An Empirical Comparison of Web Content Extraction Algorithms

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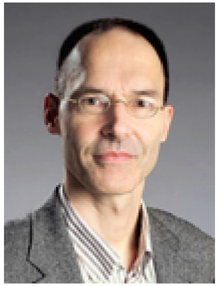

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SIGIR 2023 – July 23–27, Taipei, Taiwan

Web (Main) Content Extraction

What?

- Extraction of textual content from web pages, excluding navigation, ads, banners, etc.
- Also referred to as “boilerplate removal.”
- Extract is unstructured, (ideally coherent) running text.

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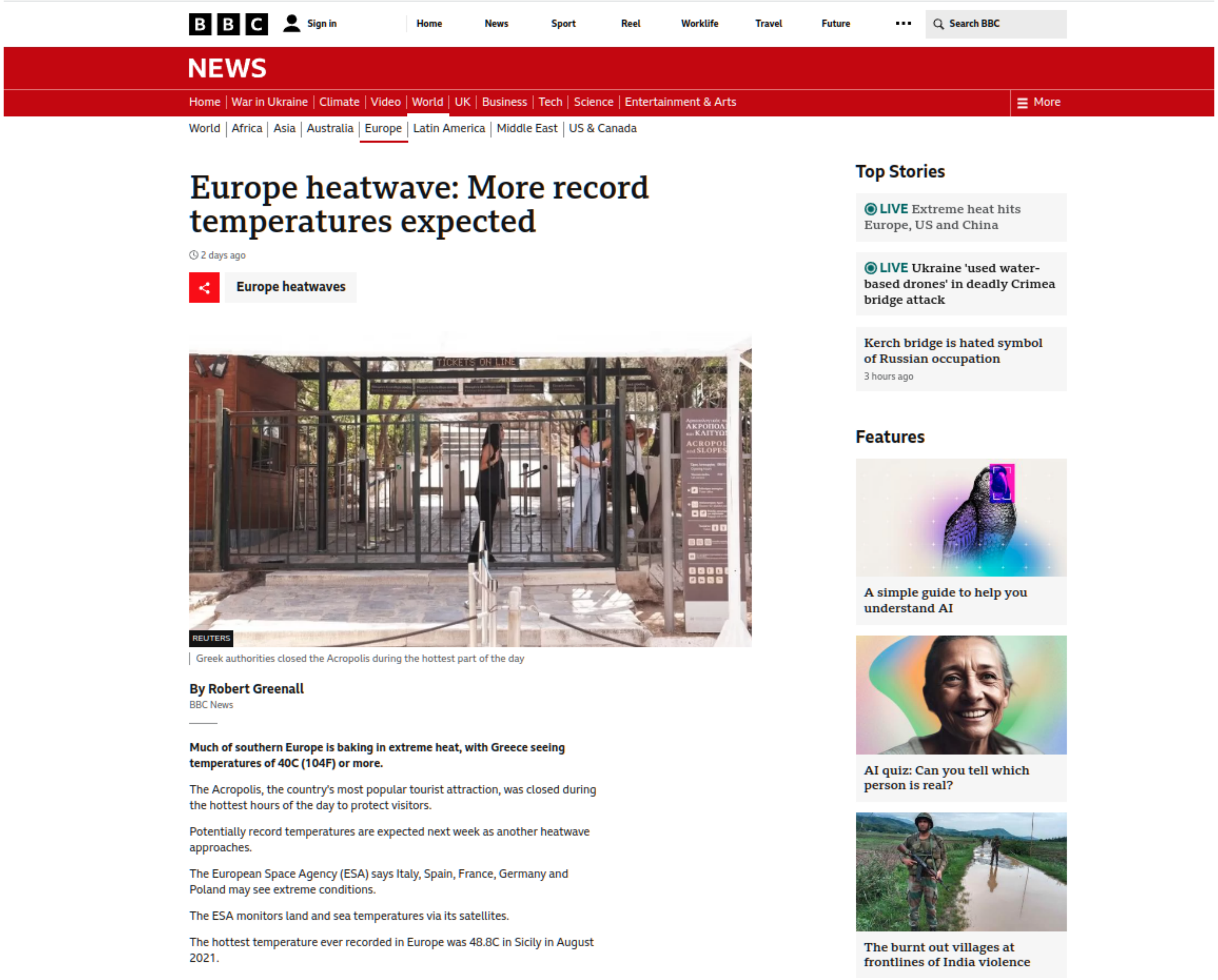
Why?

- Indexing / snippet generation for search applications.
- Content summarization.
- Assistive technologies.
- Training of (large) language models.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Europe heatwave: More record temperatures expected

2 days ago

Europe heatwaves

Greek authorities closed the Acropolis during the hottest part of the day

By Robert Greenall
BBC News

Much of southern Europe is baking in extreme heat, with Greece seeing temperatures of 40C (104F) or more.

The Acropolis, the country's most popular tourist attraction, was closed during the hottest hours of the day to protect visitors.

Potentially record temperatures are expected next week as another heatwave approaches.

The European Space Agency (ESA) says Italy, Spain, France, Germany and Poland may see extreme conditions.

The ESA monitors land and sea temperatures via its satellites.

The hottest temperature ever recorded in Europe was 48.8C in Sicily in August 2021.

Top Stories

LIVE Extreme heat hits Europe, US and China

LIVE Ukraine 'used water-based drones' in deadly Crimea bridge attack

Kerch bridge is hated symbol of Russian occupation
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AI quiz: Can you tell which person is real?

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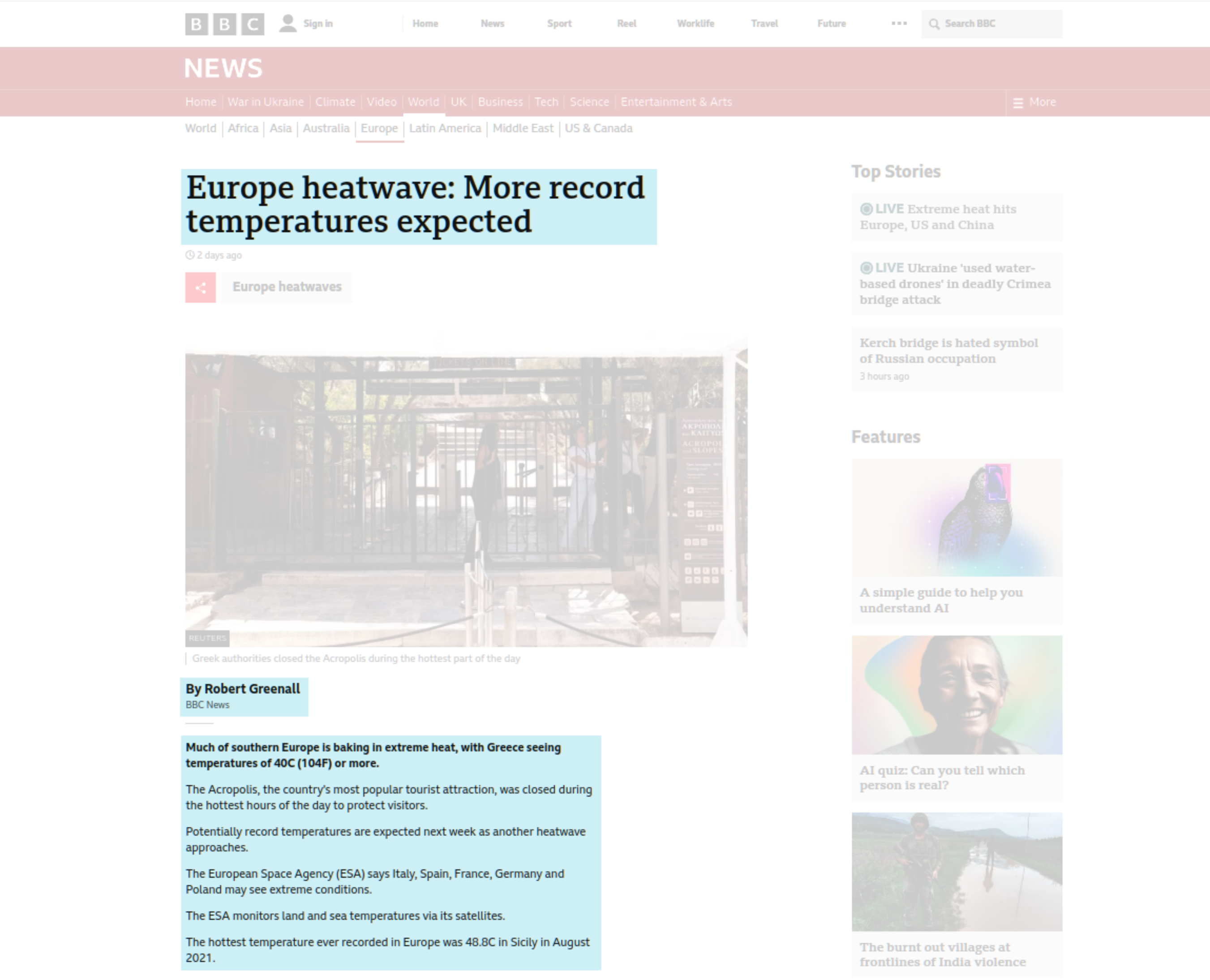
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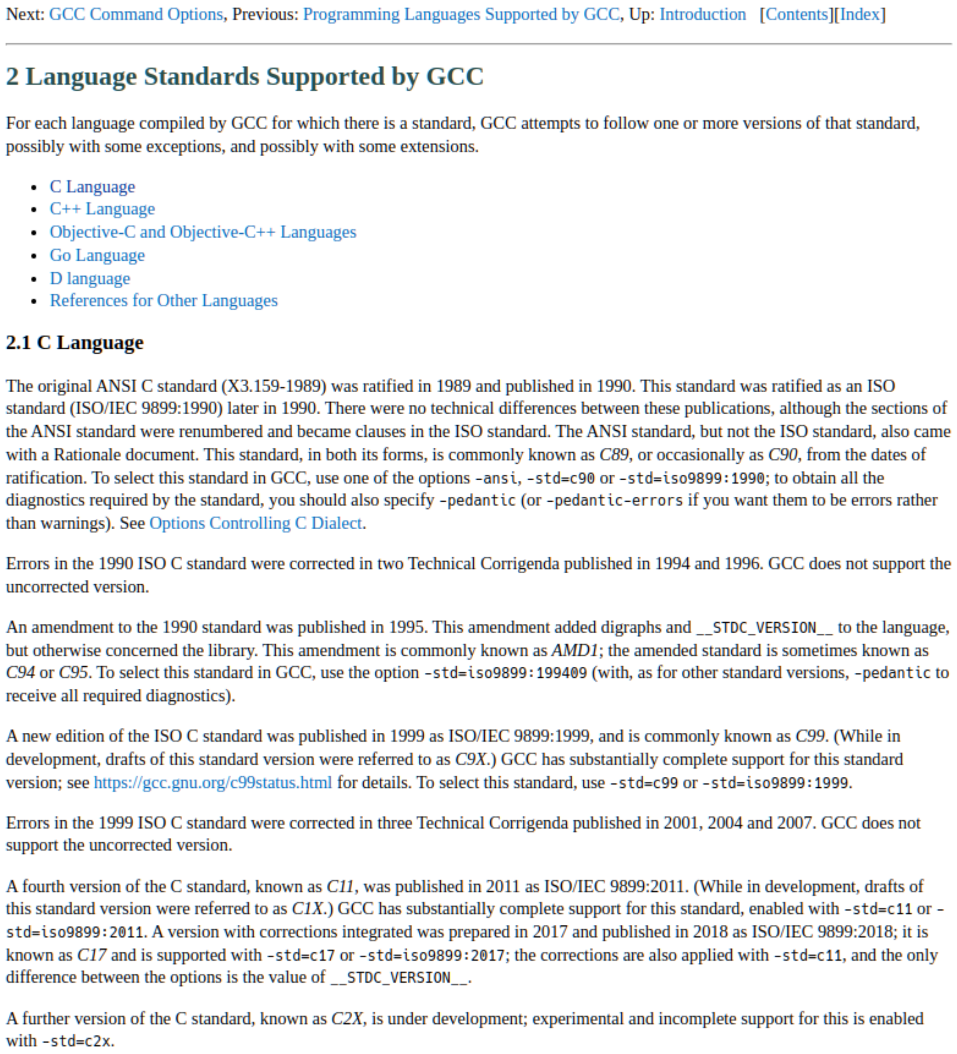

Next: GCC Command Options, Previous: Programming Languages Supported by GCC, Up: Introduction [Contents][Index]

2 Language Standards Supported by GCC

For each language compiled by GCC for which there is a standard, GCC attempts to follow one or more versions of that standard, possibly with some exceptions, and possibly with some extensions.

- C Language
- C++ Language
- Objective-C and Objective-C++ Languages
- Go Language
- D language
- References for Other Languages

2.1 C Language

The original ANSI C standard (X3.159-1989) was ratified in 1989 and published in 1990. This standard was ratified as an ISO standard (ISO/IEC 9899:1990) later in 1990. There were no technical differences between these publications, although the sections of the ANSI standard were renumbered and became clauses in the ISO standard. The ANSI standard, but not the ISO standard, also came with a Rationale document. This standard, in both its forms, is commonly known as *C89*, or occasionally as *C90*, from the dates of ratification. To select this standard in GCC, use one of the options `-ansi`, `-std=c90` or `-std=iso9899:1990`; to obtain all the diagnostics required by the standard, you should also specify `-pedantic` (or `-pedantic-errors` if you want them to be errors rather than warnings). See Options Controlling C Dialect.

Errors in the 1990 ISO C standard were corrected in two Technical Corrigenda published in 1994 and 1996. GCC does not support the uncorrected version.

An amendment to the 1990 standard was published in 1995. This amendment added digraphs and `__STDC_VERSION__` to the language, but otherwise concerned the library. This amendment is commonly known as *AMD1*; the amended standard is sometimes known as *C94* or *C95*. To select this standard in GCC, use the option `-std=iso9899:199409` (with, as for other standard versions, `-pedantic` to receive all required diagnostics).

A new edition of the ISO C standard was published in 1999 as ISO/IEC 9899:1999, and is commonly known as *C99*. (While in development, drafts of this standard version were referred to as *C9X*.) GCC has substantially complete support for this standard version; see https://gcc.gnu.org/c99status.html for details. To select this standard, use `-std=c99` or `-std=iso9899:1999`.

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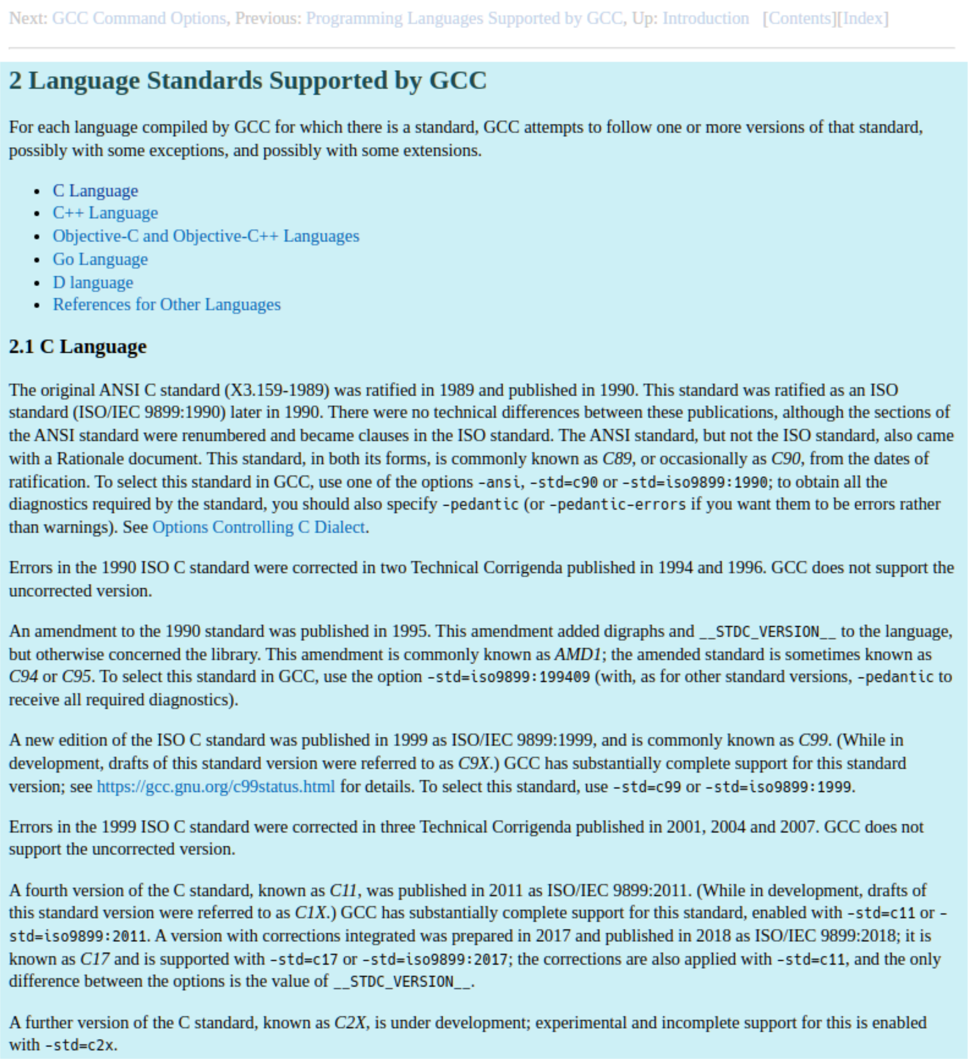
A fourth version of the C standard, known as *C11*, was published in 2011 as ISO/IEC 9899:2011. (While in development, drafts of this standard version were referred to as *C1X*.) GCC has substantially complete support for this standard, enabled with `-std=c11` or `-std=iso9899:2011`. A version with corrections integrated was prepared in 2017 and published in 2018 as ISO/IEC 9899:2018; it is known as *C17* and is supported with `-std=c17` or `-std=iso9899:2017`; the corrections are also applied with `-std=c11`, and the only difference between the options is the value of `__STDC_VERSION__`.

A further version of the C standard, known as *C2X*, is under development; experimental and incomplete support for this is enabled with `-std=c2x`.



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Web Content Extraction

The (Sad) State of the Art

- Goldstandard datasets are rare (and also small and quite dated).
- Academic research and open source tools exist.
- Yet, very little rigorous and comparable evaluation has been done.
- There is no clear-cut definition of “main content.”

Web Content Extraction

Datasets

We collected, cleaned, and combined **8 datasets** of varying **complexity**:

- CETD (700)
- CleanEval (738)
- CleanPortalEval (71)
- Dragnet (1,379)
- Google-Trends (180)
- L3S-GN1 (621)
- Readability (115)
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- (Combined: 3,985 pages)

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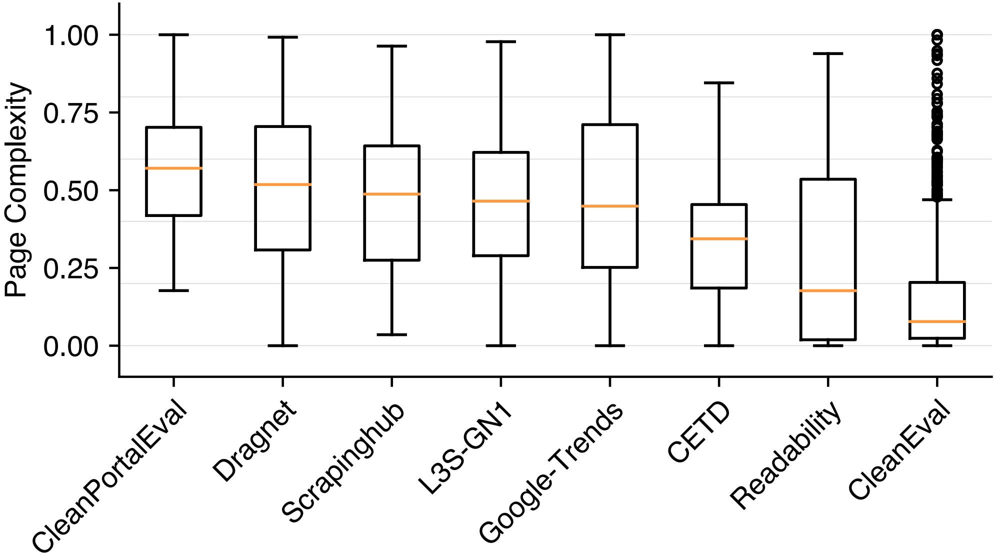

Web Content Extraction

SotA Extraction Systems

We reproduced **14 main content extractors** and **5 baseline text converters**:

Heuristic

- BTE
- Goose3
- jusText
- Newspaper3k
- Readability
- Resiliparse
- Trafilatura

ML-based

- BoilerNet
- Boilerpipe
- Dragnet
- ExtractNet
- Go DOM Distiller
- news-please
- Web2Text

Baseline

- BS4
- html_text
- inscriptis
- lxml Cleaner
- XPath Text

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Three 4-gram majority vote ensembles (66 %): **All** / **Best only** / **Best only (weighted)**

Web Content Extraction

Evaluation

Extractor performance ranked by ROUGE-L[1] at summary level (ROUGE-LSum):

LCS : (Union) Longest Common Subsequence

The quick brown fox jumps over the lazy dog.   A brown fox hits the crazy dog.

[1] Lin, 2004; ROUGE: A Package for Automatic Evaluation of Summaries

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$$P_{\textit{lcs}} = \frac{\sum_i^n \textit{LCS}(T_i, , C)}{|C|_{\text{words}}}, \qquad R_{\textit{lcs}} = \frac{\sum_i^n \textit{LCS}(T_i, C)}{|T|_{\text{words}}}.$$

T : Target sentence(s)

C : Candidate sentence(s)

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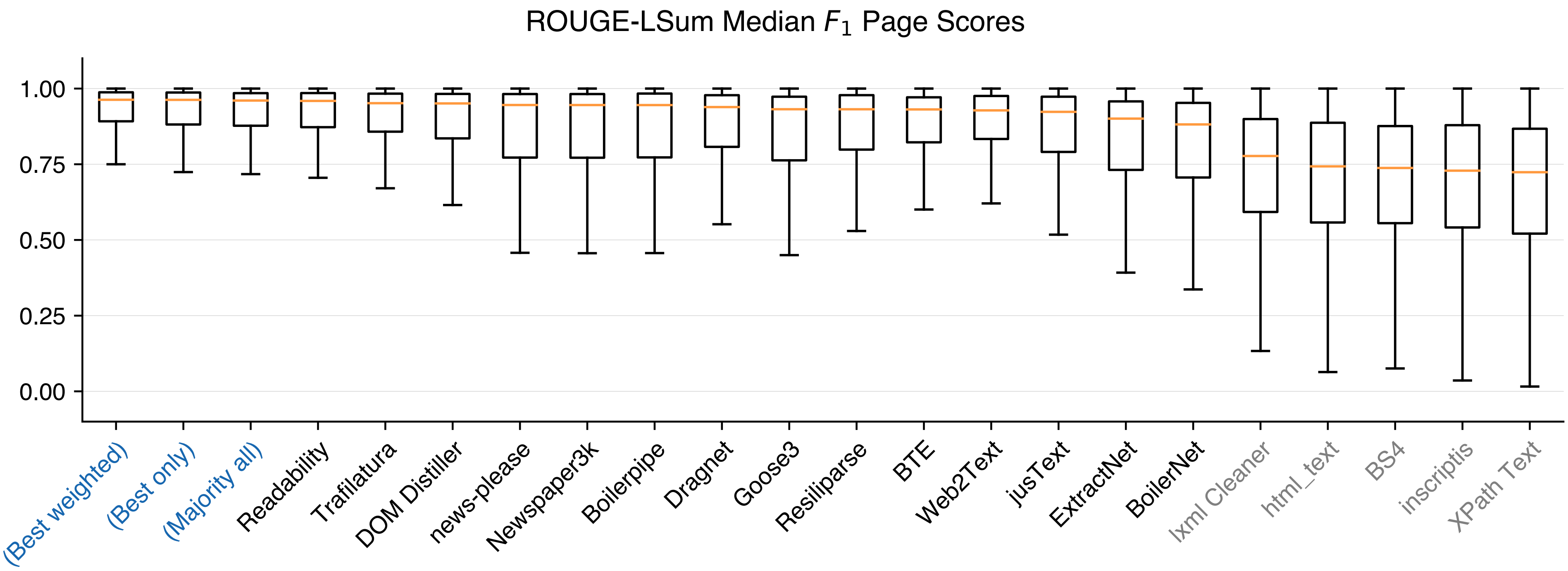
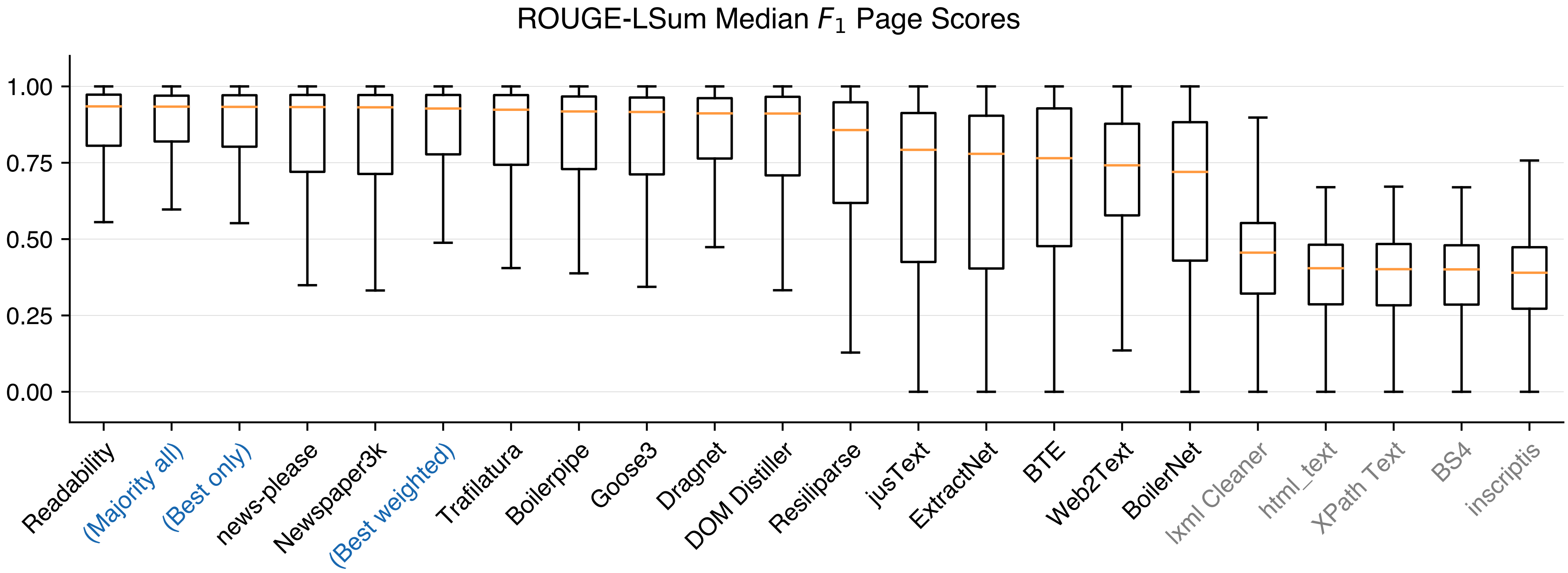
Web Content Extraction

Evaluation – All Pages



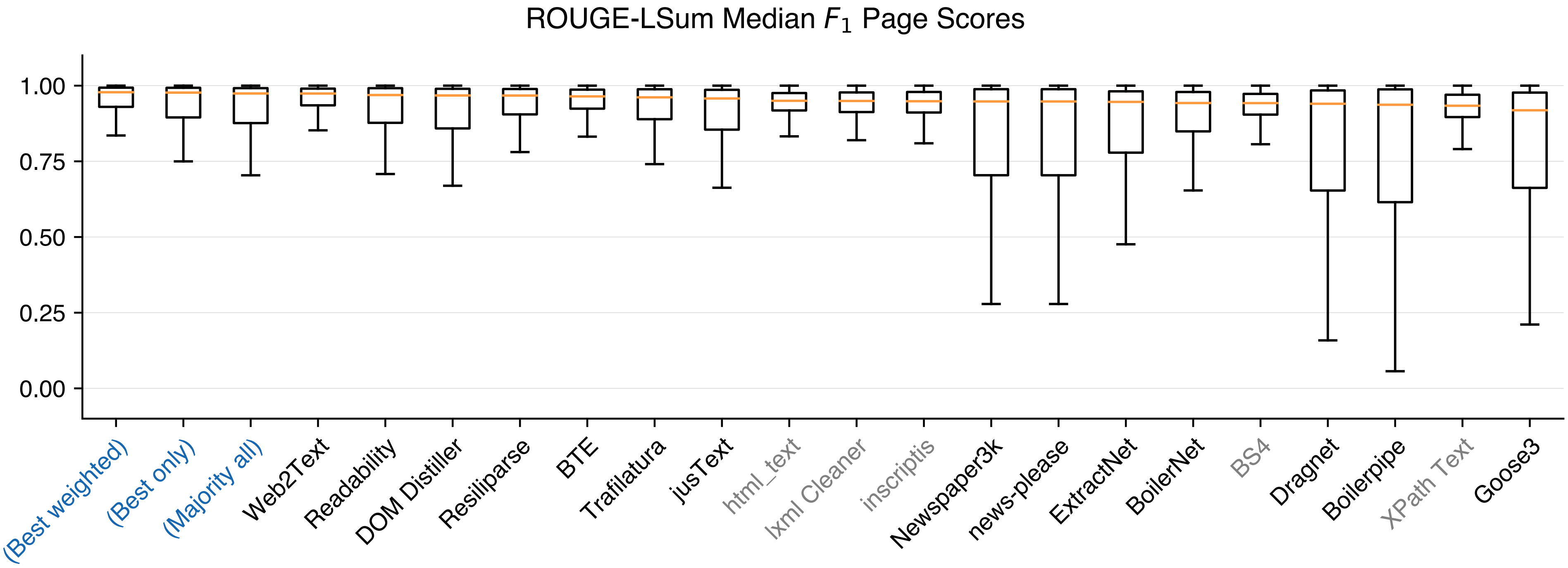
Web Content Extraction

Evaluation – Complex Pages ($Q_4 < c \leq 1$)



Web Content Extraction

Evaluation – Easy Pages ($0 \leq c < Q_1$)



Summary

- New datasets needed!
- Precision-oriented heuristic models perform quite well.
- Deep neural models perform rather poorly (so far).
- Please don’t report only single numbers!
- Readability / Trafilatura / DOM Distiller are the most robust right now.
- Resiliparse (ours) is (not yet!) the best, but the fastest by an order of magnitude. :-)

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More in our paper, all code and data publicly available:

github.com/webis-de/SIGIR-23

webis.de/publications