Computational Communication Science 2
Week 1 - Lecture
»Introduction«

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Digital Society Minor, University of Amsterdam

Today

Introducing...the people

Introducing...the course

Text as Data

Analyzing songtexts: NLP

Analyzing songtexts: RegEx

All course materials can be found at...

https://github.com/annekroon/CCS-2

Introducing...the people

Introducing...Marthe

dr. A. Marthe Möller

Assistant Professor Entertainment Communication

- Studying entertainment experiences in the digital space using:
  - Computational methods (e.g., ACA of user comments)
  - Experimental methods

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Introducing...Anne

dr. Anne Kroon

Assistant Professor Corporate Communication

- Research focus on biased AI in recruitment, and media bias regarding minorities
- Text analysis using automated approaches, word embeddings

@annekroon |a.c.kroon@uva.nl |http://www.uva.nl/profiel/k/r/a.c.kroon/a.c.kroon.html

Introducing... You

Your name?

Your background?

Your reason for taking this course?

Do you have a dataset you are working on?

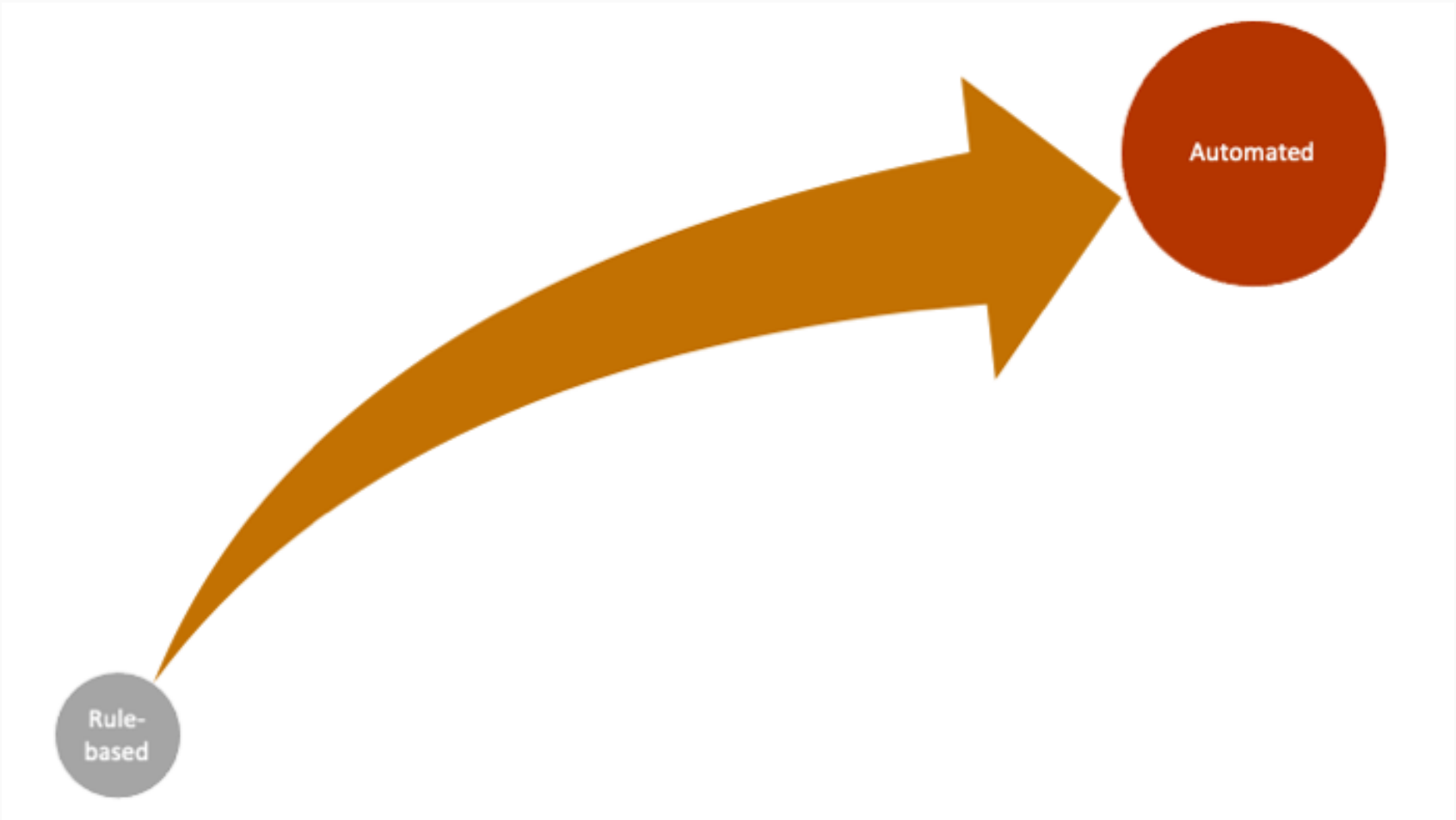
Introducing...the course

About CCS-2

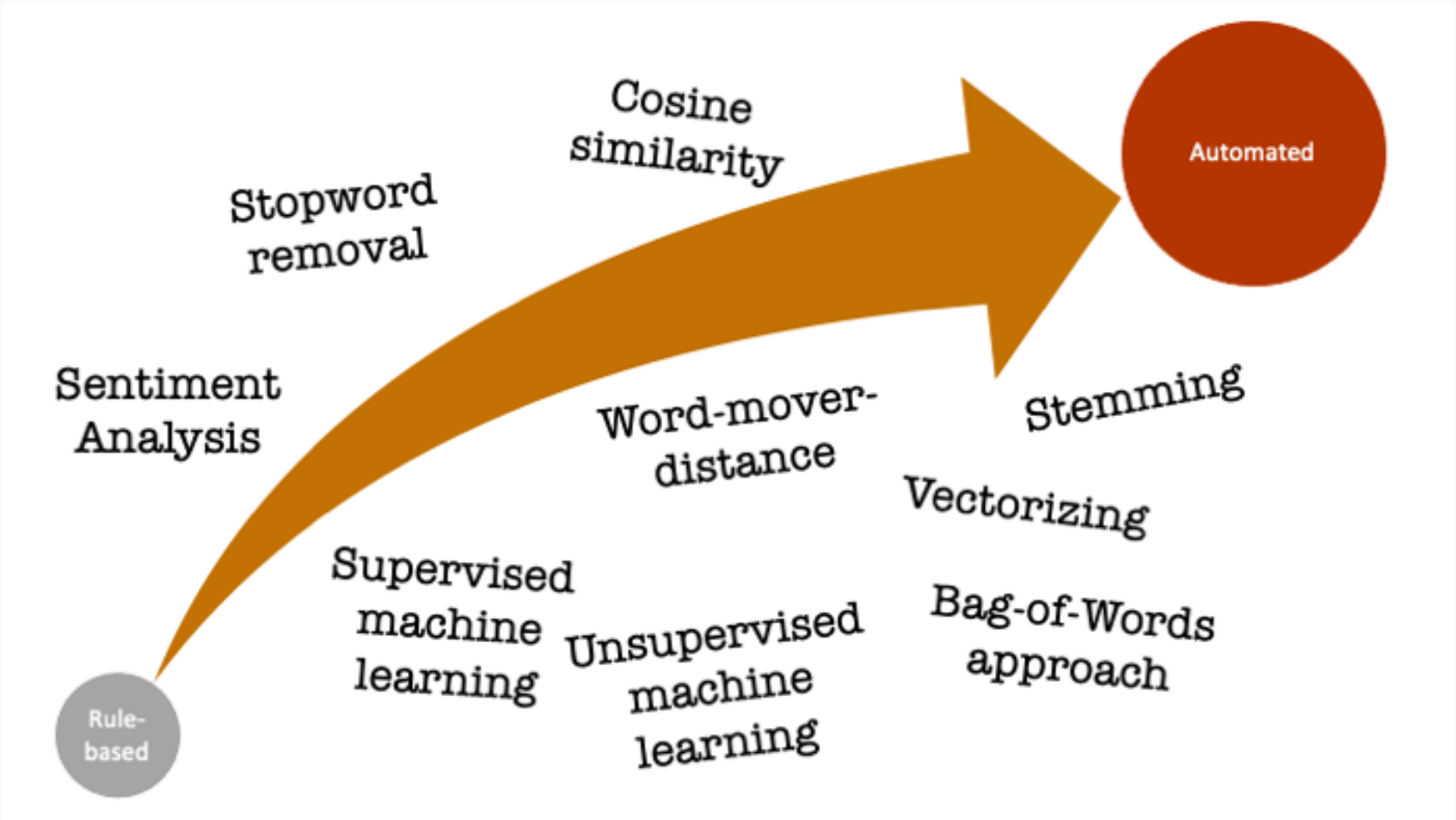
What is CCS-2?

- Next step after CCS-1
- How to use what you learned in CCS-1 for research?
  - Learn computational techniques (e.g. data vectorization, machine learning)
  - Learn how to use these techniques for research (e.g., content analysis)
- By the end of the course, you'll be prepared to do computational research in the Research Project

About CCS-2



About CCS-2


Automated
Cosine similarity
Stopword removal
Sentiment Analysis
Word-mover-distance
Stemming
Vectorizing
Supervised machine learning
Unsupervised machine learning
Bag-of-Words approach
Rule-based

About CCS-2

What will we do in this course?

- We discuss techniques in the lectures
- We practice with techniques in the tutorials
- Graded assignments to master the techniques:
  - Regular multiple choice questions (20%) about readings that use the techniques we discuss
  - Coding challenge (group assignment): Get more experienced with the techniques and build a recommender system
    - Report (20%)
    - Presentation (10%)
  - Take-home exam (50%) at the end of the course so you can show off what you learned
- We provide structure through the meetings and assignments, you do the (home-)work

About CCS-2

How to stay informed and where to find all the materials?
Regularly check:

- The course Canvas page
- Your email
- The course Github page

In addition, make sure that you read the course manual so that you know all the ins and outs of this course!

About CCS-2

How to contact Anne and Marthe?

We kunnen hier eventueel iets over zeggen: mogen ze mailen, zijn er spreekuren etc.?

Ready? Set? Go!

Without further ado...

...let's get started!

Text as Data

Text as Data

CCS-1: You learned how to...

- Work with Python, for example, you:
  - Store text in json-files, csv-files etc.
  - Work with texts in Python

Text as Data: Learning from text directly

Studying text can teach us a lot about human behavior:

What topics do people discuss on online cancer-related platforms?
(**sanders_different_2020**)

To what extent does content differ between online and print news?
(**burggraaff_through_2020**)

What topics do people discuss in their movie reviews?
(**schneider_what_2020**)

Text as Data: Analzing text as a means

Studying text can give us information we can use to answer broader questions:

Analyze textual information about movies from IMDB to learn about the representation of women in movies
(**poma-murialdo_gender_2019**)

Automatically distinguish between reliable and unreliable online information about vaccines by investigating what characterizes reliable and unreliable texts
(**meppelink_reliable_2021**)

Text as Data: Combining text analysis with other methods

We can use data about text in combination with other methods:

Combining data about media content and survey data to investigate how media coverage affects citizens' trust in the EU (**brosius_trust_2019**)

Text as Data: NLP

"**Natural language processing (NLP)** refers to the branch of computer science — and more specifically, the branch of artificial intelligence or AI — concerned with giving computers the ability to understand text and spoken words in much the same way human beings can."
(IBM, 2020)

Analyzing songtexts: NLP

Molly Malone

```
1  MollyMalone = "In Dublin's fair city, where the girls are so pretty, I
       first set my eyes on sweet Molly Malone. As she wheeled her
       wheelbarrow, Through streets broad and narrow Crying, Cockles and
       mussels, alive, alive, oh! Alive, alive, oh, Alive, alive, oh,
       Crying, Cockles and mussels, alive, alive, oh."
```

Molly Malone

```
print(type(MollyMalone))
print(len(MollyMalone))
print(MollyMalone[0])
print(MollyMalone[-1:])
```

```
<class 'str'>
96
I
.
```

NLTK

NLTK: Natural Language Toolkit (www.nltk.org)

Tokenization: The process of breaking text (paragraphs, sentences, etc.) into smaller parts (individual sentences, words, etc.)

Tokenization

```
1 MM_words = word_tokenize(MollyMalone)
2
3 print(MM_words)
```

```
1 ['In', 'Dublin', "'s", 'fair', 'city', ',', 'where', 'the', '
    girls', 'are', 'so', 'pretty', ',', 'I', 'first', 'set', 'my
    ', 'eyes', 'on', 'sweet', 'Molly', 'Malone', '.', 'As', 'she
    ', 'wheeled', 'her', 'wheelbarrow', ',', 'Through', 'streets
    ', 'broad', 'and', 'narrow', 'Crying', ',', 'Cockles', 'and
    ', 'mussels', ',', 'alive', ',', 'alive', ',', 'oh', '!', '
    Alive', ',', 'alive', ',', 'oh', ',', 'Alive', ',', 'alive',
     ',', 'oh', ',', 'Crying', ',', 'Cockles', 'and', 'mussels',
     ',', 'alive', ',', 'alive', ',', 'oh', '.']
```

Tokenization

```
print(Counter(MM_words).most_common(3))
```

```
[(',', 17), ('alive', 6), ('oh', 4)]
```

Removing Stopwords

```
stopwords = ['in', 'the', 'and', 'a','I', 'she', 'her', 'are', 'so', 'on
    ', 'me', 'my', 'mine', 'oh']
nostopwords = []

for word in MM_words:
   if word not in stopwords:
      nostopwords.append(word)

print(nostopwords)
```

```
['In', 'Dublin', "'s", 'fair', 'city', ',', 'where', 'girls', '
    pretty', ',', 'first', 'set', 'eyes', 'sweet', 'Molly', '
    Malone', '.', 'As', 'wheeled', 'wheelbarrow', ',', 'Through
    ', 'streets', 'broad', 'narrow', 'Crying', ',', 'Cockles', '
    mussels', ',', 'alive', ',', 'alive', ',', '!', 'Alive',
    ',', 'alive', ',', ',', 'Alive', ',', 'alive', ',', ',', '
    Crying', ',', 'Cockles', 'mussels', ',', 'alive', ',', '
    alive', ',', '.']
```

Removing Stopwords

```
print(Counter(nostopwords).most_common(3))
```

```
[(',', 17), ('alive', 6), ('.', 2)]
```

Removing Stopwords

```
1
2 from nltk.corpus import stopwords
3 print(len(stop_words))
```

```
1 179
```

Removing Stopwords

```
1 nostopwords = []
2
3 for word in MM_words:
4    if word not in stop_words:
5       nostopwords.append(word)
6
7 print(nostopwords)
```

```
1 ['In', 'Dublin', "'s", 'fair', 'city', ',', 'girls', 'pretty',
     ',', 'I', 'first', 'set', 'eyes', 'sweet', 'Molly', 'Malone
     ', '.', 'As', 'wheeled', 'wheelbarrow', ',', 'Through', '
     streets', 'broad', 'narrow', 'Crying', ',', 'Cockles', '
     mussels', ',', 'alive', ',', 'alive', ',', 'oh', '!', 'Alive
     ', ',', 'alive', ',', 'oh', ',', 'Alive', ',', 'alive', ',',
      'oh', ',', 'Crying', ',', 'Cockles', 'mussels', ',', 'alive
     ', ',', 'alive', ',', 'oh', '.']
```

Molly Malone

```
print(Counter(nostopwords).most_common(3))
```

```
[(',', 17), ('alive', 6), ('oh', 4)]
```

Molly Malone

```
import string
punct = list(string.punctuation)
print(punct[:5])
```

```
['!', '"', '#', '$', '%']
```

Molly Malone

```
1  nostopnopunct = []
2
3  for word in nostopwords:
4     if word not in punct:
5        nostopnopunct.append(word)
6
7  print(nostopnopunct)
```

```
1  ['In', 'Dublin', "'s", 'fair', 'city', 'where', 'girls', 'pretty
       ', 'first', 'set', 'eyes', 'sweet', 'Molly', 'Malone', 'As',
        'wheeled', 'wheelbarrow', 'Through', 'streets', 'broad', '
      narrow', 'Crying', 'Cockles', 'mussels', 'alive', 'alive', '
      Alive', 'alive', 'Alive', 'alive', 'Crying', 'Cockles', '
      mussels', 'alive', 'alive']
```

Molly Malone

```
1 print(Counter(nostopnopunct).most_common(3))
```

```
1 [('alive', 6), ('Crying', 2), ('Cockles', 2)]
```

Molly Malone

```
1 lower = []
2
3 for word in nostopnopunct:
4 lower.append(word.lower())
5
6 print(lower)
```

```
1 ['in', 'dublin', "'s", 'fair', 'city', 'where', 'girls', 'pretty
    ', 'first', 'set', 'eyes', 'sweet', 'molly', 'malone', 'as',
     'wheeled', 'wheelbarrow', 'through', 'streets', 'broad', '
    narrow', 'crying', 'cockles', 'mussels', 'alive', 'alive', '
    alive', 'alive', 'alive', 'alive', 'crying', 'cockles', '
    mussels', 'alive', 'alive']
```

Molly Malone

```
print(Counter(lower).most_common(3))
```

```
[('alive,', 8), ('crying', 2), ('cockles', 2)]
```

Zooming out

So far, we talked about:

- Natural Language Processing and the NLTK
- Tokenization

Next, we will talk about:

- Stemming and lemmatization

Stemming

```
from nltk.stem.porter import *
stemmer = PorterStemmer()

stems = [stemmer.stem(word) for word in lower]
print(tems)
^^I
```

```
['in', 'dublin', "'s", 'fair', 'citi', 'where', 'girl', 'pretti',
     'first', 'set', 'eye', 'sweet', 'molli', 'malon', 'as', '
    wheel', 'wheelbarrow', 'through', 'street', 'broad', 'narrow
    ', 'cri', 'cockl', 'mussel', 'aliv', 'aliv', 'aliv', 'aliv',
     'aliv', 'aliv', 'cri', 'cockl', 'mussel', 'aliv', 'aliv']
```

Stemming

Compare:

```
['in', 'dublin', "'s", 'fair', 'citi', 'where', 'girl', 'pretti',
    'first', 'set', 'eye', 'sweet', 'molli', 'malon', 'as', '
   wheel', 'wheelbarrow', 'through', 'street', 'broad', 'narrow
   ', 'cri', 'cockl', 'mussel', 'aliv', 'aliv', 'aliv', 'aliv',
    'aliv', 'aliv', 'cri', 'cockl', 'mussel', 'aliv', 'aliv']
```

```
['in', 'dublin', "'s", 'fair', 'city', 'where', 'girls', 'pretty
   ', 'first', 'set', 'eyes', 'sweet', 'molly', 'malone', 'as',
    'wheeled', 'wheelbarrow', 'through', 'streets', 'broad', '
   narrow', 'crying', 'cockles', 'mussels', 'alive', 'alive', '
   alive', 'alive', 'alive', 'alive', 'crying', 'cockles', '
   mussels', 'alive', 'alive']
```

Lemmatization

```
1 from nltk.stem import WordNetLemmatizer
2 lemmatizer = WorddNetLemmatizer(
3 nltk.download('wordnet'))
4
5 lems = [lemmatizer.lemmatize(word) for word in lower]
6 print(lems)
```

```
1 ['in', 'dublin', "'s", 'fair', 'city', 'where', 'girl', 'pretty',
      'first', 'set', 'eye', 'sweet', 'molly', 'malone', 'a', '
    wheeled', 'wheelbarrow', 'through', 'street', 'broad', '
    narrow', 'cry', 'cockle', 'mussel', 'alive', 'alive', 'alive
    ', 'alive', 'alive', 'alive', 'cry', 'cockle', 'mussel', '
    alive', 'alive']
```

Lemmatization

Compare:

```
['in', 'dublin', "'s", 'fair', 'city', 'where', 'girl', 'pretty',
     'first', 'set', 'eye', 'sweet', 'molly', 'malone', 'a', '
    wheeled', 'wheelbarrow', 'through', 'street', 'broad', '
    narrow', 'cry', 'cockle', 'mussel', 'alive', 'alive', 'alive
    ', 'alive', 'alive', 'alive', 'cry', 'cockle', 'mussel', '
    alive', 'alive']
```

```
['in', 'dublin', "'s", 'fair', 'citi', 'where', 'girl', 'pretti',
     'first', 'set', 'eye', 'sweet', 'molli', 'malon', 'as', '
    wheel', 'wheelbarrow', 'through', 'street', 'broad', 'narrow
    ', 'cri', 'cockl', 'mussel', 'aliv', 'aliv', 'aliv', 'aliv',
     'aliv', 'aliv', 'cri', 'cockl', 'mussel', 'aliv', 'aliv']
```

Zooming out

So far, we talked about:

- Natural Language Processing and the NLTK
- Tokenization
- Stemming and lemmatization

Next, we will talk about:

- Regular expressions

Analyzing songtexts: RegEx

RegEx

"A *regular expression* or *regex* is a powerful language to locate strings that conform to a given pattern. [...] Specifically, regular expressions are a sequence of characters that we can use to design a pattern and then use this pattern to *find* strings (identify or extract) and also *replace* those strings by new ones."

van_atteveldt_computational_2022

RegEx: Search, Match, or Findall

```
print(re.search("live", "Alive"))
```

```
live
```

```
print(re.match("live", "Alive"))
```

```
print(re.match("live", MollyMalone_words))
```

```
live
live
live
live
live
live
live
live
```

RegEx

```
for word in MollyMalone_words:
  if re.search("[Aa]live", word):
    print(word)
```

```
alive
alive
Alive
alive
Alive
alive
alive
alive
```

RegEx

`m[oa]lly` matches molly, but also mally

`m.lly` matches molly, but also mally, or melly, or milly...

Quantifiers

`mol+y` matches moly, molly, mollly, molllly...

`[mM]ol+y` matches moly, molly, and mollly, but also Moly, Molly, Mollly, Molllly...

Quantifiers

Molly Malone

`<.*>` is greedy and will select everything

`<.*?>` is non-greedy and will match and

Groups

```
That was (not)? the end of sweet Molly Malone
```

will select both:

That was the end of sweet Molly Malone and That was not the end of sweet Molly Malone

Character classes

The Dublin Millennium Commission proclaimed 13 June to be "Molly Malone Day"

```
[1-9]+.[A-Z][a-z]+
```

will select 13 June

RegEx in ComScience

"Next to steps like conversion to lowercase and the removal of stop words and punctuation,we paid extensive attention to the recoding of potential firms mentioned in our datain order to circumvent underestimation of news attention to firms. We manually compileda list of companies – based on existing lists of Dutch and Non-Dutch multinationals, and AEX stock market–listed firms potentially relevant for our study. If a firm on this listcontained more than one word or had synonyms or different spellings, our program usedregular expressions to replace these by a unique term that we defined. For example, AirFrance KLM and different variations on it were all converted into Air_France_KLM andABN AMRO into ABN_AMRO. In addition, we supplemented abbreviations like ABNby the full (new) name, if the full name was mentioned in the same text." Jonkman et al. (2016), p. 1615

Zooming out

Today, we talked about:

- Natural Language Processing and the NLTK
- Tokenization
- Stemming and lemmatization
- Regular expressions: what can you do with it?

In this weeks' tutorial, you will:

- Practice with these processes, so that you can use them (amongst others) when you explore data next week!