	0	6	1	2	6	1	0		

What is tf-idf for senator in 1981?

#### Suppose

features										
	senator	hatfield	mr	chief	justice	president	vice	bush		
1981	2	1	3	1	1	5	2	1		
1985	4	0	0	1	1	3	1	1		
1989	2	0	6	1	2	6	1	0		

What is tf-idf for senator in 1981?

What is tf-idf for mr in 1989?

1981 'senator' is used 2 times.

1981 'senator' is used 2 times. So, tf=2.

1981 'senator' is used 2 times. So, tf=2. and in the 3 speeches (our corpus),

1981 'senator' is used 2 times. So, tf=2.

and in the 3 speeches (our corpus), it is used (at least once) in *every* speech. So, |D|=3 and df=3

1981 'senator' is used 2 times. So, tf=2.

- and in the 3 speeches (our corpus), it is used (at least once) in  $\it every$  speech. So, |D|=3 and  $\it df=3$ 
  - so the *idf* is  $\ln \frac{|D|}{df} = \ln \left(\frac{3}{3}\right)$

1981 'senator' is used 2 times. So, tf=2.

and in the 3 speeches (our corpus), it is used (at least once) in every speech. So, |D|=3 and df=3

so the *idf* is  $\ln \frac{|D|}{df} = \ln \left(\frac{3}{3}\right) = 0$ 

1981 'senator' is used 2 times. So, tf=2.

- and in the 3 speeches (our corpus), it is used (at least once) in *every* speech. So, |D|=3 and df=3
  - so the *idf* is  $\ln \frac{|D|}{df} = \ln \left(\frac{3}{3}\right) = 0$
  - $\rightarrow$  tf-idf=0 for 'senator' in 1981.

1981 'senator' is used 2 times. So, tf=2.

- and in the 3 speeches (our corpus), it is used (at least once) in *every* speech. So, |D|=3 and df=3
  - so the *idf* is  $\ln \frac{|D|}{df} = \ln \left(\frac{3}{3}\right) = 0$
  - $\rightarrow$  tf-idf=0 for 'senator' in 1981.

but 'mr' is used 6 times in 1989, 3 times in 1981 and not at all in 1985.

1981 'senator' is used 2 times. So, tf=2.

- and in the 3 speeches (our corpus), it is used (at least once) in *every* speech. So, |D|=3 and df=3
  - so the *idf* is  $\ln \frac{|D|}{df} = \ln \left(\frac{3}{3}\right) = 0$
  - $\rightarrow$  tf-idf=0 for 'senator' in 1981.
- but 'mr' is used 6 times in 1989, 3 times in 1981 and not at all in 1985.
  - so idf is  $\ln \frac{|D|}{df} = \ln \left(\frac{3}{2}\right)$

1981 'senator' is used 2 times. So, tf=2.

- and in the 3 speeches (our corpus), it is used (at least once) in *every* speech. So, |D|=3 and df=3
  - so the *idf* is  $\ln \frac{|D|}{df} = \ln \left(\frac{3}{3}\right) = 0$
  - $\rightarrow$  tf-idf=0 for 'senator' in 1981.
- but 'mr' is used 6 times in 1989, 3 times in 1981 and not at all in 1985.
  - so idf is  $\ln \frac{|D|}{df} = \ln \left(\frac{3}{2}\right) = 0.41$

1981 'senator' is used 2 times. So, tf=2.

- and in the 3 speeches (our corpus), it is used (at least once) in *every* speech. So, |D|=3 and df=3
  - so the *idf* is  $\ln \frac{|D|}{df} = \ln \left(\frac{3}{3}\right) = 0$
  - $\rightarrow$  tf-idf=0 for 'senator' in 1981.
- but 'mr' is used 6 times in 1989, 3 times in 1981 and not at all in 1985.
  - so idf is  $\ln \frac{|D|}{df} = \ln \left(\frac{3}{2}\right) = 0.41$
- $\rightarrow$  tf-idf=0.41  $\times$  6 = 2.46 for 'mr' in 1989.

1981 'senator' is used 2 times. So, tf=2.

- and in the 3 speeches (our corpus), it is used (at least once) in *every* speech. So, |D|=3 and df=3
  - so the *idf* is  $\ln \frac{|D|}{df} = \ln \left(\frac{3}{3}\right) = 0$
  - $\rightarrow$  tf-idf=0 for 'senator' in 1981.
- but 'mr' is used 6 times in 1989, 3 times in 1981 and not at all in 1985.
  - so idf is  $\ln \frac{|D|}{df} = \ln \left(\frac{3}{2}\right) = 0.41$
- $\rightarrow$  tf-idf=0.41  $\times$  6 = 2.46 for 'mr' in 1989.

• Why do we log the idf part in tf-idf?

• Why do we log the idf part in tf-idf? (hint: think about how we'd like idf to react to very rare vs fairly rare words)

- Why do we log the idf part in tf-idf? (hint: think about how we'd like idf to react to very rare vs fairly rare words)
- Suppose the goal is rank terms by their tf-idf: does the base of the logarithm matter?

- Why do we log the idf part in tf-idf? (hint: think about how we'd like idf to react to very rare vs fairly rare words)
- Suppose the goal is rank terms by their tf-idf: does the base of the logarithm matter?
- Consider comparing two novels from Tolstoy in terms of the common (weighted) terms they contain. Now consider comparing two tweets.

- Why do we log the idf part in tf-idf? (hint: think about how we'd like idf to react to very rare vs fairly rare words)
- Suppose the goal is rank terms by their tf-idf: does the base of the logarithm matter?
- Consider comparing two novels from Tolstoy in terms of the common (weighted) terms they contain. Now consider comparing two tweets.
  Which set of documents will, on average, have more elements in common?

- Why do we log the idf part in tf-idf? (hint: think about how we'd like idf to react to very rare vs fairly rare words)
- Suppose the goal is rank terms by their tf-idf: does the base of the logarithm matter?
- Consider comparing two novels from Tolstoy in terms of the common (weighted) terms they contain. Now consider comparing two tweets.
  Which set of documents will, on average, have more elements in common? Why?

- Why do we log the idf part in tf-idf? (hint: think about how we'd like idf to react to very rare vs fairly rare words)
- Suppose the goal is rank terms by their tf-idf: does the base of the logarithm matter?
- Consider comparing two novels from Tolstoy in terms of the common (weighted) terms they contain. Now consider comparing two tweets.
  Which set of documents will, on average, have more elements in common? Why? What should we do about this?

- Why do we log the idf part in tf-idf? (hint: think about how we'd like idf to react to very rare vs fairly rare words)
- Suppose the goal is rank terms by their tf-idf: does the base of the logarithm matter?
- Consider comparing two novels from Tolstoy in terms of the common (weighted) terms they contain. Now consider comparing two tweets.
  Which set of documents will, on average, have more elements in common? Why? What should we do about this?

Rarely an issue in English,

Rarely an issue in English, though we might want to make sure cliché is treated as cliche.

Rarely an issue in English, though we might want to make sure cliché is treated as cliche. Generally, preprocessing gets rid of accents.

Rarely an issue in English, though we might want to make sure cliché is treated as cliche. Generally, preprocessing gets rid of accents.

More of a concern in other languages, but mostly when accent completely changes meaning:

Rarely an issue in English, though we might want to make sure cliché is treated as cliche. Generally, preprocessing gets rid of accents.

More of a concern in other languages, but mostly when accent completely changes meaning: pena vs peña.

Rarely an issue in English, though we might want to make sure cliché is treated as cliche. Generally, preprocessing gets rid of accents.

More of a concern in other languages, but mostly when accent completely changes meaning: pena vs peña. Perhaps map back to non-accented words (look-up table), or make use of specific unicode (if available)?

Rarely an issue in English, though we might want to make sure cliché is treated as cliche. Generally, preprocessing gets rid of accents.

More of a concern in other languages, but mostly when accent completely changes meaning: pena vs peña. Perhaps map back to non-accented words (look-up table), or make use of specific unicode (if available)?

In practice, often written same way in casual communication (emails, search queries),

Rarely an issue in English, though we might want to make sure cliché is treated as cliche. Generally, preprocessing gets rid of accents.

More of a concern in other languages, but mostly when accent completely changes meaning: pena vs peña. Perhaps map back to non-accented words (look-up table), or make use of specific unicode (if available)?

In practice, often written same way in casual communication (emails, search queries), and disambiguation can be hard!

Rarely an issue in English, though we might want to make sure cliché is treated as cliche. Generally, preprocessing gets rid of accents.

More of a concern in other languages, but mostly when accent completely changes meaning: pena vs peña. Perhaps map back to non-accented words (look-up table), or make use of specific unicode (if available)?

In practice, often written same way in casual communication (emails, search queries), and disambiguation can be hard!

Grammatical gender often removed via stopping.