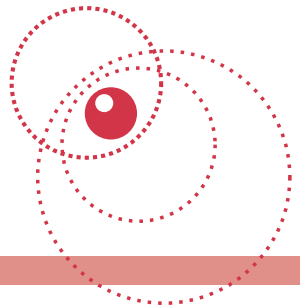

Structured Web Content Extraction

24 November 2015

TELECOM ParisTech

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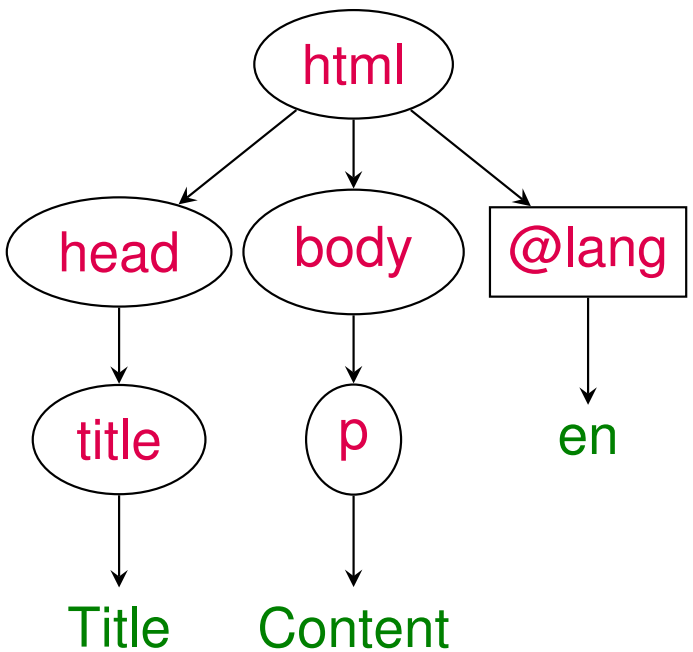
Document Object Model (DOM)

Tree representation of an HTML document, suitable for manipulation and extraction.

Example

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



Languages for extraction

- 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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Regular Expressions

- 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.

Operators

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
$r \mid s$	r or s
rs	r concatenated with s

r and s are regular expressions.

Grouping and extra symbols

- 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.

Character groups

- 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, multiple, universal selectors

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 selectors

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 selector

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 selectors

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

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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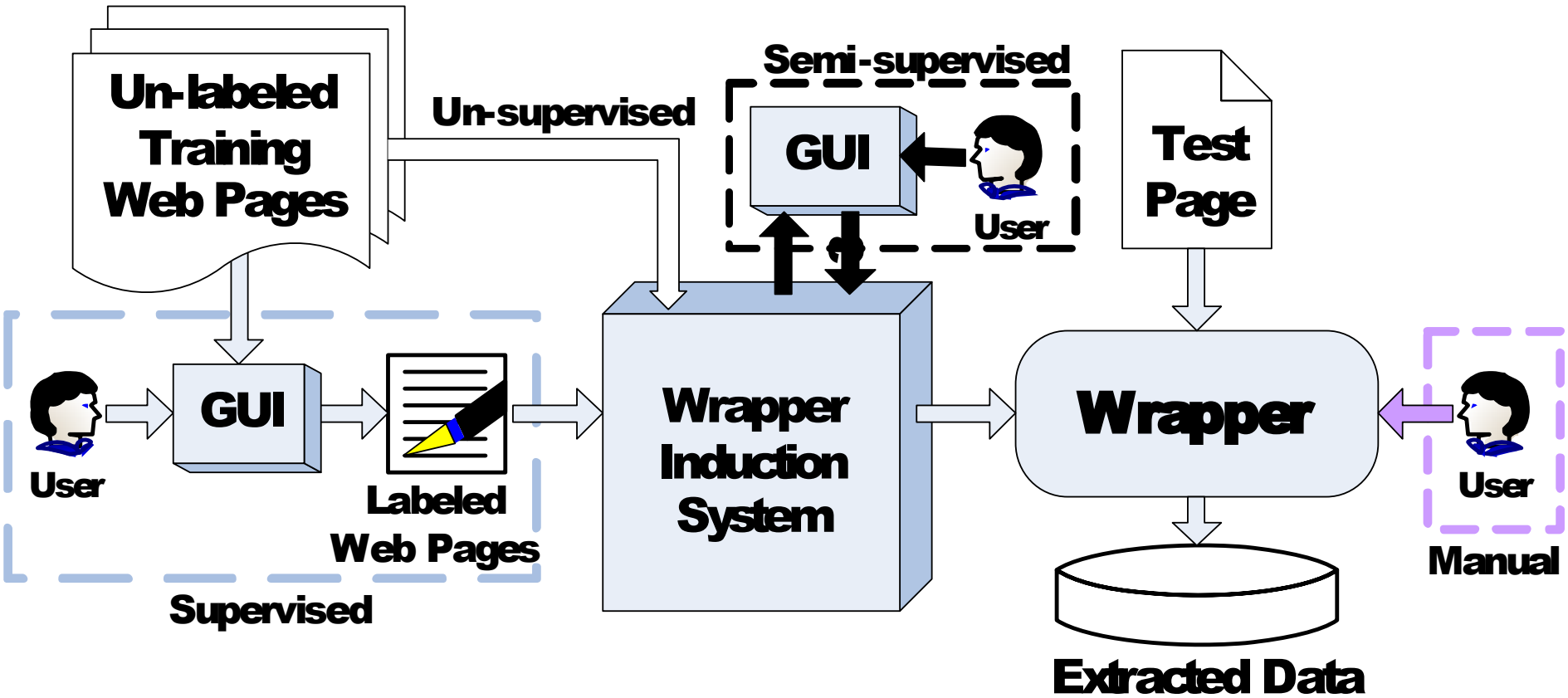
cf. separate set of slides

Manual Selection and Extraction Techniques

Wrapper induction

Principles [Chang et al., 2006]



Supervised, semi-supervised, and domain-based techniques

- 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)

Unsupervised techniques

- 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/`

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