

Structured Web Content Extraction



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Manual Selection and Extraction Techniques

Generalities

Regular Expressions

CSS selectors

XPath

Wrapper induction





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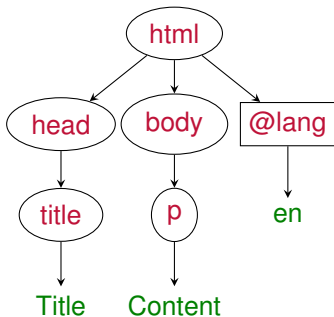
Wrapper induction



add extra information.

Example

```
<html lang="en">  
<head><title>Title</title></head>  
<body><p>Content</p></body>  
</html>
```





- Based on serialization: regular expressions (see further)
- Based on DOM:

DOM navigation expresses local navigation in the DOM, from a node to its parent, its children, its attribute, etc.
Standard API [W3C] but variations.

searching elements by tag names, identifiers, names, class names

CSS selectors (see further)

XPath (see further)





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- Apply to the serialized representation, not to the DOM tree.
- Available in a wide range of host languages (including Python with the `re` package).
- The following characters are **metacharacters**.

? * + | () ^ \$. [] { } " \

- Metacharacters have special meaning; they do not represent themselves.
- All other characters represent themselves.





- r One occurrence of r
- $r?$ Zero or one occurrence of r
- r^* Zero or more occurrences of r
- r^+ One or more occurrences of r
- $r|s$ r or s
- rs r concatenated with s

r and s are regular expressions.





- Parentheses are used for grouping.
- The expression

`("+" | "-")?`

represents an optional plus or minus sign.

- If a regular expression begins with `^`, then it is matched only at the beginning of a line or string (depending on context).
- If a regular expression ends with `$`, then it is matched only at the end of a line or string (depending on context).
- The dot `.` matches any non-newline character.





- Brackets [] match any single character listed within the brackets.
- For example,
 - [abc] matches a or b or c.
 - [A-Za-z] matches any letter.
- If the first character after [is ^, then the brackets match any character *except* those listed.
 - [^A-Za-z] matches any nonletter.





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Simple selector: tag name

Multiple selector: several selectors joined by commas

Universal selector: '*', selects everything

Examples

- `ul` selects unordered lists
- `h1, h2, h3, h4, h5, h6` selects all section titles
- `*` selects everything





Class selector: class name, prefixed with '.', as it appears in a `class` attribute of an HTML tag

Examples

- `.person` selects all tags with class `person`
- `p.comment` selects all `<p>` tags with class `comment`





Identifier: as defined by the `id` attribute of an HTML tag. Similar to classes, but **only one** tag with a given `id` in the whole HTML document

Identifier selector: identifier name, prefixed with '#', as it appears in the `id` attribute of an HTML tag

Examples

- `#introduction` selects the tag with identifier `introduction`
- `p#introduction` selects the `<p>` tag with identifier `introduction`





Contextual selector: 2 selectors or more separated by spaces. $A B$ selects B 's only if they are contained in A 's

Child selector: 2 selectors separated by $>$. $A > B$ selects B 's children of A 's

Next sibling selector: 2 selectors separated by $+$. $A + B$ selects B 's that are the next sibling of an A

Examples

- `h1 em` selects text in emphasis within a main title
- `ul ol, ol ul, ul ul, ol ol` selects nested lists





Pseudo-class: specify some external properties of a class

Examples

- `article > p:first-child` selects all paragraphs that are first-children of an `<article>`





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cf. separate set of slides

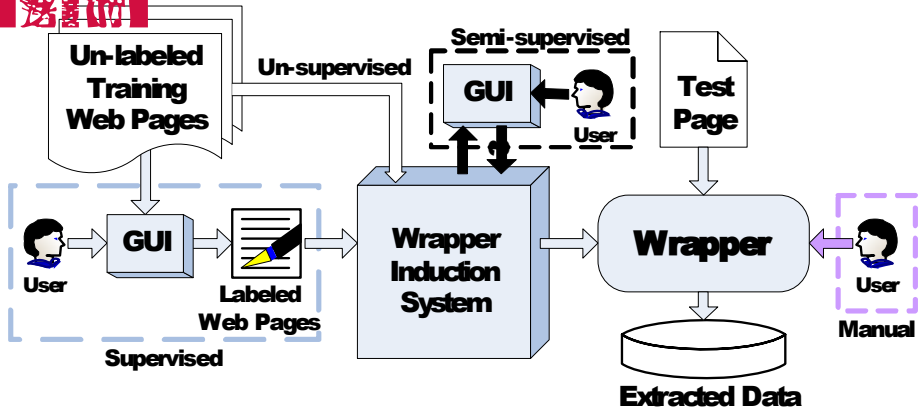




Manual Selection and Extraction Techniques

Wrapper induction







- Many academic approaches and systems
- No ready-to-use free software for supervised and semi-supervised extraction (as far as I know)
- Existing companies selling wrapper induction software: Lixto (semi-supervised), Wrapidity (domain-based)





- Exploiting data redundance within a page [Liu et al., 2004] or across pages [Crescenzi et al., 2001, Arasu and Garcia-Molina, 2003]
- RoadRunner: freely downloadable and existing demos at <http://www.dia.uniroma3.it/db/roadRunner/>



Arvind Arasu and Hector Garcia-Molina. Extracting structured data from Web pages. pages 337–348, June 2003.

Valter Crescenzi, Giansalvatore Mecca, and Paolo Merialdo. RoadRunner: Towards Automatic Data Extraction from Large Web Sites. 2001.

Bing Liu, Robert L. Grossman, and Yanhong Zhai. Mining Web Pages for Data Records. *IEEE Intelligent Systems*, 19(6):49–55, 2004.

W3C. Document Object Model. <http://w3.org/DOM>.



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