Crawling in Reverse

Lightweight Targeted Crawling of News Portals

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The improvements that have been made since then are Balázs Indig's work (pending publication)

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Motivation

Preserving and Using Textual Data

- The classical sources of text are *National Archives*
    - Processing them involves a **lot of manual work** (scanning and OCR)
    - Nowadays, the OCR is done by neural networks very efficiently
    - However, these sources are mostly **not open-access** and their **growth is slow and limited**
- With Web 2.0, a lot of texts are **born-digital**
    - Born-digital materials also need to be preserved
    - They are **more endangered than physically existing materials**
    - Far easier to collect, store and process them (eg. *Common Crawl*, *Internet Archive*)
    - Upcoming EU law allows archiving and using archives for scientific purposes

The Age of Crawlers

What does the **Boss** say?

- The usual **Natural Language Processing (NLP)** workflow: ‘`Get` **`SOME`** `text to work with! The individual content` **`does NOT`** `matter.`’
- The usual **digital humanist** workflow: ‘`Get` **`THAT SPECIFIC`** `text to work with! The individual content` **`does REALLY`** `matter.`’

The Classic NLP Workflow Including Crawling

Crawling for NLP: the Traditional Way

1. Start a webspider to crawl the web, starting from an initial seed (optionally with additional rules)
2. Use some boilerplate removal logic (*heuristics/rule-based*)
3. **Deduplication**
4. Run the NLP pipeline (split to sentences, tokenize, POS-tag, etc.)
5. **Store the corpus**

6. Use the text
7. Discover and fix errors in the pipeline
8. Go to step 1 and start with FRESH/OTHER text

Crawling for NLP: the Traditional Way

Let’s Put Crawling in Reverse!

Crawling for NLP: the Digital Humanist Way

1. Carefully select portals to crawl
2. Study the portal to extract its essential properties

3. Start a webspider to crawl the portal with the gained information (**virtually without duplication**)
4. Store the resulting HTML pages – **these are the primary sources**
5. Use boilerplate removal rules *tailored to the portal*
6. Run the NLP pipeline (split to sentences, tokenize, POS-tag, etc.)

7. Store the corpus elsewhere – **it is automatically reproducible**
8. Use the text
9. Discover and fix errors in the pipeline
10. Go to step 5 and start with **THE VERY SAME** text

The Main Idea

‘If an ARTICLE does not appear in THE (PORTAL’S) ARCHIVE, it does not exist!’ (adapted from Star Wars)

In Technical Terms

The **Two-level Crawling** and **portal-based boilerplate removal**:

- Most (news) portals use **permalinks** to identify articles and use an **article archive** to make the articles searchable
  - The article archive has simple structure and can be crawled easily for the permalinks (**dilemma**: rules or machine-learning?)
- We must only crawl the gathered permalinks
  - Virtually no duplication or junk!
  - **Less noise, reduced load, faster process**
- A specific portal has its unique layout which is the same or very similar for every article
  - Simple, efficient rules to remove boilerplate or targeted machine-learning (**dilemma** again)

In Technical Terms (cont.)

The details:

- We use a subset of **the ISO standard WARC archive format** for the crawled webpages **(request, response record pairs)** and *reuse them as cache* when needed
    - **Everything is reproducible** in the pipeline from here on (We only need to have the archive and know the exact versions of the programs used)
- We tailored the crawling and the boilerplate removal to the selected portals
    - As layout changes are infrequent, **it can collect new materials on a daily basis**
    - In an *easy-to-adjust framework*
- We can supervise and adjust the rules and add new portals if needed

Testing the Idea

The Task and the Resources

The Task:

- From five (structurally) quite different Hungarian news portals
- Extract text with metadata: *Author*, *Publication date*, *Title*, *Lead*, *Specified keywords*, *Text*
- Be **precise and sustainable**, runtime is secondary
- Reuse existing tools when possible!

The Resources:

- One low-end office machine (4 GB RAM, Intel i3 with 4 cores)
- 100 Mb/s uplink

Programs Compared, Problems Found

Crawlers:

- The existing crawlers were too different to compare
- However, we compared one portal with the crawl made by the National Széchényi Library
  - The result was about 1,000 vs. 52,850 articles for our method

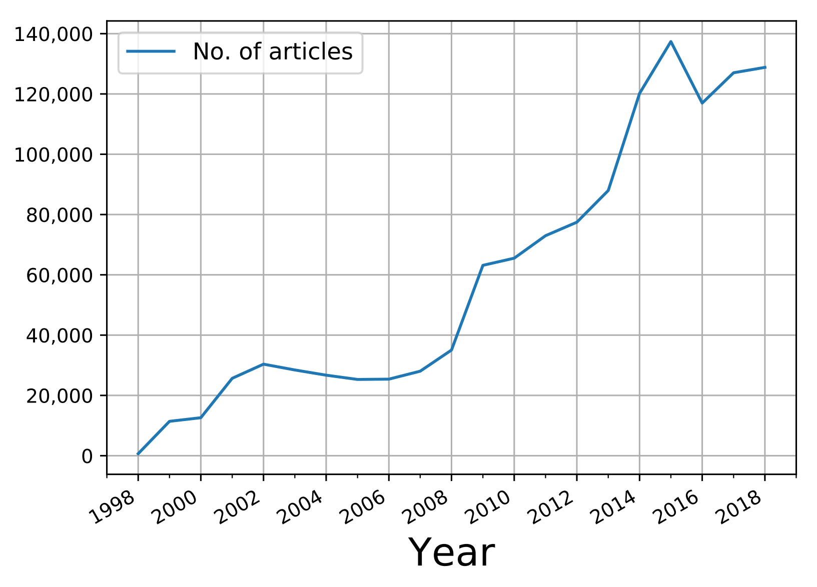
Boilerplate removal tools (JusText [3], Newspaper3k [2], our rules):

- **All methods are rule-based** and hard to compare
- Our method is specialised in the examined portals
- The two other methods are general and **built as a monoliths**
- Most existing tools can not (properly) extract metadata
- Existing tools have limited support for the Hungarian typography

Results

- **Regular Expressions** < existing programs < hand-crafted rules that **meet our requirements**
    - Now we use **HTML parsers** instead of REs (hard to automatise)
    - On the portals' article archives it was a great success!
- Numbers are growing, but new problems come to surface
- The first comparison with other archiving techniques is very promising, but there are more to come
- We clearly need more portals, more comparisons, more time to standardise the workflow

The annual distribution of 1,247,082 Articles (5 News Portals)



Conclusion

Conclusion

- In **10 days** with a low-end computer (due to rate limiting)
- Less than 100 GB space required (no garbage, just HTMLs)
- About **half billion** tokens estimated and growing
- Sustainable, **low load on both sides**
- Reproducible, improvable, extendable
- **Groundbreaking** work for later studies
    - Topic modeling, Stylometry analysis (with the available metadata)
    - Temporal (socio-)linguistic analysis (with the publication time)
    - Future machine-learning-based improvement of the workflow
    - Extending the set of targeted portals
- Future work:
    - Standardised workflow and TEI output
    - More comparisons in every possible way
    - A semantic searching service on the crawled material

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