

Big Data and Automated Content Analysis

Week 3 – Monday

Data harvesting and storage

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Today

- 1 Last week's exercise
 - Step by step
 - Concluding remarks
- 2 Data harvesting and storage
 - APIs
 - RSS feeds
 - Scraping and crawling
 - Parsing text files
- 3 Storing data
 - CSV tables
 - JSON and XML
- 4 Next meetings

Last week's exercise

Discussing the code

Reading a JSON file into a dict, looping over the dict

Task 1: Print all titles of all videos

```
1 import json
2
3 with open("/home/damian/pornexercise/xhamster.json") as fi:
4     data=json.load(fi)
5
6 for k,v in data.items():
7     print (v["title"])
```

Reading a JSON file into a dict, looping over the dict

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NB: You have to know (e.g., by reading the documentation of the dataset) that the key is called title

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6 for k,v in data.items():
7     print (v["title"])
```

NB: You have to know (e.g., by reading the documentation of the dataset) that the key is called `title`

NB: `data` is in fact a dict of dicts, such that each value `v` is another dict.

For each of these dicts, we retrieve the value that corresponds to the key `title`

What to do if you do not know the structure of the dataset?

Inspecting your data: use the functions `type()` and `len()` and/or the dictionary method `.keys()`

```
1 len(data)
2 type(data)
3 data.keys()
```

What to do if you do not know the structure of the dataset?

Inspecting your data: use the functions `type()` and `len()` and/or the dictionary method `.keys()`

```
1 len(data)
2 type(data)
3 data.keys()
```

`len()` returns the number of items of an object; `type()` returns the type object; `.keys()` returns a list of all available keys in the dictionary

What to do if you do not know the structure of the dataset?

Inspecting your data: use the module pprint

```
1 from pprint import pprint
2
3 pprint(data)
```

```
{'1002968': {'channels': ['Tits'],
  'description': 'NA',
  'id': 1002968,
  'nb_comments': 6,
  'nb_views': 26683,
  'nb_votes': 68,
  'runtime': 1083,
  'title': 'big tit chick gets fucked',
  'upload_date': '2012-01-22',
  'uploader': '894621d2f89ab1b859c17b9b81f182e82a375c55'},
'1003007': {'channels': ['Hardcore', 'Spanking', 'Squirting'],
  'description': 'Antonia plays with her 16 inch toy and her '
    'crop,till she sprays cum into her own mouth!',
  'id': 1003007,
  'nb_comments': 5,
  'nb_views': 5008,
  'nb_votes': 35,
  'runtime': 213,
  'title': 'antonia just playin around',
  'upload_date': '2012-01-22',
```

data1000 - Dictionary (1000 elements)

Key	Type	Size	Value
1001532	dict	10	{'channels': ['Amateur', 'BDSM'...
100164	dict	10	{'channels': ['Funny', 'Webcams...
100350	dict	10	{'channels': ['Brunettes', 'Har...
1006970	dict	10	{'channels': ['Amateur', 'BBW', ...
1007380	dict	10	{'channels': ['Anal', 'Brazill...
1009468	dict	10	{'channels': ['Asian', 'Bukkake...
1009768	dict	10	{'channels': ['Grannies', 'Hair...
100982	dict	10	{'channels': ['Amateur', 'Nippl...
1012321	dict	10	{'channels': ['Anal', 'Czech', ...
1015614	dict	10	{'channels': ['Japanese', 'Porn...
1017137	dict	10	{'channels': ['Blondes', 'Danis...
1019227	dict	10	{'channels': ['Amateur', 'Blowj...
1021809	dict	10	{'channels': ['Men'], 'descript...
1023861	dict	10	{'channels': ['Amateur', 'BDSM'...
1027108	dict	10	{'channels': ['Amateur', 'Blowj...
1031179	dict	10	{'channels': ['Shenales'], 'des...

Cancel

OK

Spyder (Python 3.5)

Help

Variable explorer

Name	Type	Size	Value
data1000	dict	1000	{'1001532': {'channels': ['Amateur', 'BDSM', 'Hardc...

1001532 - Dictionary (10 elements)

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

Cancel

OK

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

Console IPython console History log

Permissions: RW End-of-lines: LF Encoding: UTF-8 Line: 7 Column: 1 Memory: 27 % 13:22

For the sake of completeness. . .

`.items()` returns a key-value *pair*, that's why we need to assign *two* variables in the for statement.

These alternatives would also work:

```
1 for v in data.values():  
2     print(v["title"])
```

```
1 for k in data:    #or: for k in data.keys():  
2     print(data[k] ["title"])
```

Do you see (dis-)advantages?

Working with a subset of the data

What to do if you want to work with a smaller subset of the data?
Taking a random sample of 10 items in your dict:

```
1 import random
2 short_dict = dict(random.sample(data.items(),10))
```

Taking the first 10 elements in a list:

```
1 short_list = list[:10]
```

Initializing variables, merging two lists, using a counter

Task 2: Average tags per video and most frequently used tags

```
1 from collections import Counter
2
3 alltags=[]
4 i=0
5 for k,v in data.items():
6     i+=1
7     alltags+=v["channels"] # or: alltags.extend(v["channels"])
8
9 print(len(alltags),"tags are describing",i,"different videos")
10 print("Thus, we have an average of",len(alltags)/i,"tags per video")
11
12 c=Counter(alltags)
13 print (c.most_common(100))
```

(there are other, more efficient ways of doing this)

Nesting blocks, using a defaultdict to count, error handling

Task 3: What porn category is most frequently commented on?

```
1 from collections import defaultdict
2
3 commentspercat=defaultdict(int)
4 for k,v in data.items():
5     for tag in v["channels"]:
6         try:
7             commentspercat[tag]+=int(v["nb_comments"])
8         except:
9             pass
10 print(commentspercat)
11 # if you want to print in a fancy way, you can do it like this:
12 for tag in sorted(commentspercat, key=commentspercat.get, reverse=True):
13     print( tag,"\t", commentspercat[tag])
```

A defaultdict is a normal dict, with the difference that the type of each value is pre-defined and it doesn't give an error if you look up a non-existing key

Nesting blocks, using a defaultdict to count, error handling

Task 3: What porn category is most frequently commented on?

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```

A defaultdict is a normal dict, with the difference that the type of each value is pre-defined and it doesn't give an error if you look up a non-existing key

NB: In line 7, we assume the value to be an int, but the datasets sometimes contains the string "NA" instead of a string representing an int. That's why we need the try/except construction

Adding elements to a list, sum() and len()

Task 4: Average length of descriptions

```
1 length=[]
2 for k,v in data.items():
3     length.append(len(v["description"]))
4
5 print ("Average length",sum(length)/len(length))
```

Merging vs appending

Merging:

```
1 l1 = [1,2,3]
2 l2 = [4,5,6]
3 l1 = l1 + l2
4 print(l1)
```

gives [1,2,3,4,5,6]

Appending:

```
1 l1 = [1,2,3]
2 l2 = [4,5,6]
3 l1.append(l2)
4 print(l1)
```

gives [1,2,3,[4,5,6]]

l2 is seen as *one* element to append to l1

Tokenizing with .split()

Task 5: Most frequently used words

```
1 allwords=[]
2 for k,v in data.items():
3     allwords+=v["description"].split()
4 c2=Counter(allwords)
5 print(c2.most_common(100))
```

.split() changes a string to a list of words.

"This is cool".split()

results in

["This", "is", "cool"]

Concluding remarks

Make sure you fully understand the code!

Re-read the corresponding chapters

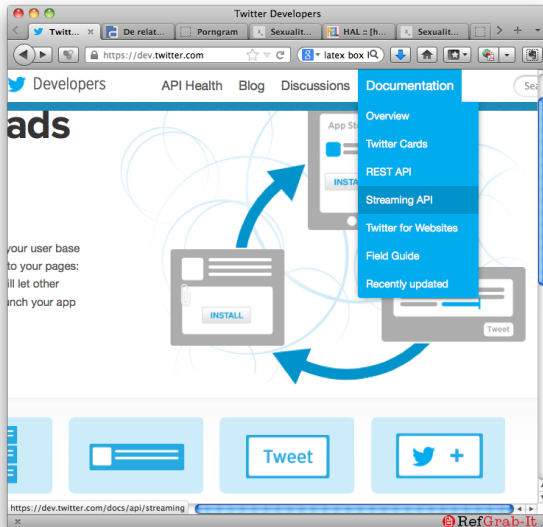
PLAY AROUND!!!

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

Who offers APIs?

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

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
- Easy to process automatically
- Can be directly embedded in your script

APIs

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- Structured data
- Easy to process automatically
- Can be directly embedded in your script

Con

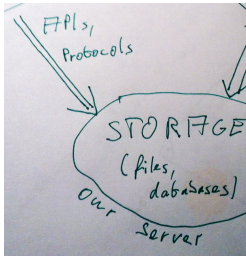
- Often limitations (requests per minute, sampling, ...)
- You have to trust the provider that he delivers the right content (\Rightarrow Morstatter e.a., 2013)
- **Some APIs won't allow you to go back in time!**

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

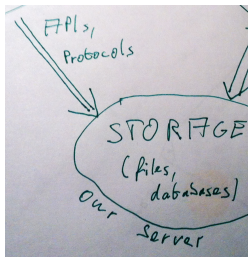
So we have learned that we can access an API directly.
But what if we have to do so 24/7?

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

Data harvesting and storage



Data harvesting and storage

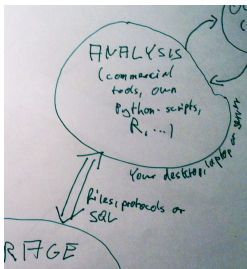


It queries the API and stores the result

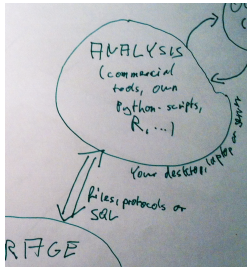
It continuously calls the Twitter-API and saves all tweets containing specific hashtags to a MySQL-database.

You tell it once which data to collect – and wait some months.

Data harvesting and storage



Data harvesting and storage



Retrieving the data for analysis

You *could* access the MySQL-database directly.

Generally raw data needs to be cleaned and parsed, before you can start analyzing and visualizing

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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- Title, teaser (or full text), date and time, link

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- You get only the new news items (and that's great!)
- Title, teaser (or full text), date and time, link

`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/atoms/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/jl1xny7aub8u_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-verbij-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="Verbij als laatste Nederlander in actie op 50
krijgt tegen Heracles eerste basisplek sinds terugkeer bij Feyenoord</title><link>https://www.nu.nl
krygenoord.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-sind
<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
overshot aangetroffen. De politie gaat ervan uit dat de dode slachtoffer is geworden van een misdri
vermist, is nog onduidelijk.</description><pubDate>Sun, 18 Feb 2018 13:08:55 +0100</pubDate><guid i
url="https://media.nu.nl/m/i9xbu6ag2e9_sqr256.jpg/dode-gevonden-in-woning-zwolle-politie-gaat-van-
<category>Algemeen</category><category>Binnenland</category><dc:creator>ANP</dc:creator><dc:rights>
&œ astronauten-tv&œ uit jaren &œ70</title><link>https://www.nu.nl/tech/5139467/brit-speelt-modern
spelcomputers werkend gekregen op de Videosphere. De Videosphere komt uit de jaren &œ70 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><
ANP</dc:rights></item><item><title>Café-gevoel van mishandeling station RAI en terroir NRC</ti

```

Parsing RSS feeds

```
1
2 tree = fromstring(htmlsource)
3
4 # parsing article teaser
5 try:
6     teaser=tree.xpath('//*[@class="item-excerpt"]//text()')[0]
7 except:
8     logger.debug("Could not parse article teaser.")
9     teaser=""
10
11 # parsing article text
12 try:
13     text=" ".join(tree.xpath('//*[@class="block-wrapper"]/div[@class="
14         block-content"]/p//text()')).strip()
15 except:
16     text = ""
17     logger.warning("Could not parse article text")
```

(abbreviated Python example of how to parse the RSS feed of NU.nl)

RSS feeds

Pro

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

Con

- Full text often not included, you have to download the link separately (⇒ 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:](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), 3452.
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)

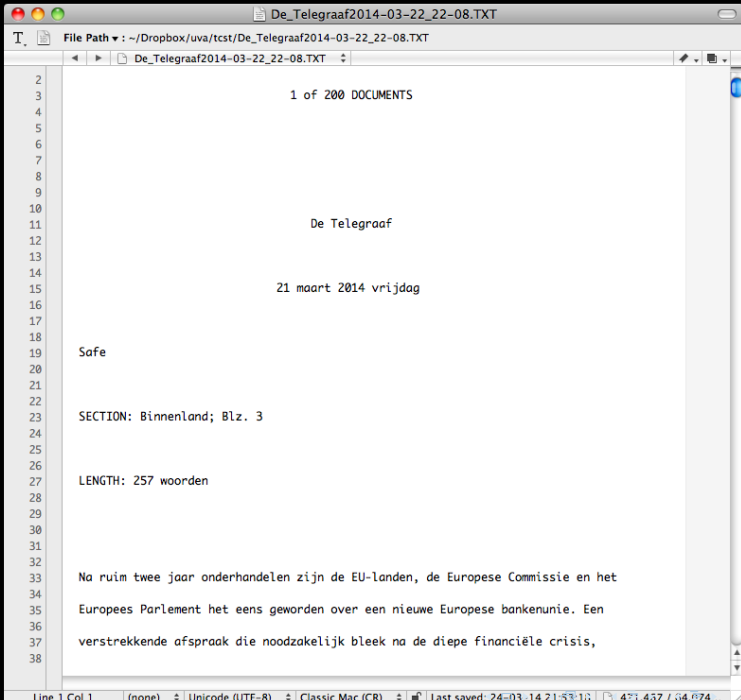
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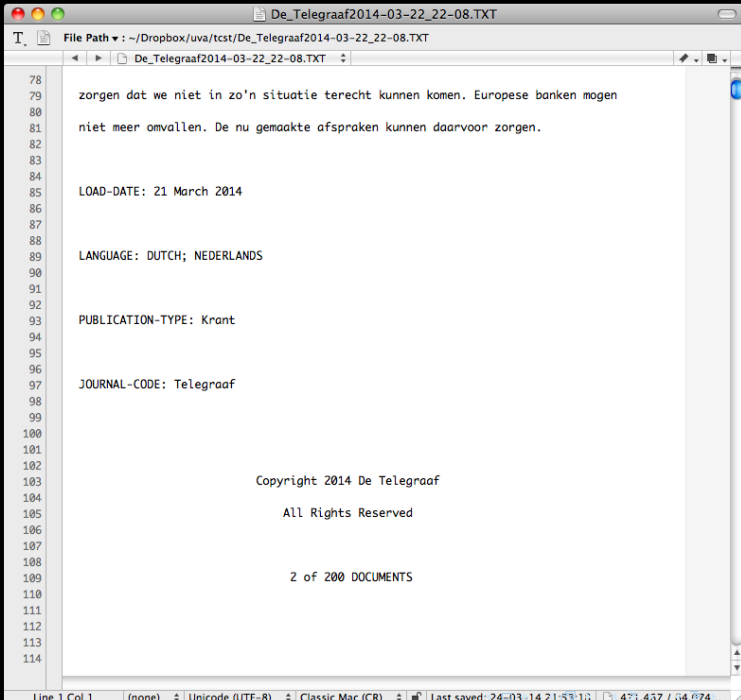
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Examples

- 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 resulataten 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\  
    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/m1mxwpka6nn2_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 a Python IDE (Spyder) with two windows. The left window, titled "data1000 - Dictionary (1000 elements)", displays a table with columns: Key, Type, Size, and Value. The table lists 1000 dictionary elements, each with a key (e.g., 1001532, 100164, 100350), a type of 'dict', a size of 10, and a value representing a dictionary of lists (e.g., {'channels': ['Amateur', 'BDSM', 'Hardcore']}). The right window, titled "1001532 - Dictionary (10 elements)", displays a detailed view of the dictionary element with key 1001532. It shows a table with columns: Key, Type, Size, and Value. The table lists 10 elements: 'channels' (list, size 3), 'description' (str, size 1), 'id' (int, size 1), 'nb_comments' (int, size 1), 'nb_views' (int, size 1), 'nb_votes' (int, size 1), 'runtime' (int, size 1), and 'title' (str, size 1). The values are: ['Amateur', 'BDSM', 'Hardcore'], 'User submitted sex scenes ...', 1001532, 2, 10337, 25, 180, and 'my slut for sex'. Below the table are 'Cancel' and 'OK' buttons. In the background, the Spyder interface shows the Variable explorer with 'data1000' as a dict of size 1000, and the IPython console with the following code:

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

Next meetings

Next meetings

Wednesday, 21–3

Writing some first data collection scripts