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The ABC of Computational Text Analysis

#5 Basic NLP with Command-line

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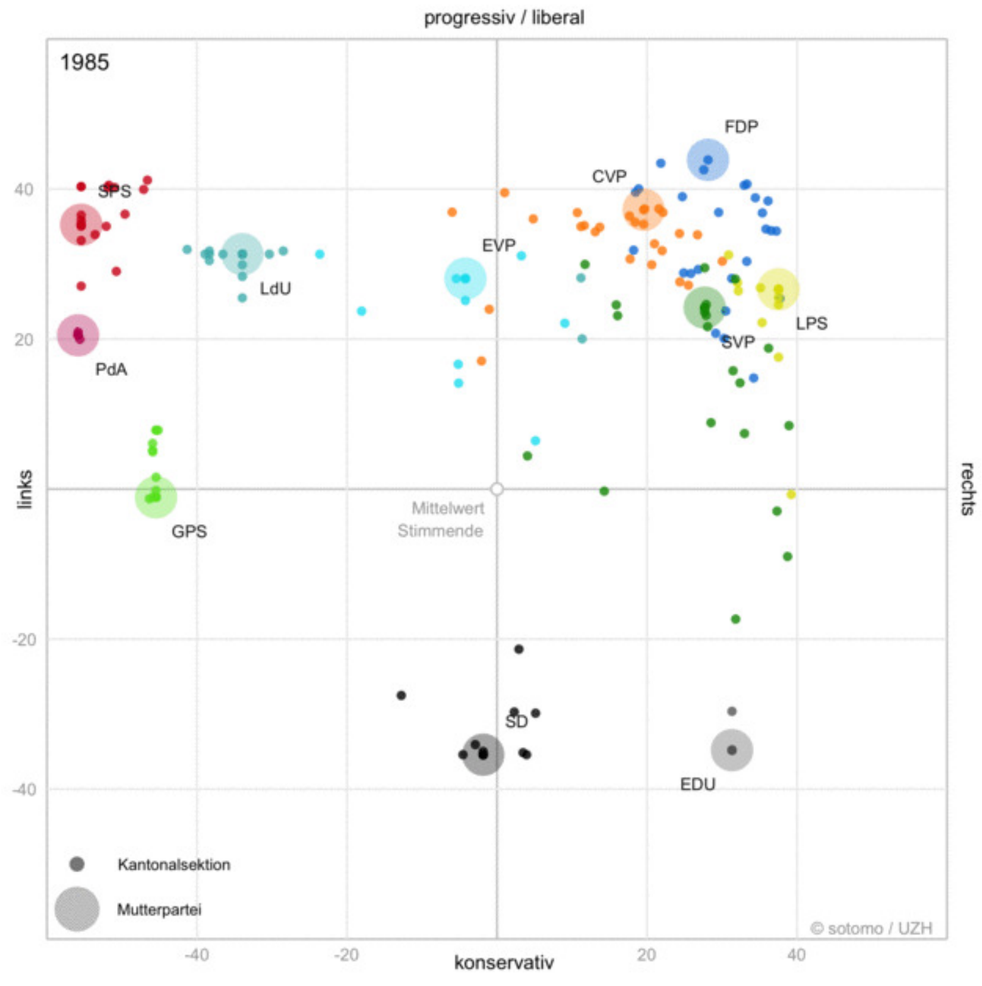
Recap last Lecture

- perform shell commands
  - navigate filesystem 🌲
  - create/copy/move/remove files 🕹️
  - pipe output into other command ⏩
- complete assignment ✍️

Outline

- performing corpus linguistic using the shell 🔪
  - counting, finding, comparing
- analyzing programmes of Swiss parties 📊

When politics changes, language changes.



Historical development of Swiss party politics (Tagesanzeiger)

How to process a Text Collection

1. each document as individual file (`.txt`)

    use shell for quick analysis

2. a dataset of documents (`.csv`, `.tsv`, `.xml`)

    use Python for in-depth analysis

From (physical) artifacts featuring texts to datasets

Counting Things

Measuring Relevance by Frequency

Bag of words approach

- counting words regardless of context
- simple (and simplistic)
- powerful
- fast

Representation of text as a bag of words

Get Key Figures of Texts

```
wc *.txt     # count number of lines, words, characters
```

Get all Word Occurrences

Show phrase in context

```
egrep -ir "data" FOLDER/    # search in all files in given folder

# common egrep options:
# -i              search case-insensitive
# -r              search recursively in all subfolders
# --colour        highlight matches
# --context 2     show 2 lines above/below match
```

Count Word Occurrences

Get counts per file

```
egrep -ic "big data" *.txt      # count across all txt-files, ignor
```

Word Frequencies

Steps of the algorithm

1. split text into one word per line (tokenize)
2. sort words alphabetically
3. count how often each word appears

```
# piping steps to get word frequencies
cat text.txt | tr " " "\n" | sort | uniq -c | sort -h > wor

# explanation of individual steps:
tr " " "\n"      # replace spaces with newline
sort -h          # sort lines alphanumerically
uniq -c          # count repeated lines
```

Two Kinds of Word Frequencies

- absolute frequency

  `= n_occurrences`

- relative frequency

  `= n_occurrences / n_total_words`

  allows to compare corpora of different sizes

- statistical validation of variation

  significance tests between corpora

Convert Stats into Dataset

- convert to `.tsv` file
- useful for further processing
  e.g., import in Excel

```
# convert word frequencies into tsv-file
# additional step: replace a sequence of spaces with a tabulator
cat text.txt | tr " " "\n" | sort | uniq -c  | sort -h | \
tr -s " " "\t"  > test.tsv
```

In-class: Matching and counting

1. Print the following sentence in your command line using `echo`.

```
echo "There are a few related fields: \
NLP, computational linguistics, and computational text analysis."
```

2. How many words are in this sentence? Use the pipe operator to combine the command above with `wc`.
3. Match the words `computational` and colorize its occurences in the sentence using `egrep`.
4. Get the frequencies of each word in this sentence using `tr` and other commands.
5. Save the frequencies into a tsv-file, open it in a spreadsheet programm (e.g., Excel, Numbers) and compute the relative frequency per word.

Preprocessing

Preprocess your data

for refining results

- lowercasing
- replace symbols
- join lines
- trimming header + footer
- splitting into multiple files
- using patterns to remove/extract parts 

Lowercasing

Reduce word forms

```
echo "ÜBER" | tr "A-ZÄÖÜ" "a-zäöü"  # fold text to lowercase
```

Removing and Replacing Symbols

```
echo "3x3" | tr -d "[:digit:]"      # remove all digits
cat text.txt | tr -d "[:punct:]"    # remove punctuation like .,:;?

tr "Y" "Z"                          # replace any Y with Z
```

Standard Preprocessing

Save a preprocessed document

```
# lowercase, no punctuation, no digits
cat speech.txt | tr "A-ZÄÖÜ" "a-zäöü" | \
tr -d "[:punct:]" | tr -d "[:digit:]" > speech_clean.txt
```

Join Lines

```
cat test.txt | tr -s "\n" " "   # replace newlines with spaces
```

Trim Lines

```
cat -n text.txt          # show line numbers
sed "1,10d" text.txt     # remove lines 1 to 10
```

Check Differences between Files

sanity check after modification

```
# show differences side-by-side and only differing lines
diff -y --suppress-common-lines text_raw.txt text_proc.txt
```

Split Files

```
# splits file at every delimiter into a standalone file
csplit huge_text.txt  "/delimiter/" {*}
```

Where there is a shell,
there is a way. 

Organizing Code

- Git tracks file changes and allows for version management
- GitHub is a popular hosting platform based on Git

  share code and collaborate

  repository = project folder

🤓 Publishing code and data are key to open science.

Move to Zoom temporarily 🖥️🏡

We are having the next to classes via Zoom

- 30 March 2023
- 06 April 2023

Questions?

In-class: Getting ready

1. Change into your local copy of the GitHub course repository KED2023 and update it with `git pull`. When you haven't cloned the repository, follow section 5 of the installation guide .
2. You find some party programmes (Grüne, SP, SVP) in `KED2023/materials/data/swiss_party_programmes/txt`. Change into that directory using `cd`.
3. The programmes are provided in plain text which I have extracted from the publicly available PDFs. Have a look at the content of some of these text files using `more`.

In-class: Analyzing Swiss Party Programmes I

1. Compare the absolute frequencies of single terms or multi-word phrases of your choice (e.g., Ökologie, Sicherheit, Schweiz)…
   - across parties
   - historically within a party

   Use the file names as filter to get various aggregation of the word counts.
2. Pick terms of your interest and look at their contextual use by extracting relevant passages. Does the usage differ across parties or time?

💡 **Share your insights with the class using Etherpad.**

In-class: Swiss Party Programmes II

1. Convert the word frequencies per party into a `tsv` dataset. Compute the relative word frequency instead of the absolute frequency using any spreadsheet software (e.g. Excel). Are your conclusions still valid after accounting for the size?
2. Can you refine the results with further preprocessing of the data (e.g., stripping punctuation, lowercasing)?
3. What is the size of the vocabulary of this data collection (number of unique words)?

Pro Tip 🤓: Use `egrep` to look up commands in the `.md` course slides

Additional Resources

When you look for useful primers on Bash, consider the following resources:

- Tutorial Basic Text Analysis by W. Turkel
- Tutorial Pattern Matching + KWIC by W. Turkel