DBAI
Institute of Information Systems
Database and Artificial Intelligence Group

Functional Semantic Analysis of Web Pages on the Visual Layer

Presentation of the Master‘s Thesis

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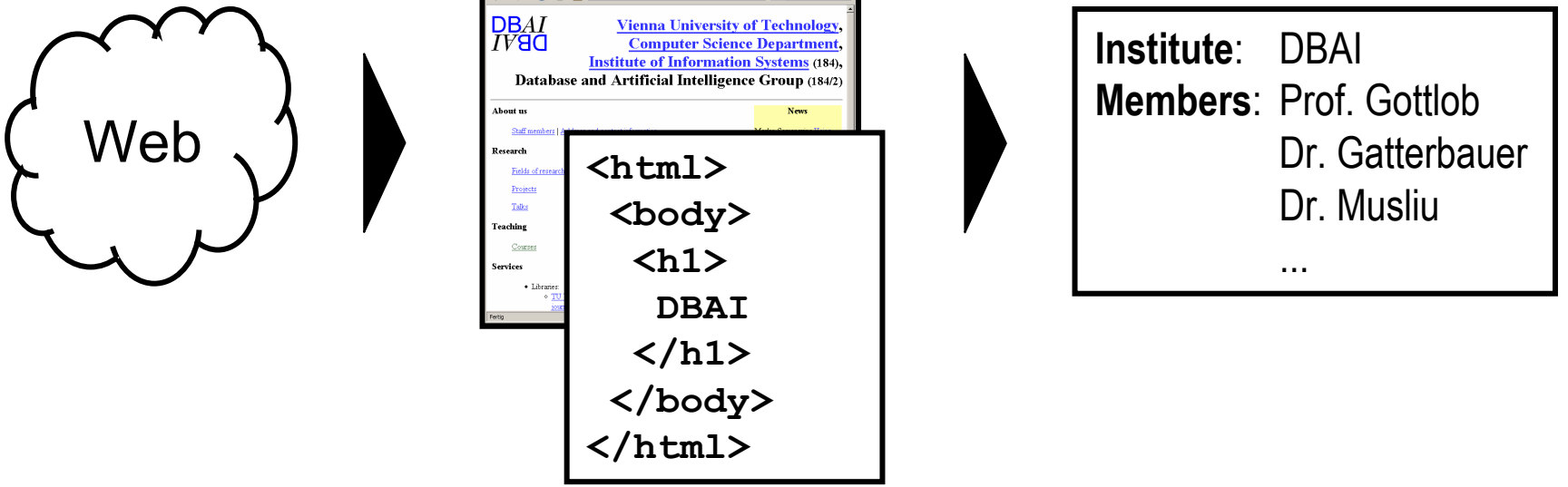
Web Information Extraction

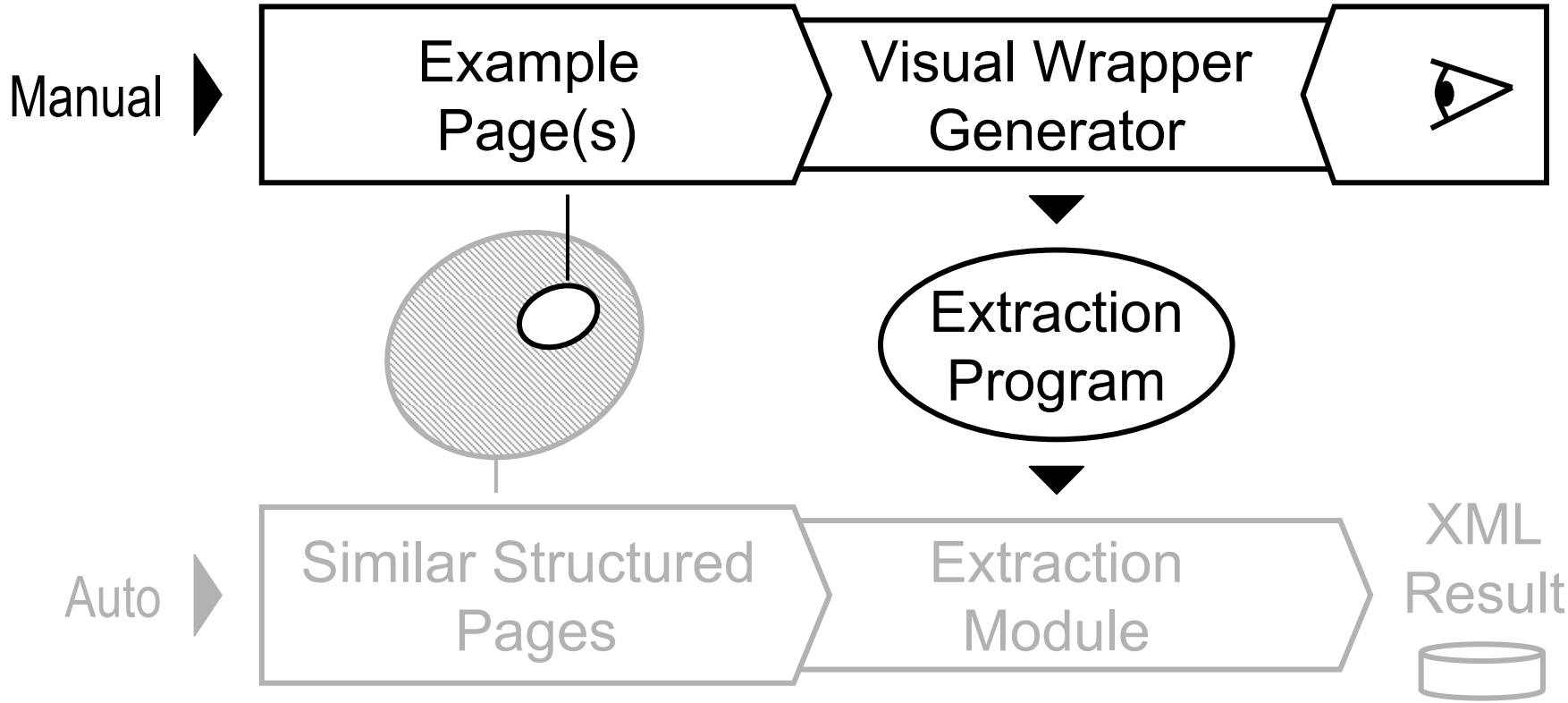
Semistructured Data

Structured Data



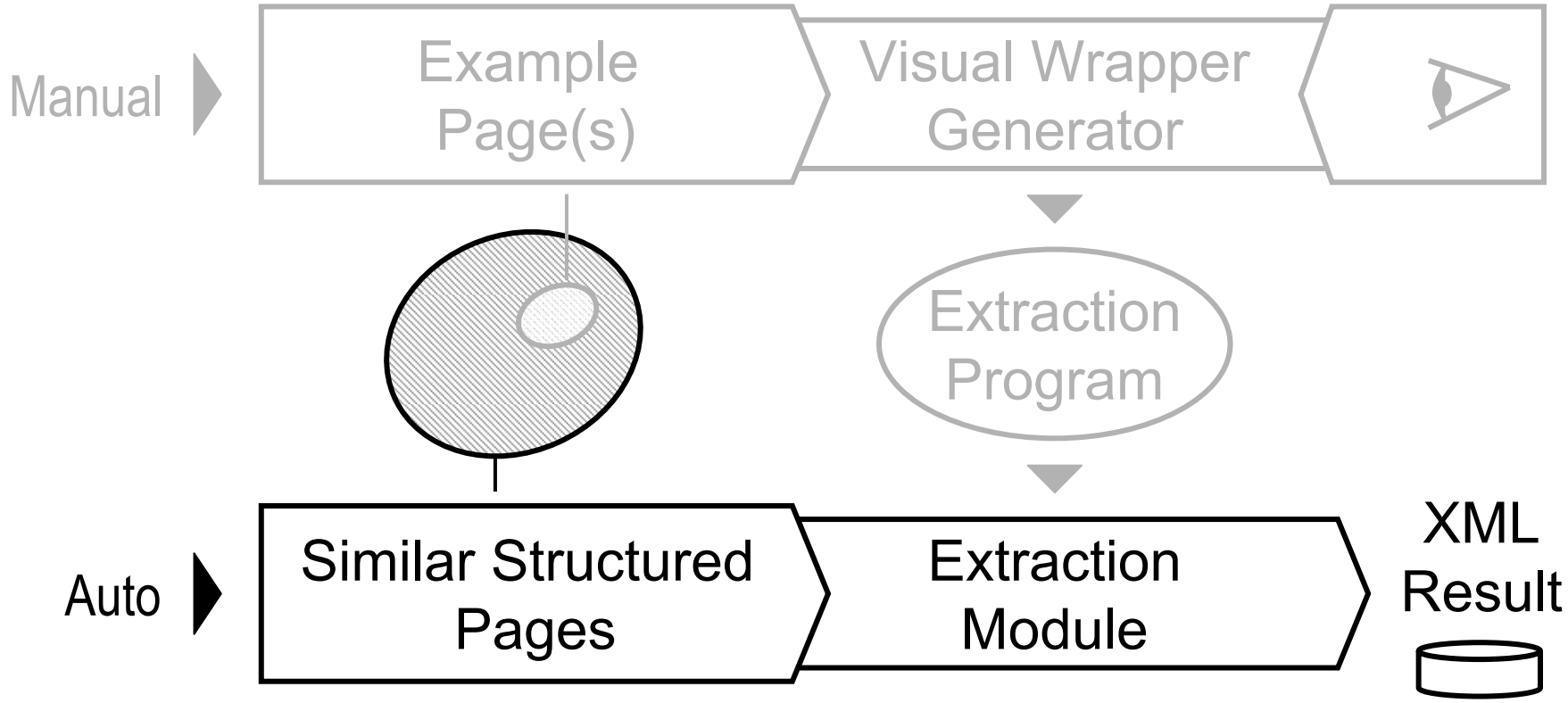
Wrapper

Lixto Concept [1]



Wrapper

Lixto Concept [1]



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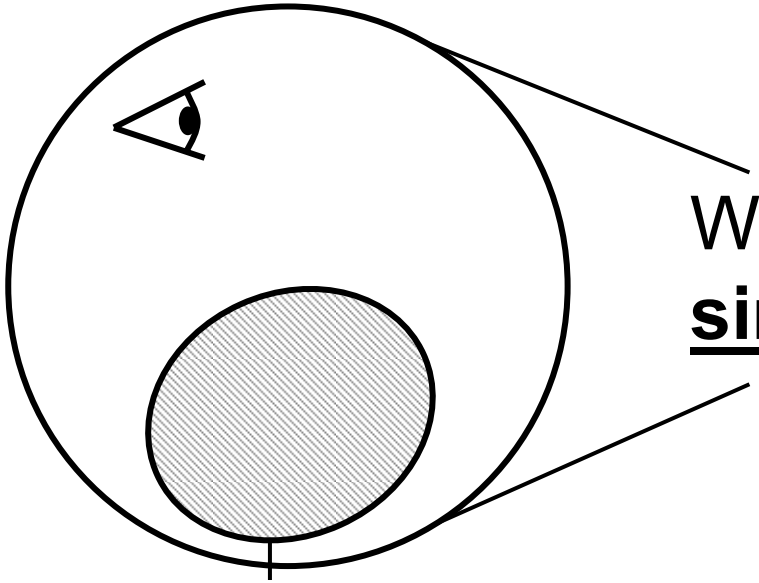
The Problem

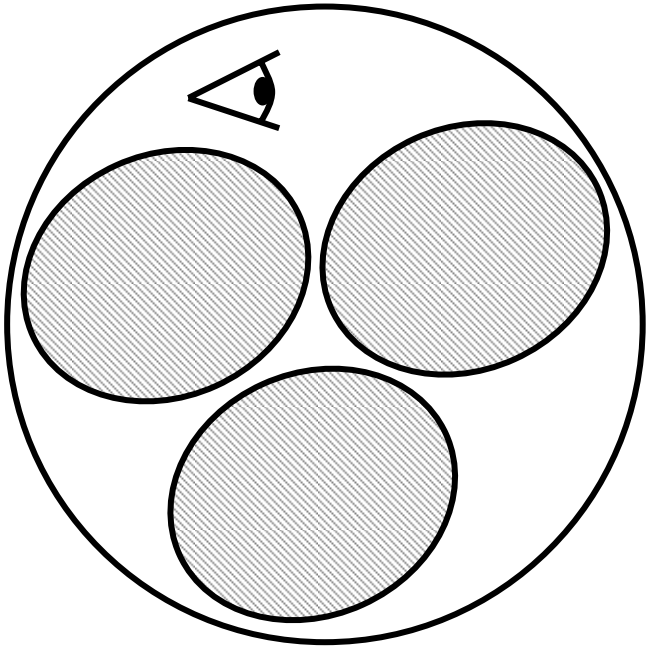


What about (visual) **similar** pages ?

Similar Structured Pages

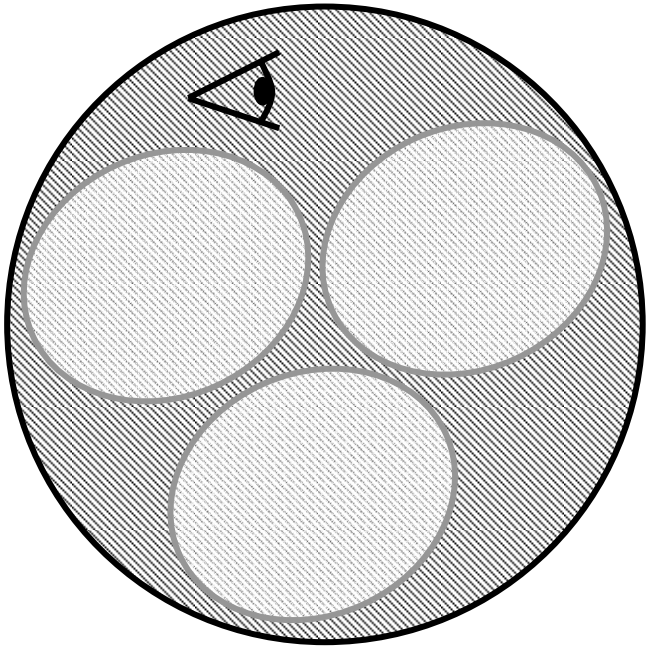
Means *similar structured* with regards to HTML

Multiple Wrappers ?



Needs **multiple** manual wrapper definitions and higher maintaining efforts

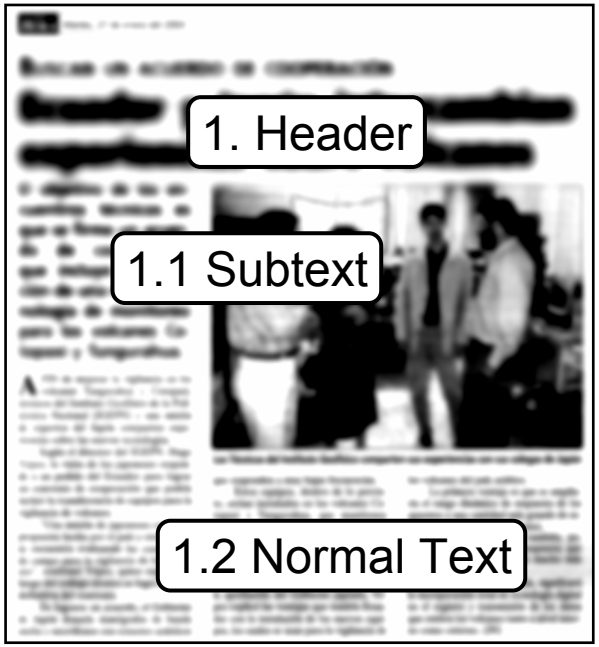
Visual Approach ?



Try to use general visual rules for **reducing** special wrapper dependence

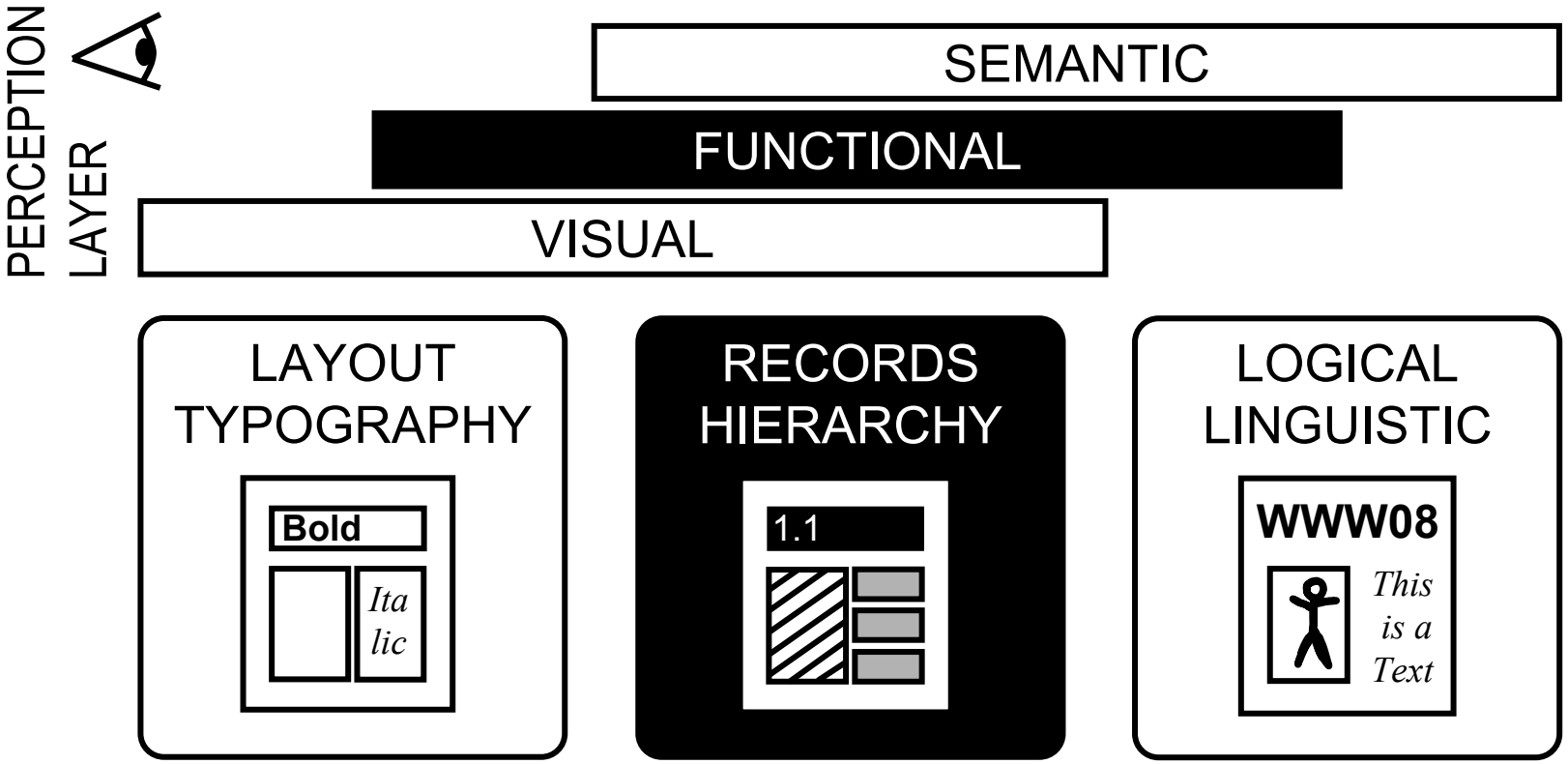
What could be deduced ?

Newspaper [2]

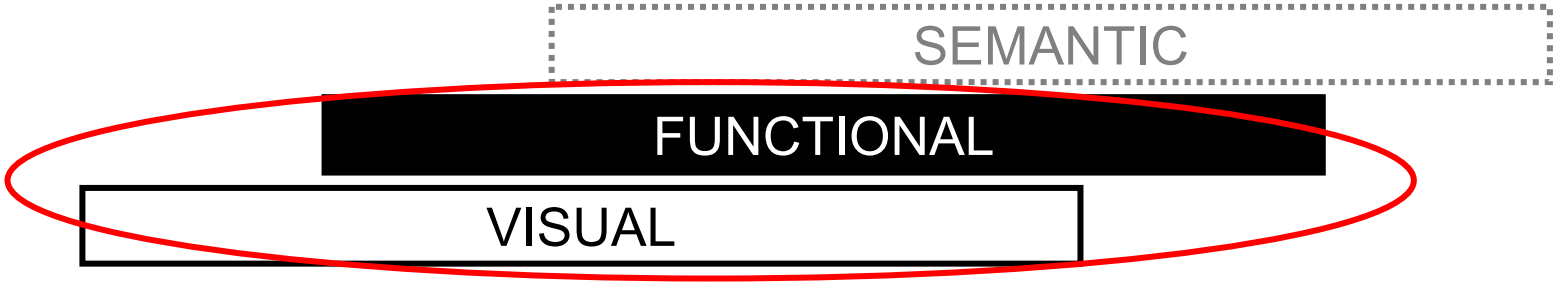


Semantic is present even without knowing the content

Functional Semantics [3]



The Solution

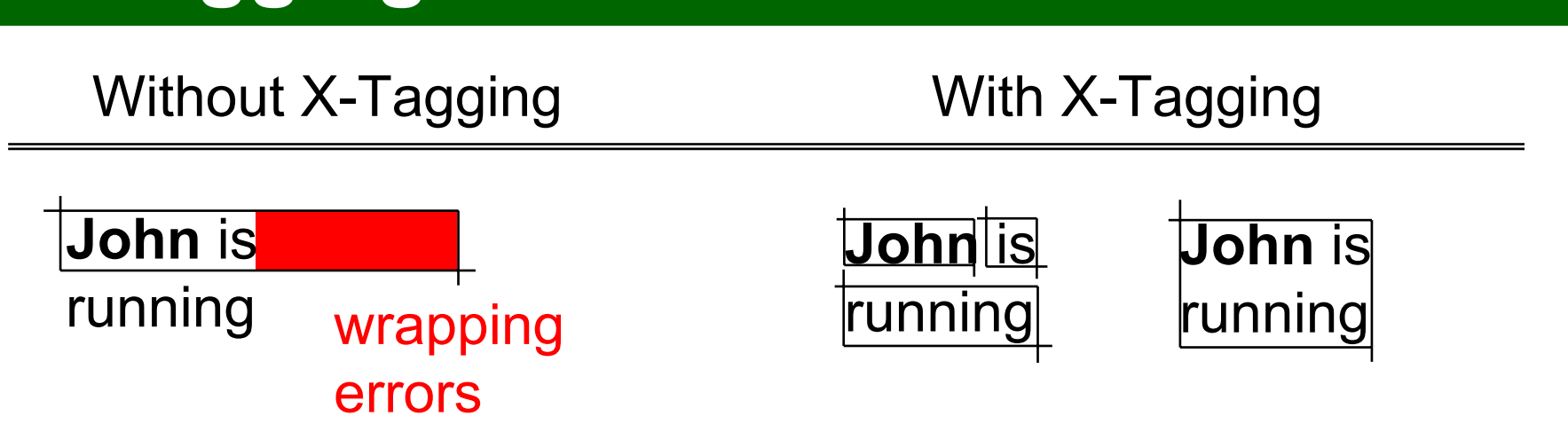


The **REDEVILA** approach

RE cord
DE tection on the
VI sual
LA yer

1. Box Identification
2. Segmentation
3. Classification
4. Ordering
5. Hierarchy

X-Tagging




```
<html>
  <body>
    <b>John</b> is
    running
  </body>
</html>
```

```
<html>
  <body>
    <b><x>John</x></b><x>is<x>
    <x>text</x>
  </body>
</html>
```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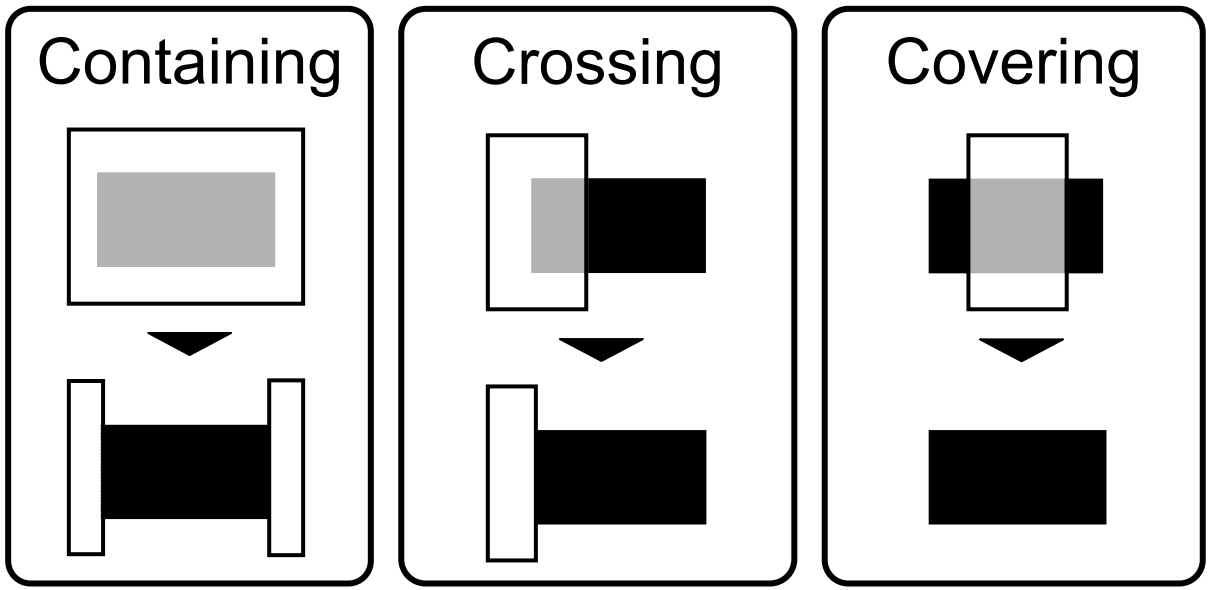
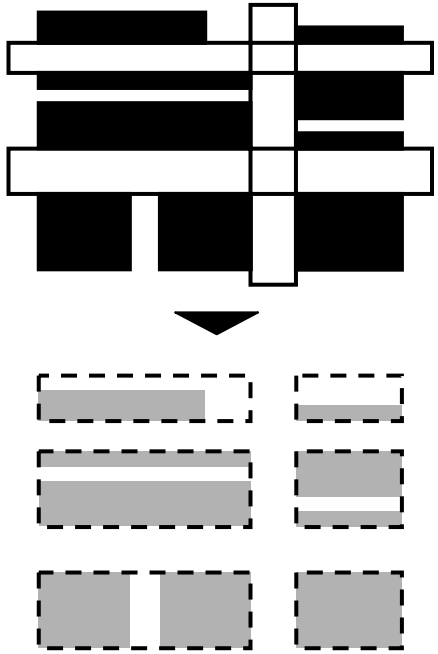
VIPS Algorithm [4]

Basic Operations



Invertion



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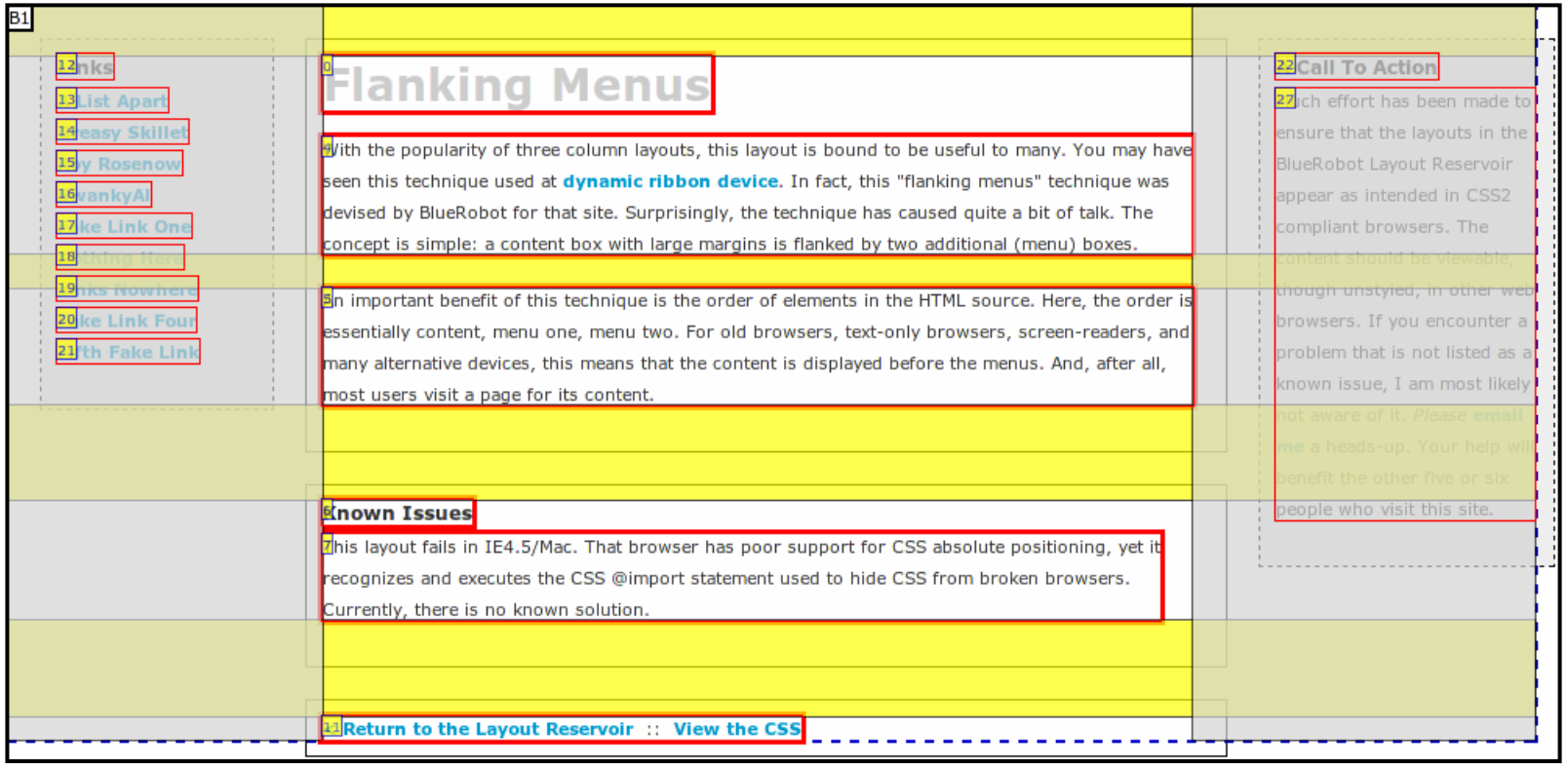
Segmentation Example [5]

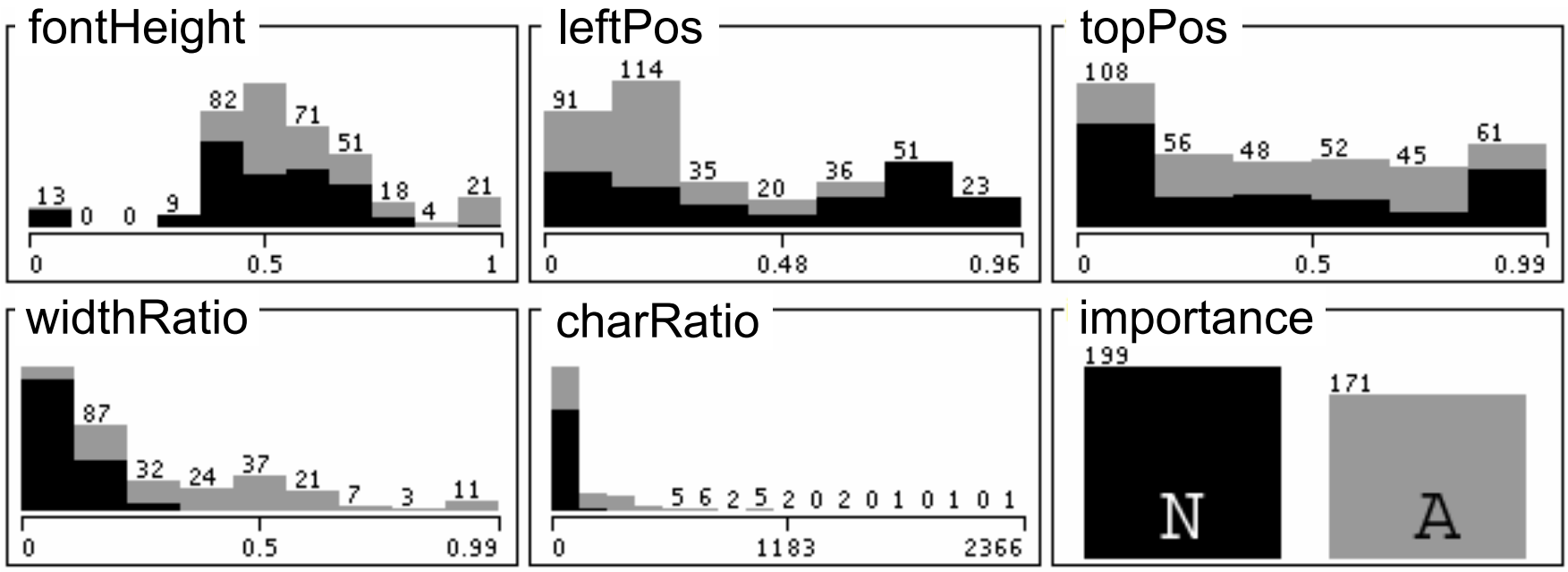


WEKA Toolkit [6]

Important vs. Noisy segments

- 370 segments from web pages
- WEKA machine learning toolkit
- Feature reduction
- PART algorithm
  - C4.5 decision tree algorithm

Final Feature Set



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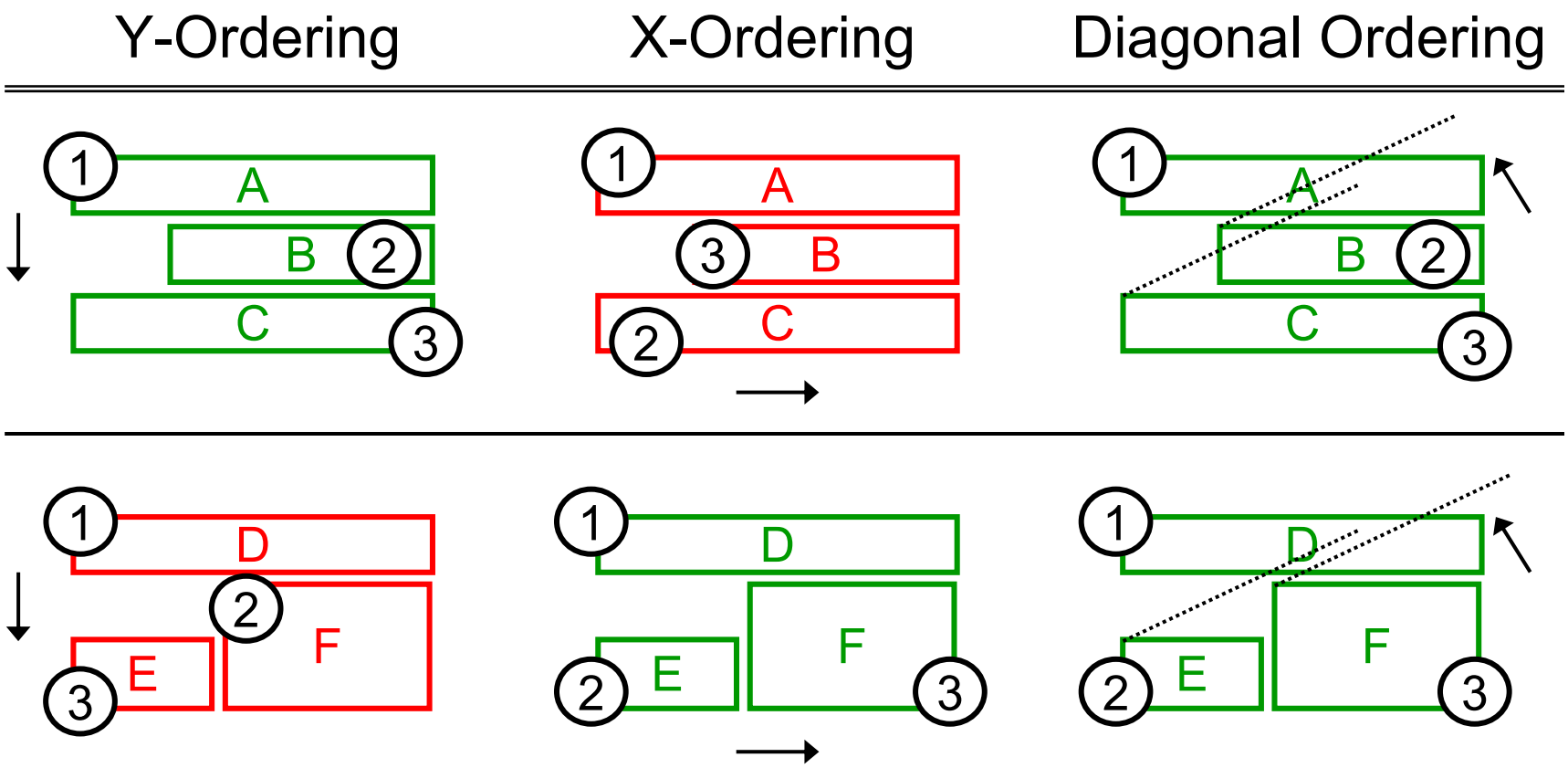
Diagonal Ordering



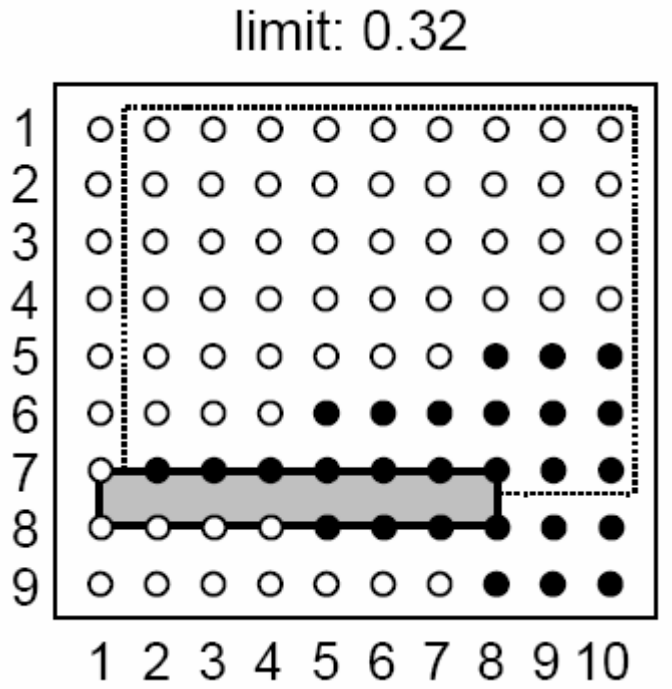
Diagonal Ordering Limit

Limit for the arctan between the two box corners:

$$limit = \frac{1}{2 + \frac{2\,b_{max}}{w_{max}} \sqrt{\frac{b_{max}}{w_{max}}}}$$

b_{max} = maximum width of the two boxes

w_{max} = maximum width of parent structure



Hierarchy Detection

- Monohierarchical structures
- Multitopological Grid
- Hierarchy model: *b.x.x*

  b = record start flag *{true, false}*, *x* = hierarchy depth

- Record start

$$fontLimit = 11 + (0.25 \cdot maxFontHeight)$$

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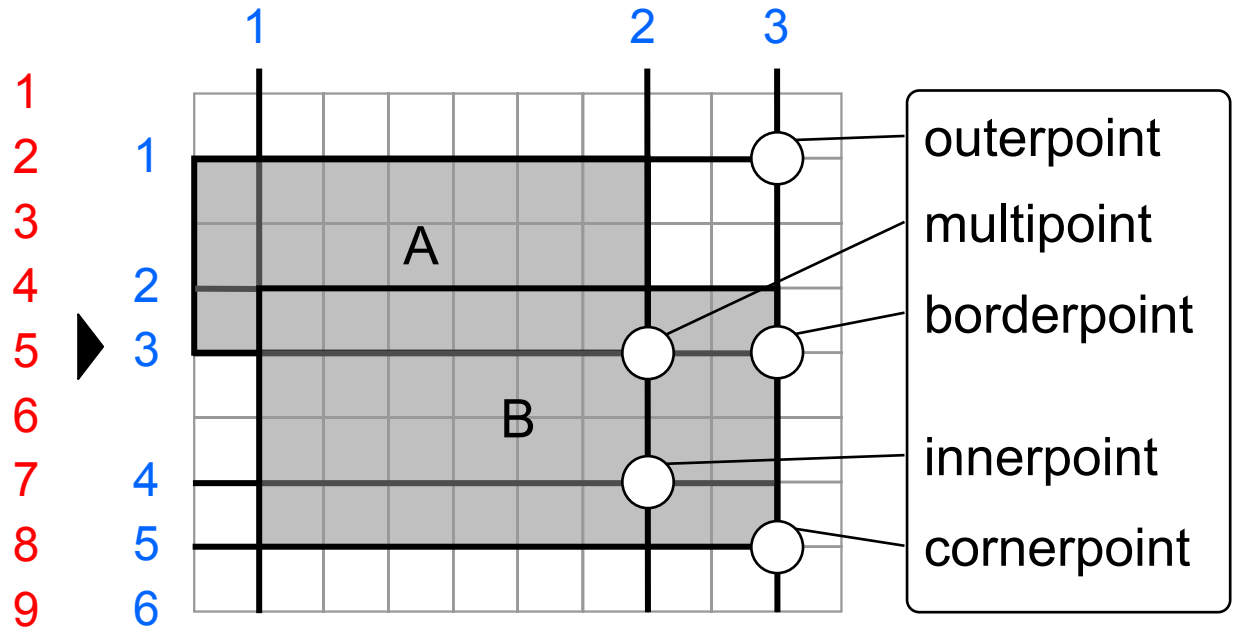
Multitopological Grid Concept

Minimal Grid: Screen Coordinates ▶ Logical Coordinates



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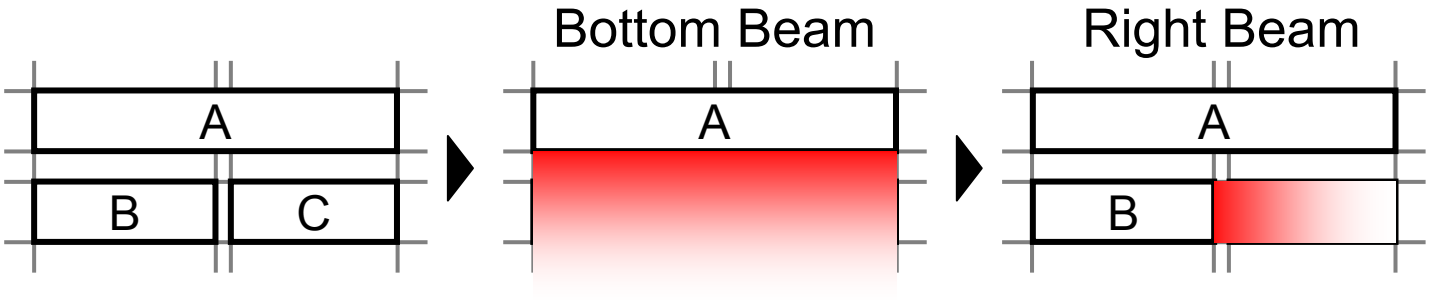
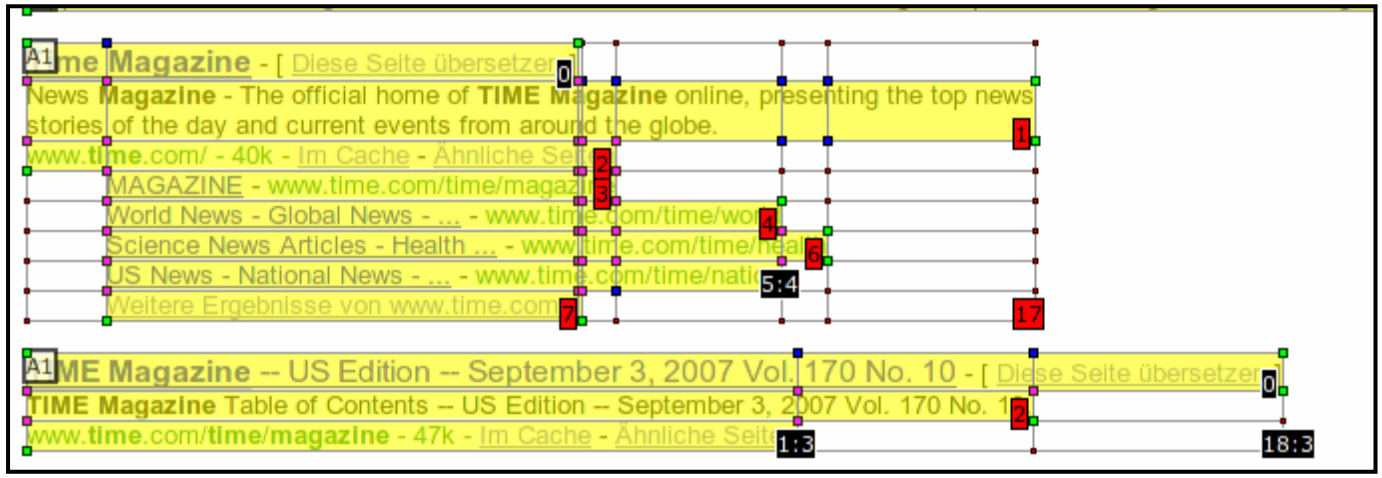
Multitopological Grid Example [7]





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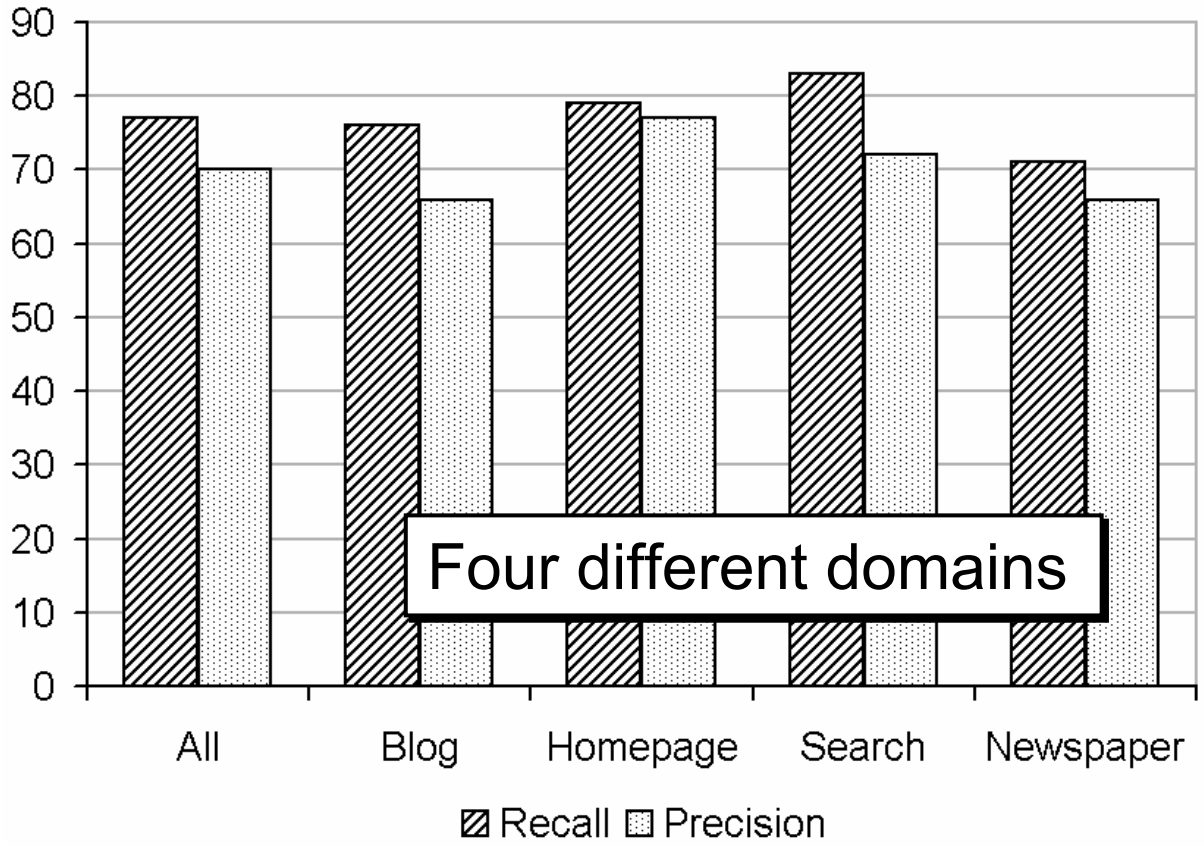
Experimental Results

Web Pages: 85
Record Count: 1086

Correct: 836
False Positives: 351
False Negatives: 241

Recall: 77%
Precision: 70%
F-Measure: 73%



Semantic (Domain) Dependence [8]

Webpage

REDEVILA Result

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REDEVILA Example [9]

Webpage

REDEVILA Result

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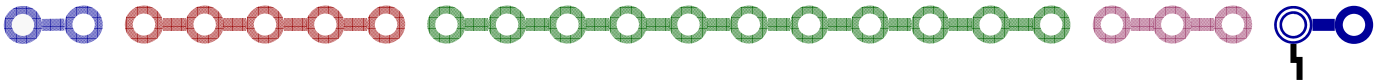
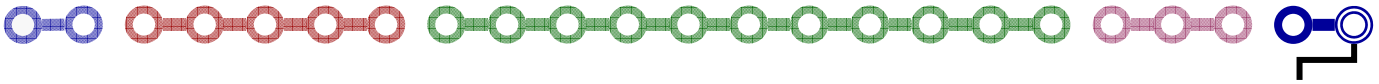
Conclusion

- Domain independence not satisfying
- Definition of distance difficult
- Would make current wrapper approaches more robust
- Potential for single record detection
- Clear separation between "tag" and "visual" approaches



Future Work

- Introducing domain dependence
- Automatic rule generation for the MT Grid
- Considering colored headers
- Considering the layout (column) structure
- Integration with tag information
- Integration of table models with substructured lists



Thank you for your attention

References

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8. http://the1review.com
9. http://www.google.com

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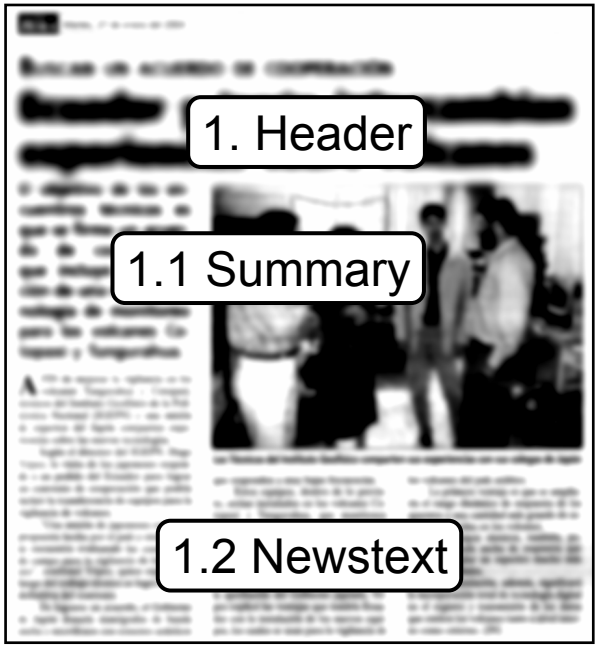
BACKUP

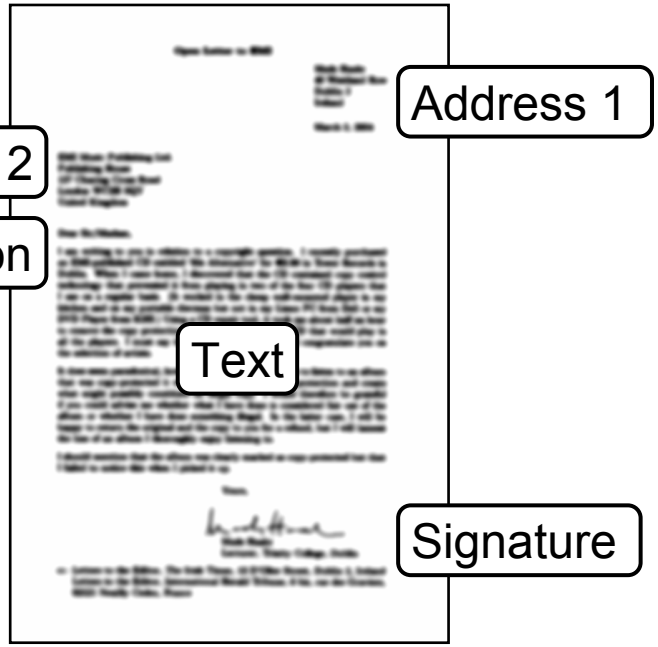
BACKUP

Domain Dependent Functional Semantics

NEWSPAPER



LETTER



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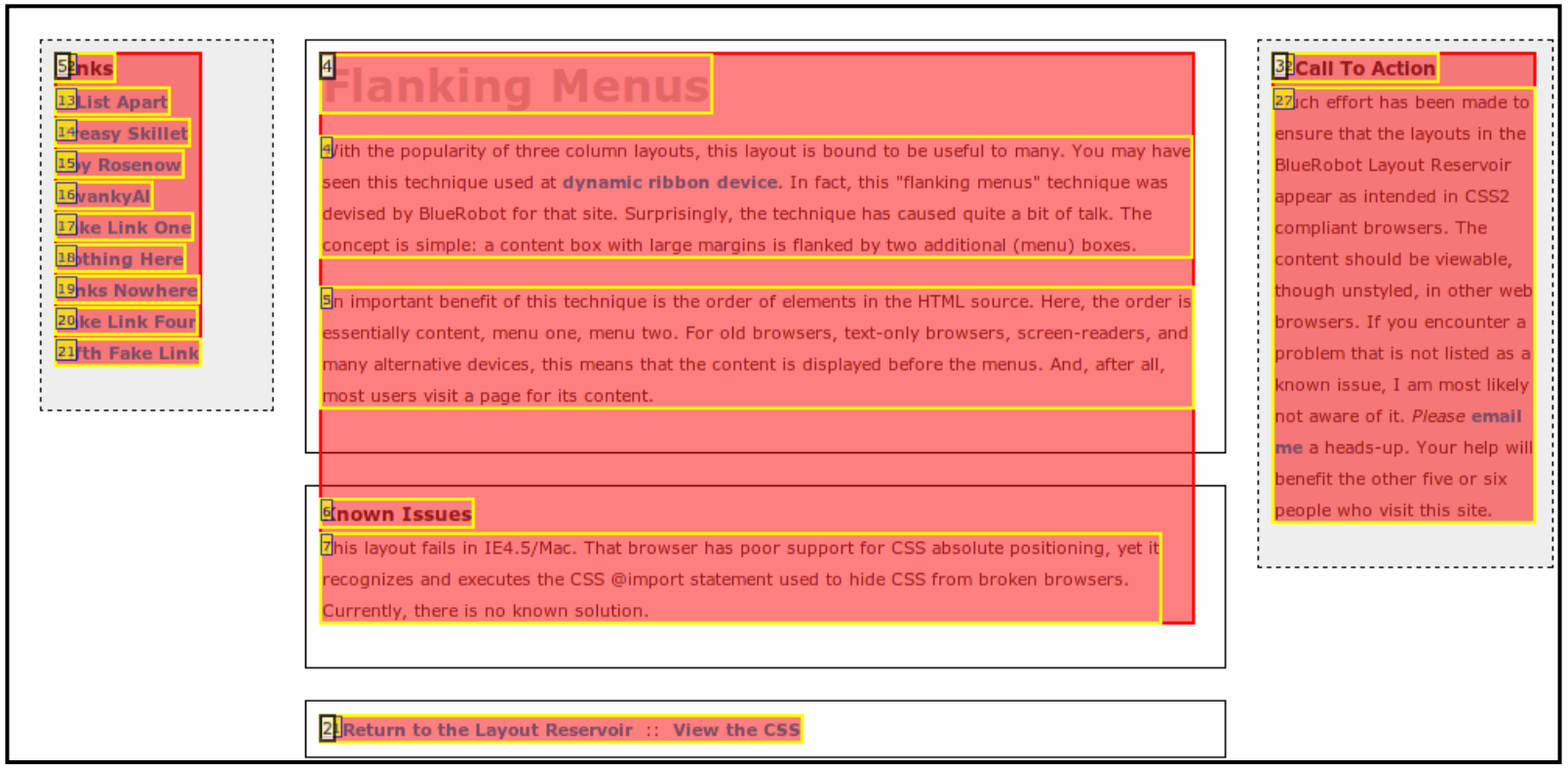
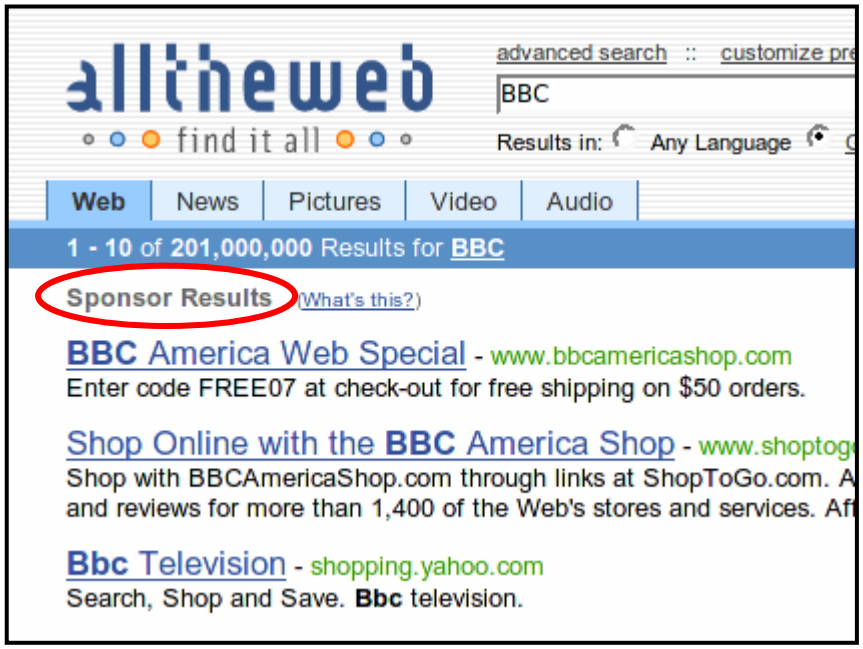
Segmentation Example II

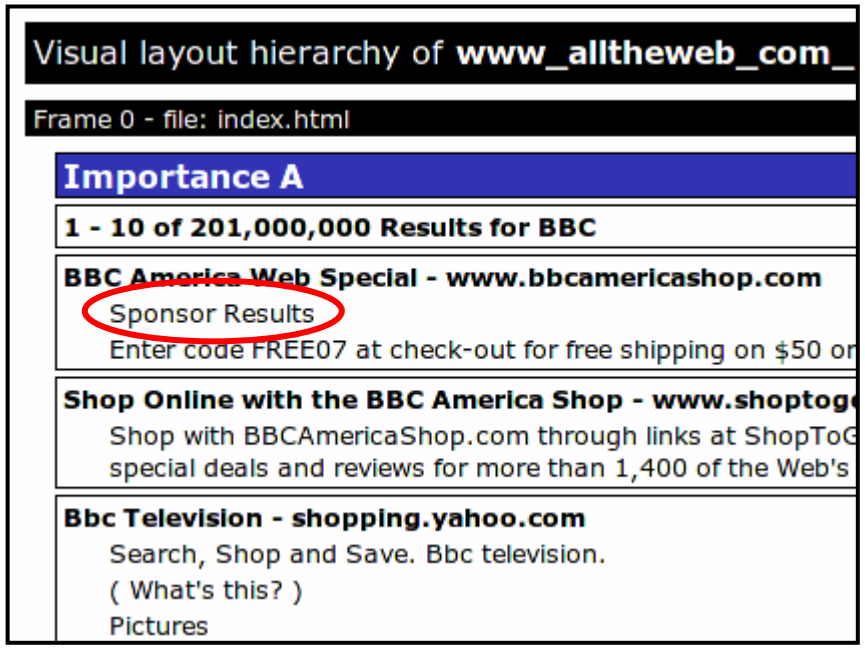


Problem: "Small Line Above" Rule

Webpage



REDEVILA Result



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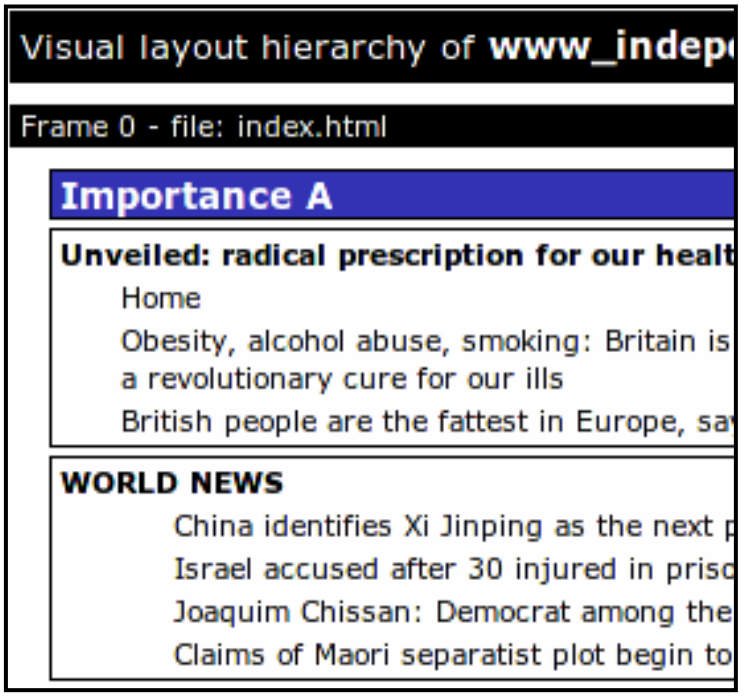
REDEVILA Example I

Webpage

REDEVILA Result



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