

Big Data and Automated Content Analysis

Week 3 – Tuesday

Data harvesting and storage

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Today

① Data harvesting and storage

APIs

RSS feeds

Scraping and crawling

Parsing text files

② Storing data

CSV tables

JSON and XML

Databases

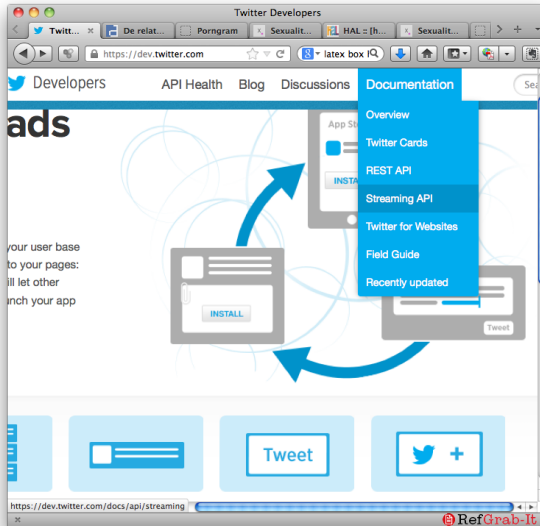
③ Next meetings

Data harvesting and storage

An overview of APIs, scrapers, crawlers, RSS-feeds, and different file formats

Collecting data: APIs

APIs



Querying an API

```
1 # contact the Twitter API
2 auth = OAuth(access_key, access_secret, consumer_key, consumer_secret)
3 twitter = Twitter(auth = auth)
4
5 # get all info about the user 'username'
6 tweepinfo=twitter.users.show(screen_name=username)
7
8 # save his bio statement to the variable bio
9 bio=tweepinfo["description"])
10
11 # save his location to the variable location
12 location=tweepinfo["location"]
```

(abbreviated Python example of how to query the Twitter REST API)

Who offers APIs?

The usual suspects: Twitter, Facebook, Google – but also Reddit, Youtube, ...

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If you ever leave your bag on a bus on Chicago

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If you ever leave your bag on a bus on Chicago

... but do have Python on your laptop, watch this:

https://www.youtube.com/watch?v=RrPZza_vZ3w.

That guy queries the Chicago bus company's API to calculate when *exactly the vehicle* with his bag arrives the next time at the bus stop in front of his office.

(Yes, he tried calling the help desk before, but they didn't know. He got his bag back.)

APIs

Pro

- Structured data (JSON!)
- Easy to process automatically
- Can be directly embedded in your script

APIs

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- Structured data (JSON!)
- Easy to process automatically
- Can be directly embedded in your script

Con

- Often limitations (requests per minute, sampling, ...)
- You have to trust the provider that he delivers the right content (⇒ Morstatter e.a., 2013)
- **Some APIs won't allow you to go back in time!**

So we have learned that we can access an API directly.
But what if we have to do so 24/7?

So we have learned that we can access an API directly.
But what if we have to do so 24/7?

Collecting tweets with a tool running on a server that *does* query the API 24/7.

Collecting data: RSS feeds

RSS feeds

What's that?

- A structured (XML) format in which for example news sites and blogs offer their content

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`http://www.nu.nl/rss`

RSS feed

```
<rss xmlns:atom="http://www.w3.org/2005/Atom" version="2.0" xmlns:media="http://search.yahoo.com/mr
<link>https://www.nu.nl/</link><description>Het laatste nieuws het eerst op NU.nl</description><ato
nl</language><copyright>Copyright (c) 2018, NU</copyright><lastBuildDate>Sun, 18 Feb 2018 13:34:17
<atom:logo>https://www.nu.nl/static/img/atoma/images/logos/rss-logo-250x40.png</atom:logo><item><ti
<link>https://www.nu.nl/olympische-winterspelen-pyeongchang-2018/5139494/kodaira-wint-olympische-50
olympisch goud veroverd op de 500 meter. De Nederlandse vrouwen grepen zoals verwacht naast een med
</description><pubDate>Sun, 18 Feb 2018 13:32:27 +0100</pubDate><guid isPermaLink="false">https://w
url="https://media.nu.nl/m/jllxny7aub8u_sqr256.jpg/kodaira-wint-olympische-500-meter-mors-knap-zesd
<category>Winterspelen</category><dc:creator>NU.nl</dc:creator><dc:rights>copyright photo: ANP</dc:
2018/5139461/verweij-vreest-ondanks-matig-optreden-niet-plek-in-ploegachtervolging.html" type="text
in ploegachtervolging"></atom:link><atom:link href="http://nu.nl/olympische-winterspelen-pyeongchan
type="text/html" rel="related" title="Nederlandse achtervolgingsploeg met enige moeite naar halve f
pyeongchang-2018/5139386/herstelde-verbijz-heeft-geen-idee-hij-kan-olympische-500-meter.html" type="
olympische 500 meter"></atom:link><atom:link href="http://nu.nl/olympische-winterspelen-pyeongchang
lorentzen.html" type="text/html" rel="related" title="Verbijz als laatste Nederlander in actie op 50
krijgt tegen Heracles eerste basisplek sinds terugkeer bij Feyenoord</title><link>https://www.nu.nl
feyenoord.html</link><description>Robin van Persie heeft zondag in de thuiswedstrijd tegen Heracles
</description><pubDate>Sun, 18 Feb 2018 13:26:20 +0100</pubDate><guid isPermaLink="false">https://w
url="https://media.nu.nl/m/9ixxvr8atmaf_sqr256.jpg/van-persie-krijgt-heracles-eerste-basisplek-bind
<category>Algemeen</category><category>Voetbal</category><dc:creator>NU.nl</dc:creator><dc:rights>c
eerste toernooizege in anderhalf jaar</title><link>https://www.nu.nl/sport-overig/5139473/luiten-bo
Luiten heeft zondag de Oman Open gewonnen. Voor de Nederlandse golfer is het zijn eerste toernooize
18 Feb 2018 13:27:52 +0100</pubDate><guid isPermaLink="false">https://www.nu.nl/-/5139473/</guid><e
eerste-toernooizege-in-anderhalf-jaar.jpg" length="0" type="image/jpeg"></enclosure><category>Sport
<dc:rights>copyright photo: Getty Images</dc:rights></item><item><title>Dode gevonden in woning Zwo
<link>https://www.nu.nl/binnenland/5139464/dode-gevonden-in-woning-zwolle-politie-gaat-van-misdrijf
overschot aangetroffen. De politie gaat ervan uit dat de dode slachtoffer is geworden van een misdr
vermist, is nog onduidelijk.</description><pubDate>Sun, 18 Feb 2018 13:08:55 +0100</pubDate><guid i
url="https://media.nu.nl/m/i9nxbu6ag2e9_sqr256.jpg/dode-gevonden-in-woning-zwolle-politie-gaat-van-
<category>Algemeen</category><category>Binnenland</category><dc:creator>ANP</dc:creator><dc:rights>
&#160;"astronauten-tv&#160;" uit jaren &#160;"70</title><link>https://www.nu.nl/tech/5139467/brit-speelt-modern
spelcomputers werkend gekregen op de Videosphere. De Videosphere komt uit de jaren &#160;"70 en ziet er
verschillende kabels gebruiken. De Brit speelde onder meer Mario Kart 8, Forza 7 en Horizon Zero Da
isPermaLink="false">https://www.nu.nl/-/5139467/</guid><enclosure url="https://media.nu.nl/m/wmqxt8
length="0" type="image/jpeg"></enclosure><category>Tech</category><dc:creator>NU.nl</dc:creator></i
ploegachtervolging</title><link>https://www.nu.nl/olympische-winterspelen-pyeongchang-2018/5139461/
</description>Koen Verweij kende zondag mede door problemen met zijn linkerschaats geen goed optrede
Hollander is voorlopig niet bang dat hij in de halve finales wordt vervangen door Patrick Roest.</d
isPermaLink="false">https://www.nu.nl/-/5139461/</guid><enclosure url="https://media.nu.nl/m/co2x9m
ploegachtervolging.jpg" length="0" type="image/jpeg"></enclosure><category>Winterspelen</category><
```

Parsing RSS feeds

```
1 import feedparser
2 d = feedparser.parse(rss_body)
3     for post in d.entries:
4         teaser=re.sub(r"\n|\r|\t"," ",post.description)
5         link = post.link
6     ...
7     ...
```

(abbreviated Python example of how to parse an RSS feed)

RSS feeds

Pro

- *One* protocol for all services
- Easy to use

Con

- Full text often not included, you have to download the link separately (\Rightarrow Problems associated with scraping)
- **You can't go back in time!** But we have archived a lot of RSS feeds

Collecting data: Scraping and crawling

Scraping and crawling

If you have no chance of getting already structured data via one of the approaches above

Scraping and crawling

If you have no chance of getting already structured data via one of the approaches above

- Download web pages, try to identify the structure yourself
- You have to *parse* the data

Scraping and crawling

If you have no chance of getting already structured data via one of the approaches above

- Download web pages, try to identify the structure yourself
- You have to *parse* the data
- Can get very complicated (depending on the specific task), especially if the structure of the web pages changes

Further reading:

<http://scrapy.org>

<https://github.com/anthonydb/python-get-started/blob/master/5-web-scraping.py>

[//github.com/anthonydb/python-get-started/blob/master/5-web-scraping.py](https://github.com/anthonydb/python-get-started/blob/master/5-web-scraping.py)

Collecting data: Parsing text files

For messy input data or for semi-structured data

Guiding question: Can we identify some kind of pattern?

For messy input data or for semi-structured data

Guiding question: Can we identify some kind of pattern?

Examples

- Lewis, Zamith, & Hermida (2013) had a corrupt CSV-file

Lewis, S. C., Zamith, R., & Hermida, A. (2013). Content analysis in an era of Big Data: A hybrid approach to computational and manual methods. *Journal of Broadcasting & Electronic Media*, 57(1), 34–52.
doi:10.1080/08838151.2012.761702

For messy input data or for semi-structured data

Guiding question: Can we identify some kind of pattern?

Examples

- Lewis, Zamith, & Hermida (2013) had a corrupt CSV-file
- LexisNexis gives you a chunk of text (rather than, e.g., a structured JSON or XML object)

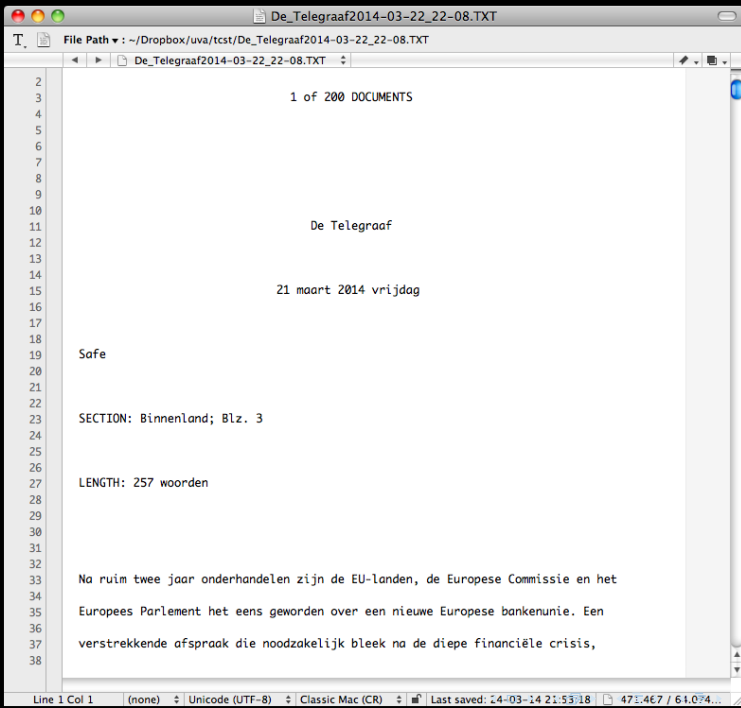
For messy input data or for semi-structured data

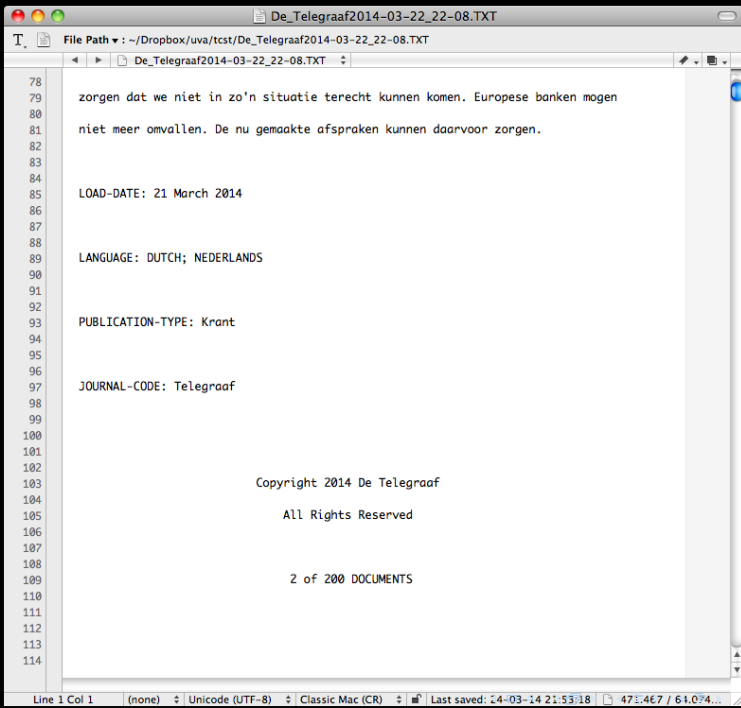
Guiding question: Can we identify some kind of pattern?

Examples

- Lewis, Zamith, & Hermida (2013) had a corrupt CSV-file
- LexisNexis gives you a chunk of text (rather than, e.g., a structured JSON or XML object)

But in both cases, as long as you can find any pattern or structure in it, you can try to write a Python script to *parse* the data.






```

tekst={}
section={}
length={}
...
...
with open(bestandsnaam) as f:
    for line in f:
        line=line.replace("\r","")
        if line=="\n":
            continue
        matchObj=re.match(r"\s+(\d+) of (\d+) DOCUMENTS",line)
        if matchObj:
            artikelnr= int(matchObj.group(1))
            tekst[artikelnr]=" "
            continue
        if line.startswith("SECTION"):
            section[artikelnr]=line.replace("SECTION: ","").rstrip("\n")
        elif line.startswith("LENGTH"):
            length[artikelnr]=line.replace("LENGTH: ","").rstrip("\n")
        ...
        ...
        ...

    else:
        tekst[artikelnr]=tekst[artikelnr]+line

```

Storing data: CSV tables

CSV-files

Always a good choice

- *All* programs can read it
- Even human-readable in a simple text editor:
- Plain text, with a comma (or a semicolon) denoting column breaks
- No limits regarding the size
- But: several dialects (e.g., , vs. ; as delimiter)

A CSV-file with tweets

```
1 text,to_user_id,from_user_id,from_user_id,iso_language_code,source,
  profile_image_url,geo_type,geo_coordinates_0,geo_coordinates_1,
  created_at,time
2 :-) #Lectrr #wereldleiders #uitspraken #Wikileaks #klimaattop http://t.
  co/Udjpk48EIB,,henklbr,407085917011079169,118374840,nl,web,http://
  pbs.twimg.com/profile_images/378800000673845195/
  b47785b1595e6a1c63b93e463f3d0ccc_normal.jpeg,,0,0,Sun Dec 01
  09:57:00 +0000 2013,1385891820
3 Wat zijn de resulatn vd #klimaattop in #Warschau waard? @EP_Environment
  ontmoet voorzitter klimaattop @MarcinKorolec http://t.co/4
  Lmiaopf60,,Europarl_NL,406058792573730816,37623918,en,<a href="http
  ://www.hootsuite.com" rel="nofollow">HootSuite</a>,http://pbs.twimg
  .com/profile_images/2943831271/
  b6631b23a86502fae808ca3efde23d0d_normal.png,,0,0,Thu Nov 28
  13:55:35 +0000 2013,1385646935
```

Storing data: JSON and XML

JSON and XML

Great if we have a nested data structure

JSON and XML

Great if we have a nested data structure

- Items within feeds

JSON and XML

Great if we have a nested data structure

- Items within feeds
- Personal data within authors within books

JSON and XML

Great if we have a nested data structure

- Items within feeds
- Personal data within authors within books
- Tweets within followers within users

A JSON object containing GoogleBooks data

```
1 {'totalItems': 574, 'items': [{'kind': 'books#volume', 'volumeInfo': {'  
    publisher': '"O'Reilly Media, Inc."', 'description': u'Get a  
    comprehensive, in-depth introduction to the core Python language  
    with this hands-on book. Based on author Mark Lutz\u2019s popular  
    training course, this updated fifth edition will help you quickly  
    write efficient, high-quality code with Python. It\u2019s an ideal  
    way to begin, whether you\u2019re new to programming or a  
    professional developer versed in other languages. Complete with  
    quizzes, exercises, and helpful illustrations, this easy-to-follow,  
    self-paced tutorial gets you started with both Python 2.7 and 3.3\u2019  
    u2014 the  
2 ...  
3 ...  
4 'kind': 'books#volumes'}
```

An XML object containing an RSS feed

```
1  ...
2  <item>
3  <title>Agema doet aangifte tegen Samsom en Spekman</title>
4  <link>http://www.nu.nl/politiek/3743441/agema-doet-aangifte-samsom-en-
   spekman.html</link>
5  <guid>http://www.nu.nl/politiek/3743441/index.html</guid>
6  <description>PVV-Kamerlid Fleur Agema gaat vrijdag aangifte doen tegen
   PvdA-leider Diederik Samsom en PvdA-voorzitter Hans Spekman wegens
   uitspraken die zij hebben gedaan over Marokkanen. </description>
7  <pubDate>Thu, 03 Apr 2014 21:58:48 +0200</pubDate>
8  <category>Algemeen</category>
9  <enclosure url="http://bin.snmm.nl/m/m1mxwpa6nn2_sqr256.jpg" type="
   image/jpeg" />
10 <copyrightPhoto>nu.nl</copyrightPhoto>
11 </item>
12 ...
```

It's the same as our “dict of dicts”/“dict of lists”/... data model!

The screenshot shows the Spyder Python IDE interface. The main window displays a table titled "data1000 - Dictionary (1000 elements)". The table has columns: Key, Type, Size, and Value. The data is a list of dictionaries, each representing a record. The first few rows are visible, showing keys like 'channels', 'description', 'id', 'nb_comments', 'nb_views', 'nb_votes', 'runtime', and 'title'.

The Variable explorer on the right shows the variable 'data1000' as a dict of size 1000. A detailed view of one element, '1001532 - Dictionary (10 elements)', is shown in the foreground. This view displays a dictionary with the following keys and values:

Key	Type	Size	Value
channels	list	3	['Amateur', 'BDSM', 'Hardc...']
description	str	1	User submitted sex scenes ...
id	int	1	1001532
nb_comments	int	1	2
nb_views	int	1	10337
nb_votes	int	1	25
runtime	int	1	180
title	str	1	my slut for sex

The code in the console shows the following steps:

```
In [1]: import json
In [2]: data1000 = json.load(open('pornexercise/xhamster1000.json'))
In [3]:
```

When it gets bigger: Databases

Out of scope of this course, but if it get's bigger, you could use a database, e.g.

- For (relational) tables: SQL, e.g. mysql
- For dumping dicts, messy content, and text: NoSQL, e.g. MongoDB or ElasticSearch

They are easy to install on Linux and can be addressed from Python!

Günther, E., Trilling, D. C., & van de Velde, R. N. (2018). But how do we store it? Data architecture in the social-scientific research process. In C. M. Stuetzer, M. Welker, & M. Egger (Eds.), *Computational social science in the age of Big Data. Concepts, methodologies, tools, and applications* (pp. 161-187). Cologne: Herbert von Halem.

Next meetings

Next meetings

Before Thursday meeting

Post all questions about Chapters 5.1–5.4 on Canvas!

Suggestion for additional exercise

If you want to exercise your skills a bit more, try Appendix B (Parsing your own WhatsApp chats)! (Before you despair: The given solution does not handle messages with a newline in the middle of it – but if you want to, we can discuss possible approaches. Just post your ideas on Canvas.)