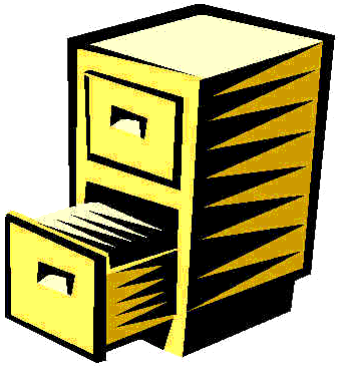
DUC IN ALTUM

UA

UNIVERSIDAD AUTONOMA DE CHILE

The Distributed Group SEVILLE

Web Page Classification



Inma Hernández

Ijui, 16th January 2014

ROADMAP

Introduction

Web Page Classification

Evaluation

Conclusions

ROADMAP

Introduction

Web Page Classification

Evaluation

Conclusions

Dr. Inmaculada Hernández

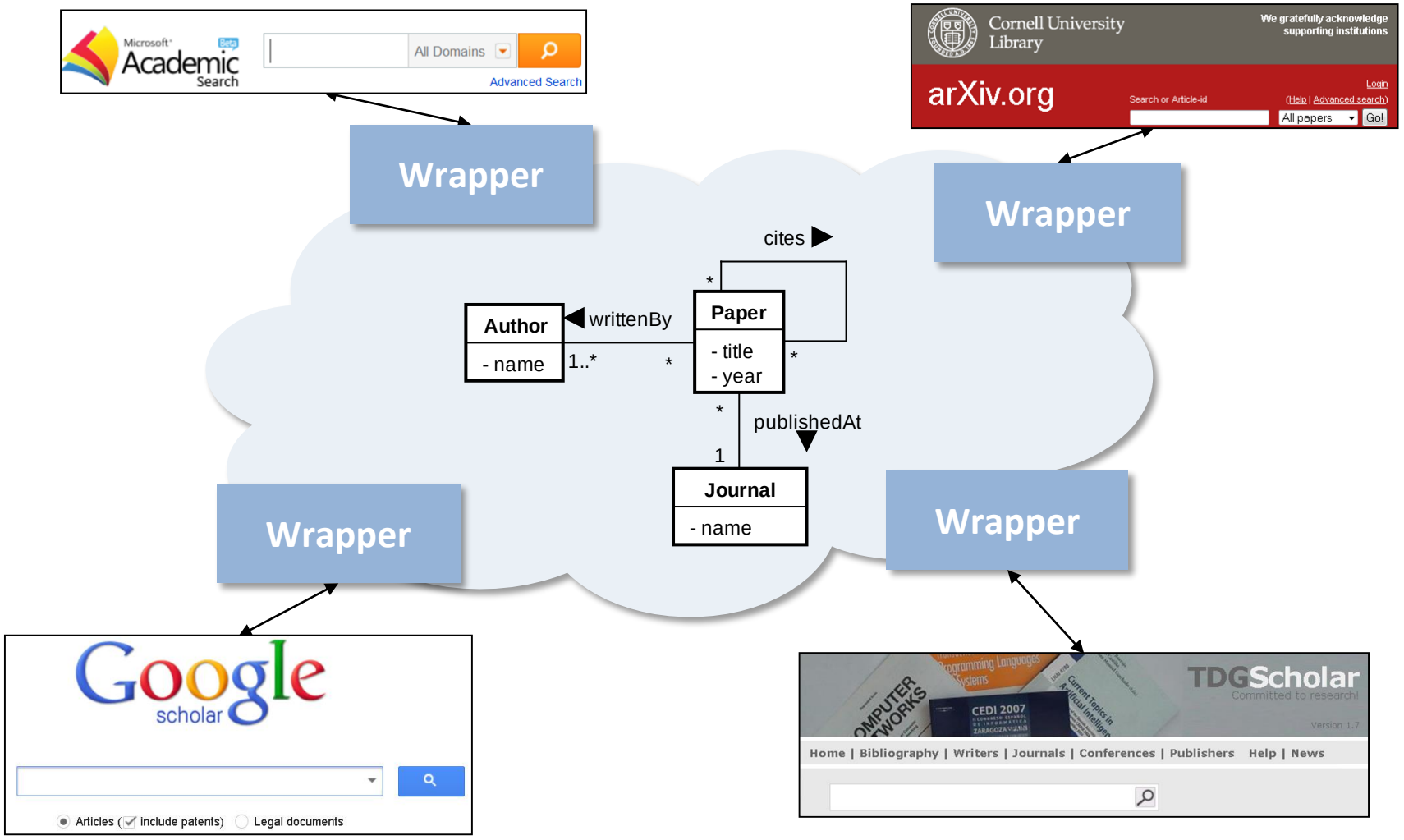
Cadiz

Research interests

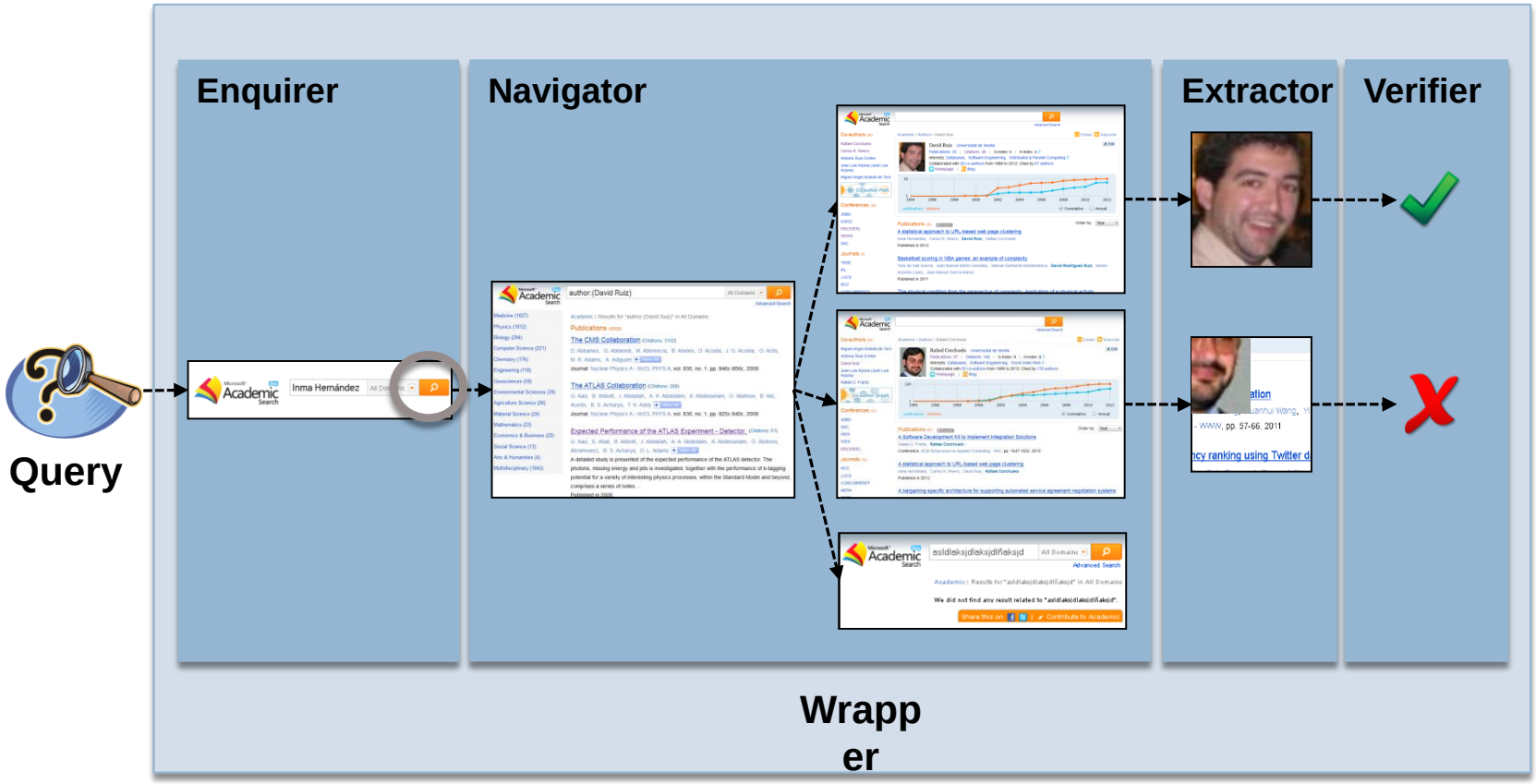
The Distributed Group Seville

- Enterprise information integration
- Enterprise application integration
- Web page classification
- Web site model discovery
- Open Data

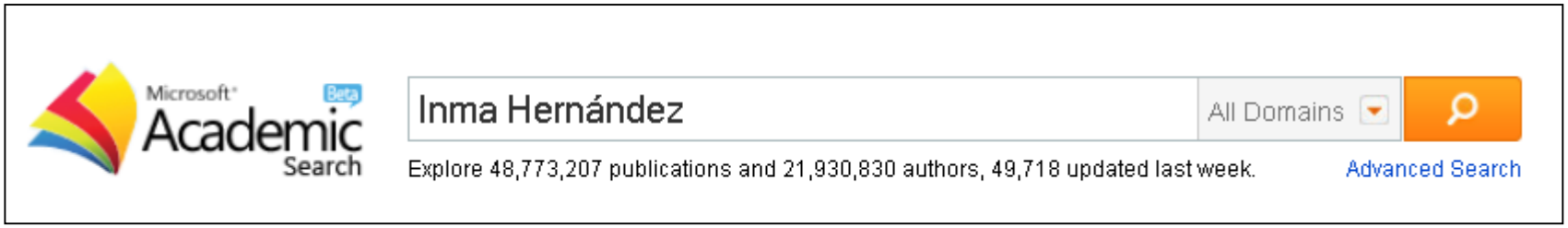
Enterprise web info integration



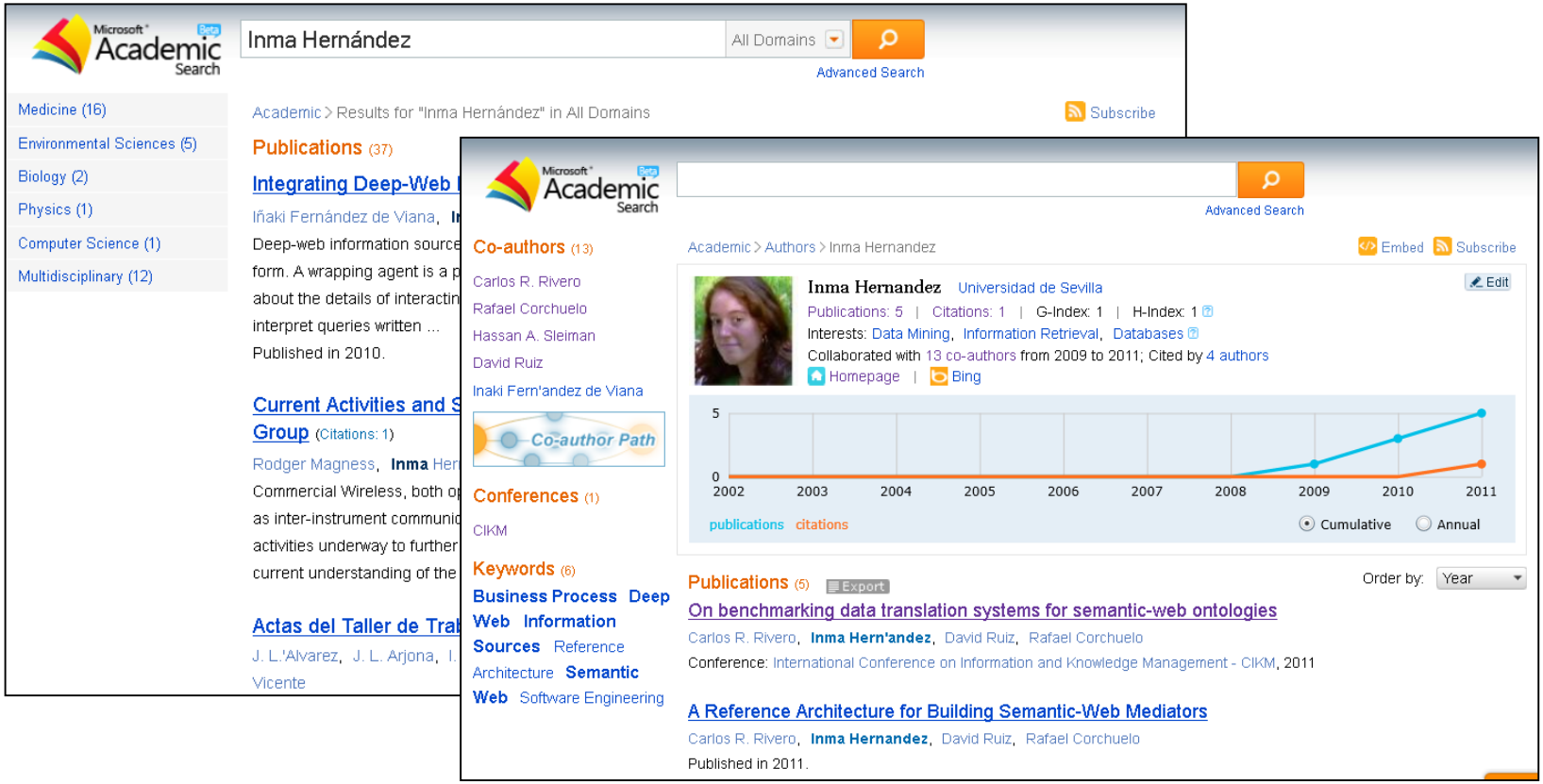
Web query wrapper



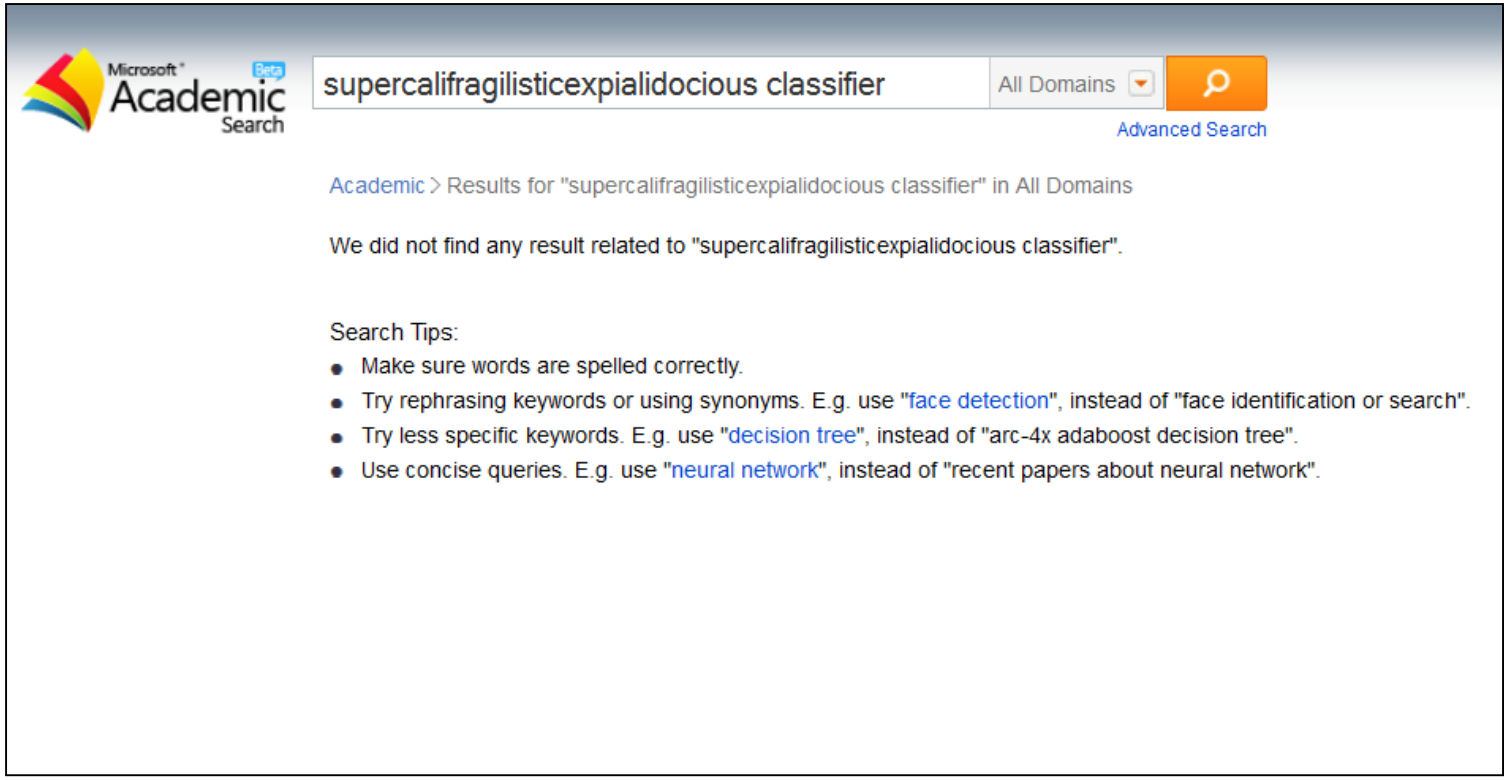
Form page


Microsoft
Beta
Academic
Search
Inma Hernández
All Domains
Explore 48,773,207 publications and 21,930,830 authors, 49,718 updated last week.
Advanced Search

Hub and detail pages



No results page



Error page

Microsoft Academic Search Beta

Advanced Search

File Not Found

Return to Homepage in 1 second. Return Now

Most likely causes:

- The requested item (paper, author, conference, journal, or organization) does not exist.
- The link might be out of date.

We are sorry that you reached this error. We would like to get more details on this error so that we can fix the underlying issue(s).

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ROADMAP

Introduction

Web Page Classification

Evaluation

Conclusions

ROADMAP

Introduction

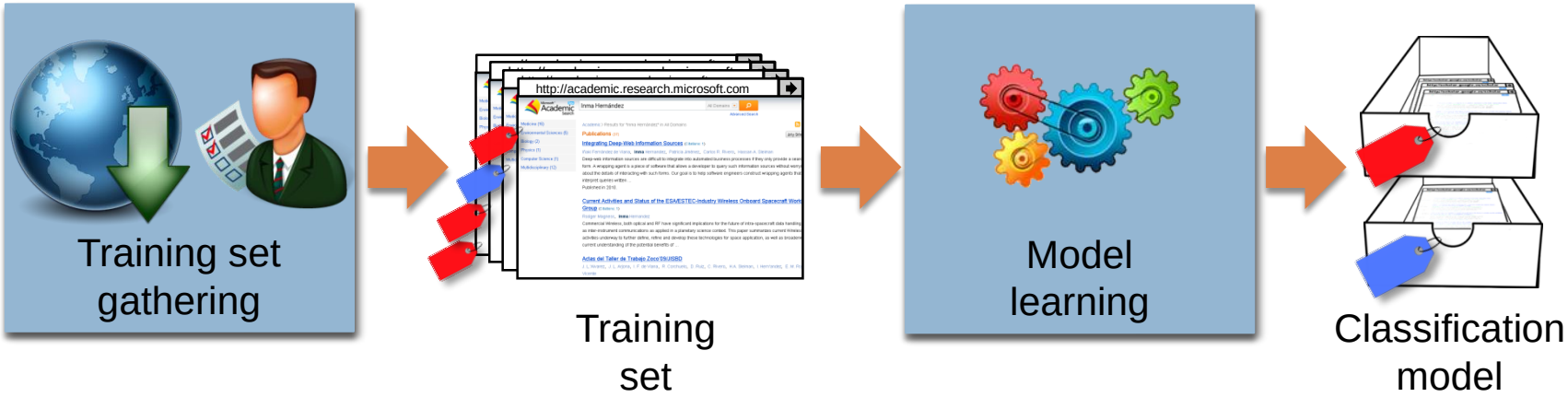
Web Page Classification

Preliminary concepts

Evaluation

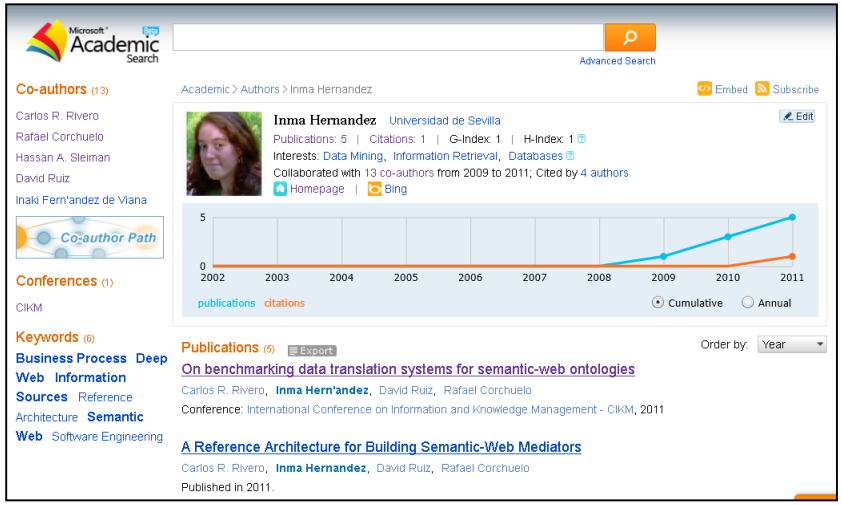
Conclusions

Supervised classification



Unsupervised classification (clustering)

Page Representation

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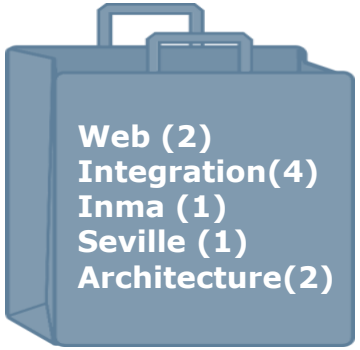
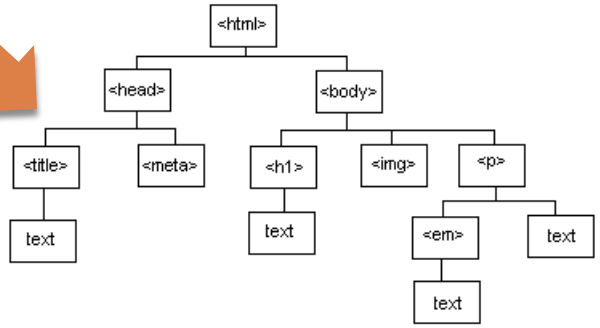
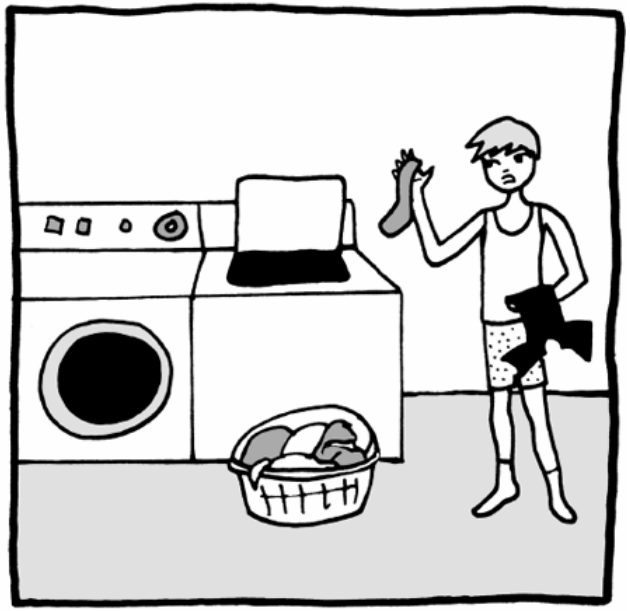




Preprocessing Techniques



- Cleansing & Formatting (jTidy)
- Tokenization
- Stemming
- Stop Words
- Removal of tags
- Removal of rare words

ROADMAP

Introduction

Web Page Classification

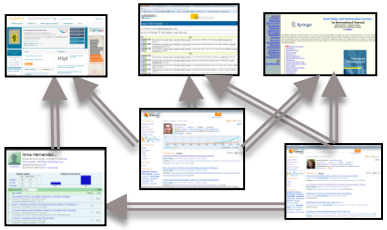
Existing proposals

Evaluation

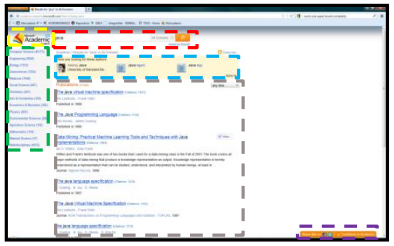
Conclusions

Types of features

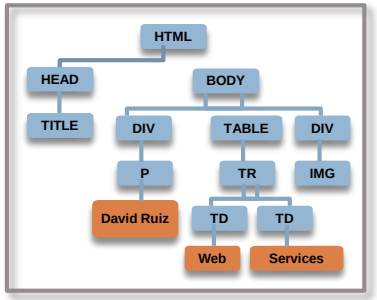
Content-based



Link-based



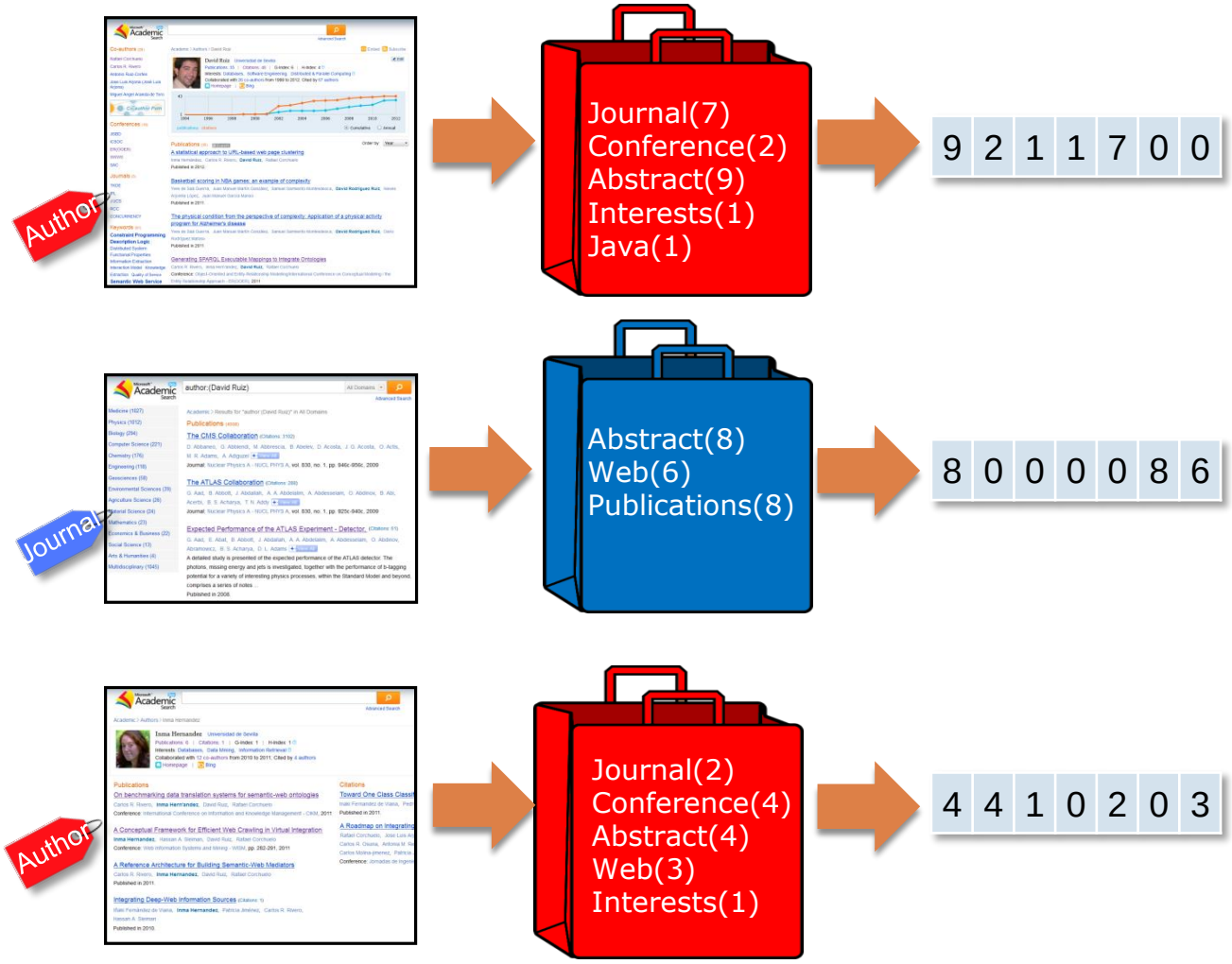
Visual-based



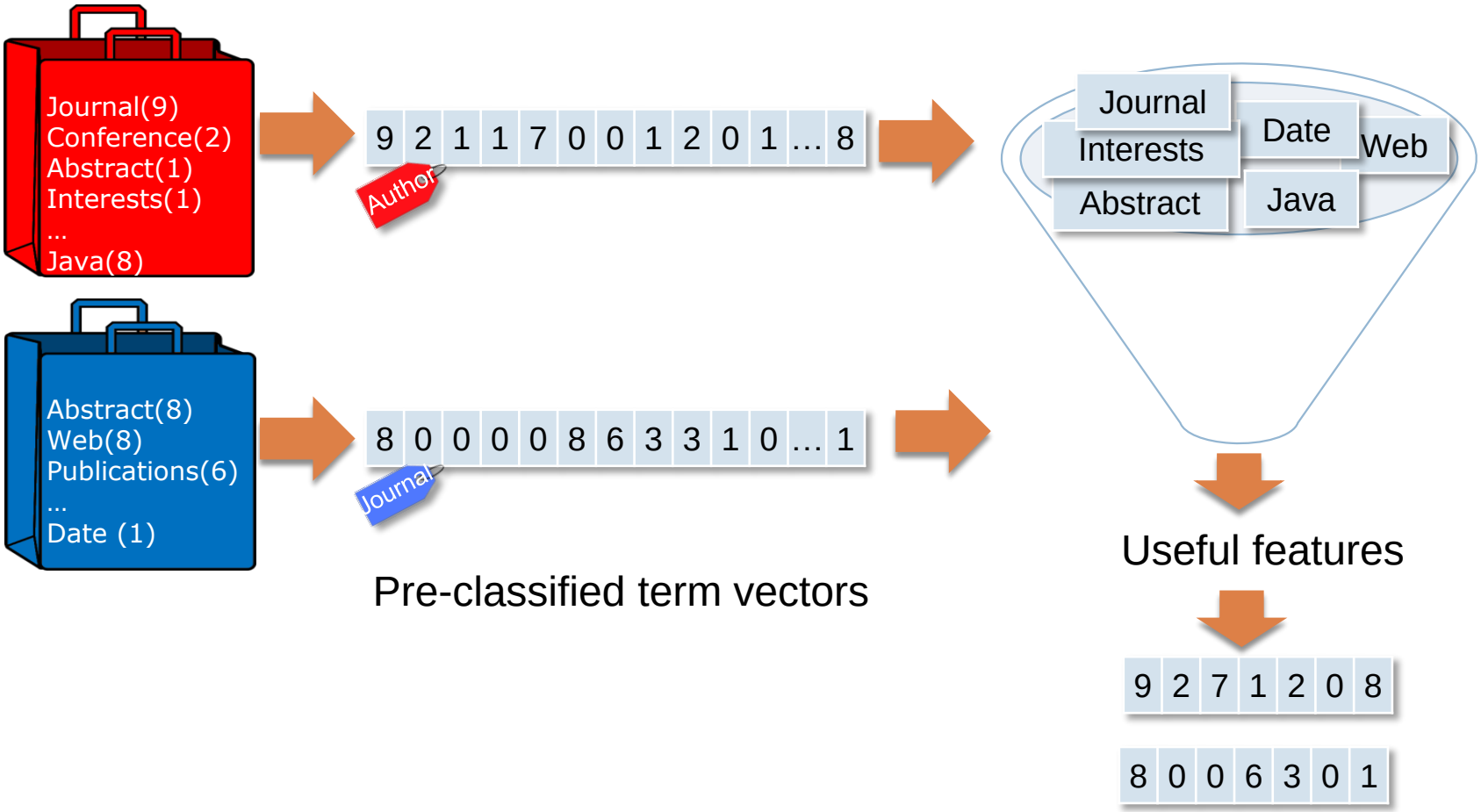
Structure-based

URL-based

Content-based features



WPCM (2004)


Journal(9)
Conference(2)
Abstract(1)
Interests(1)
...
Java(8)
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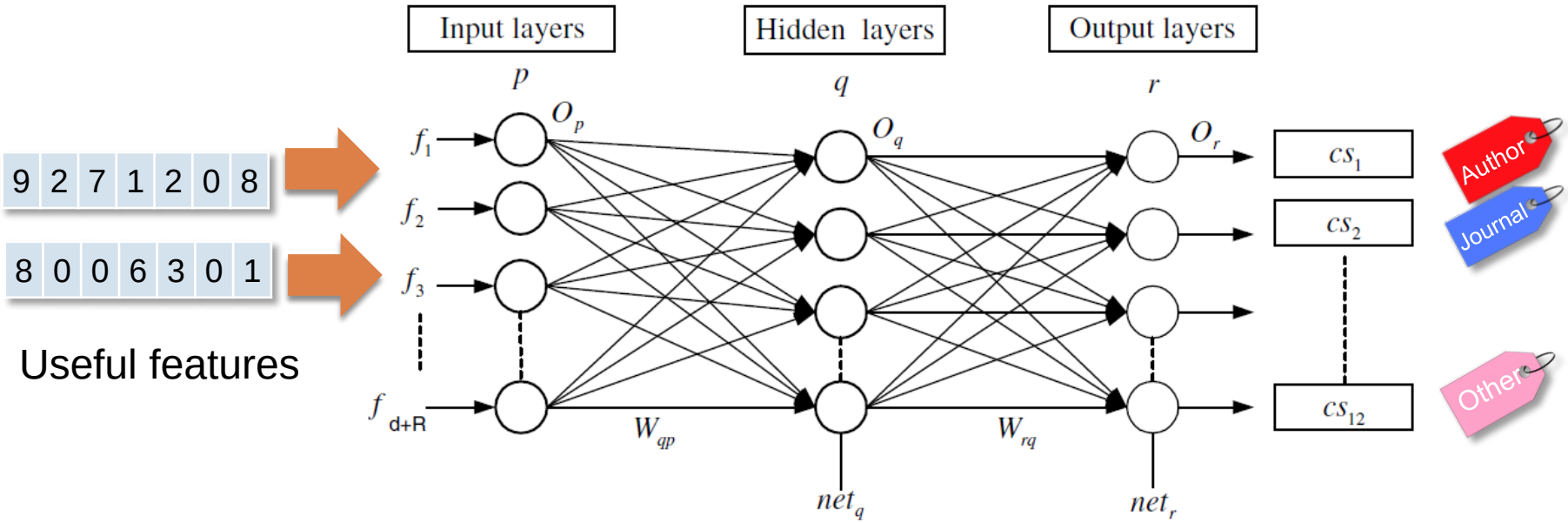
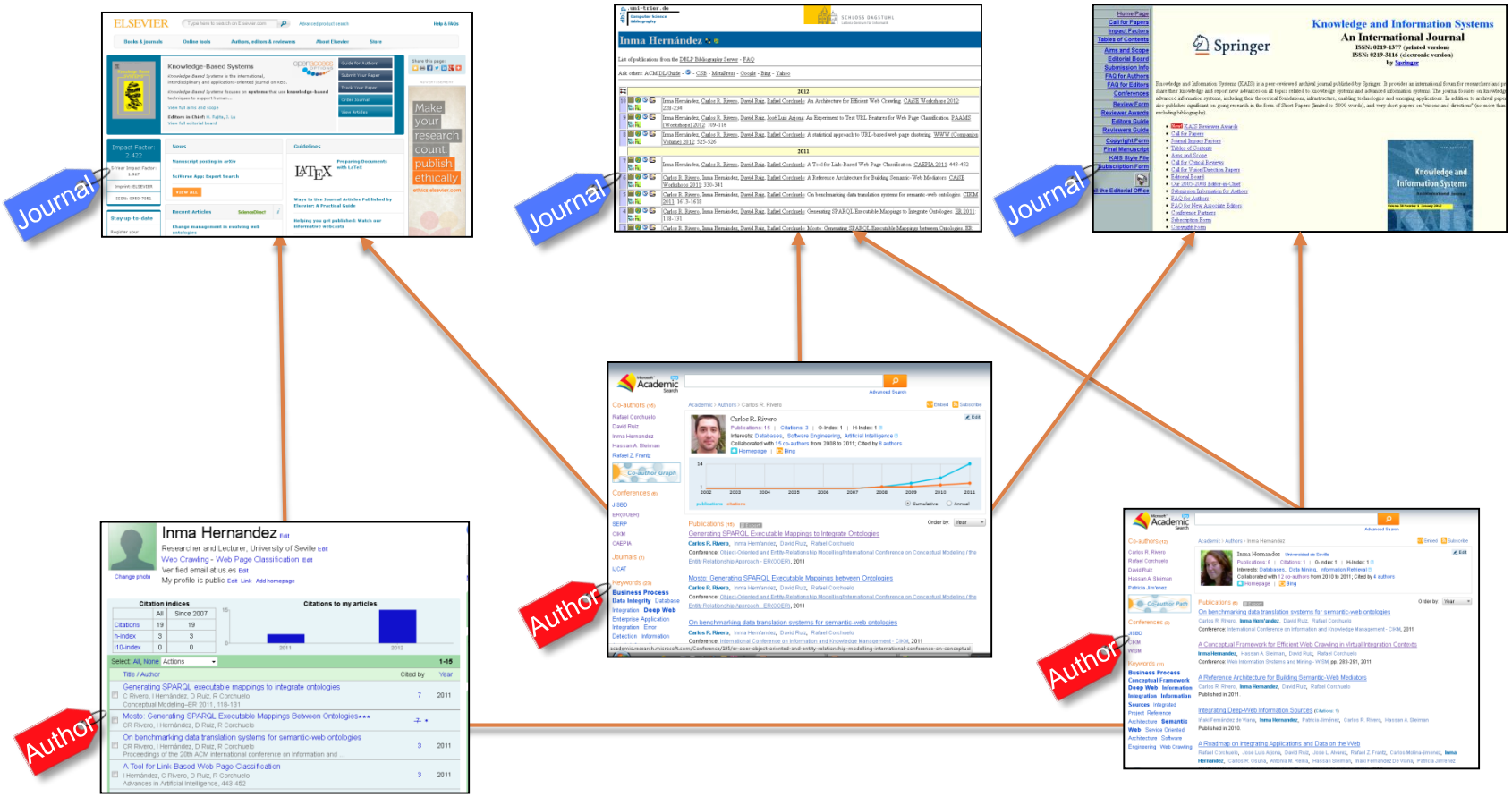
Author
Abstract(8)
Web(8)
Publications(6)
...
Date (1)
8 0 0 0 0 8 6 3 3 1 0 ... 1
Journal
Pre-classified term vectors
Journal
Interests
Date
Web
Abstract
Java
Useful features
9 2 7 1 2 0 8
8 0 0 6 3 0 1

WPCM (2004)

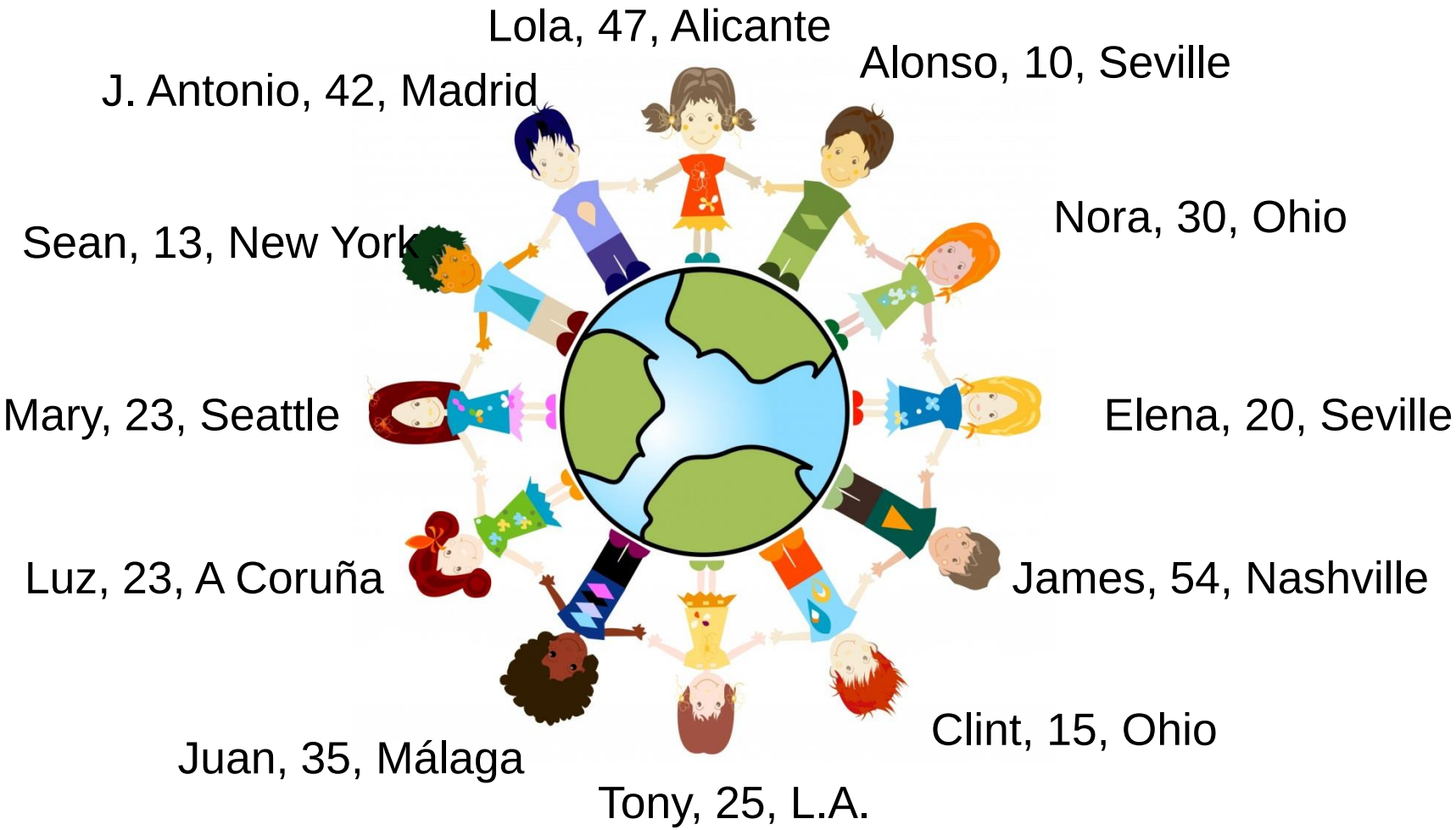


Neural networks

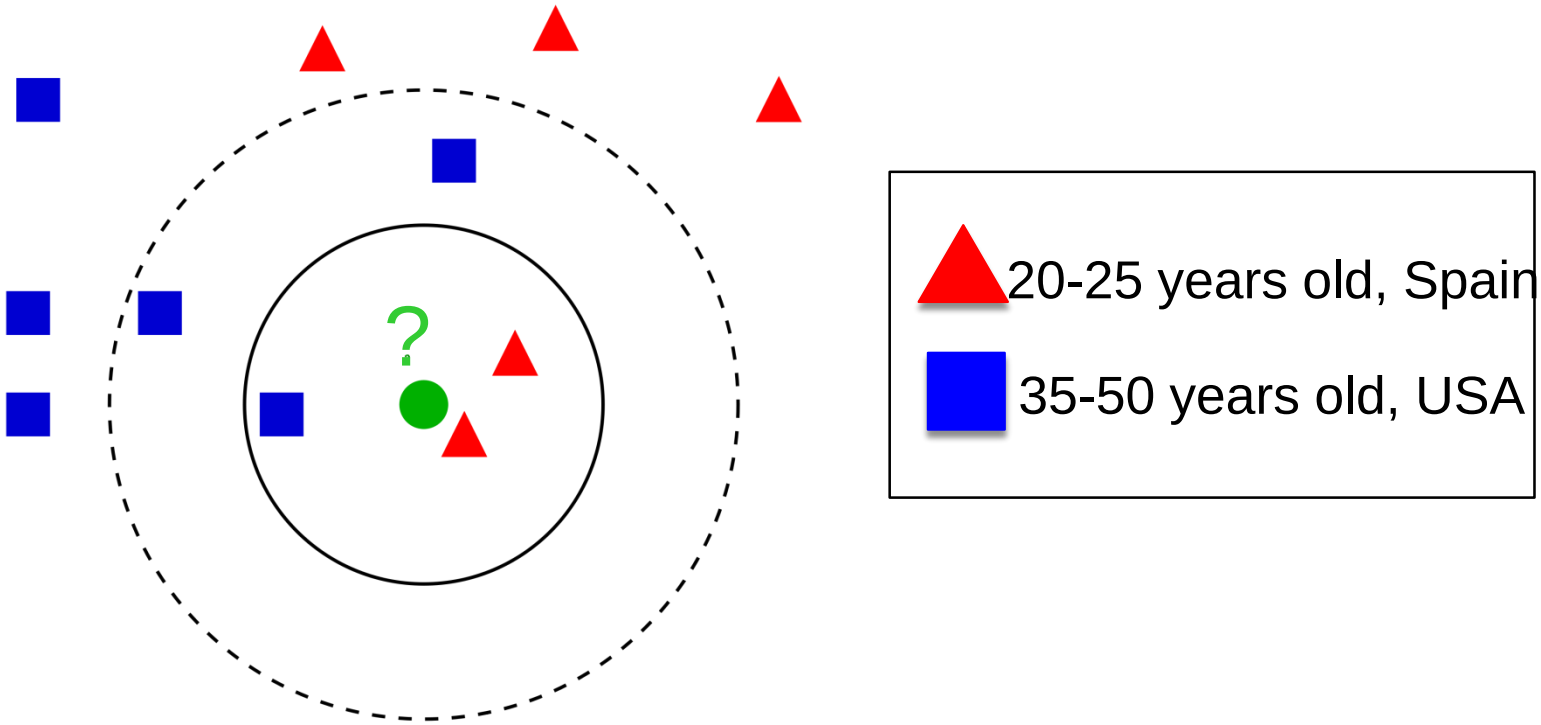
Link-based features



Bhagat et al. (2007)



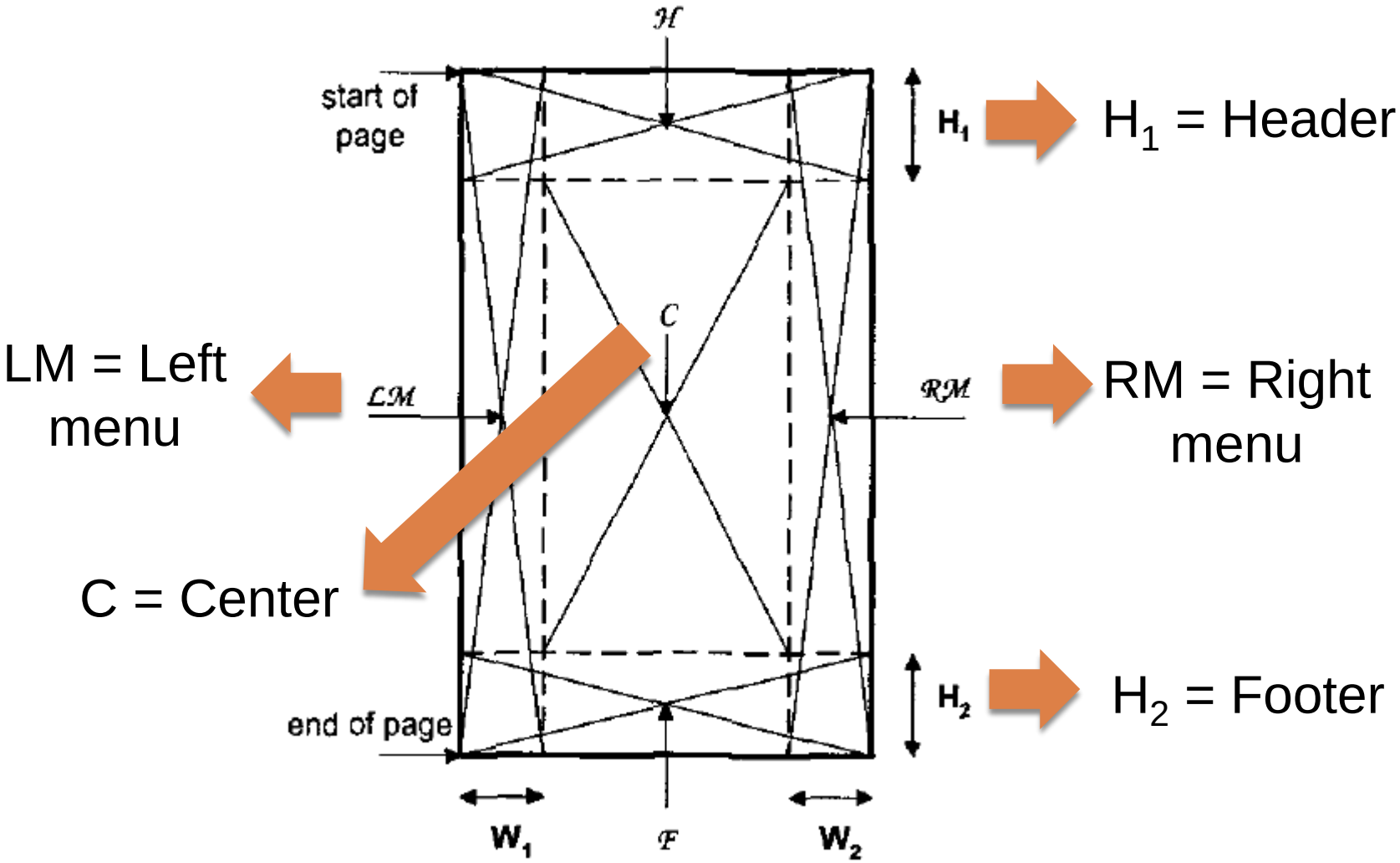
Bhagat et al. (2007)



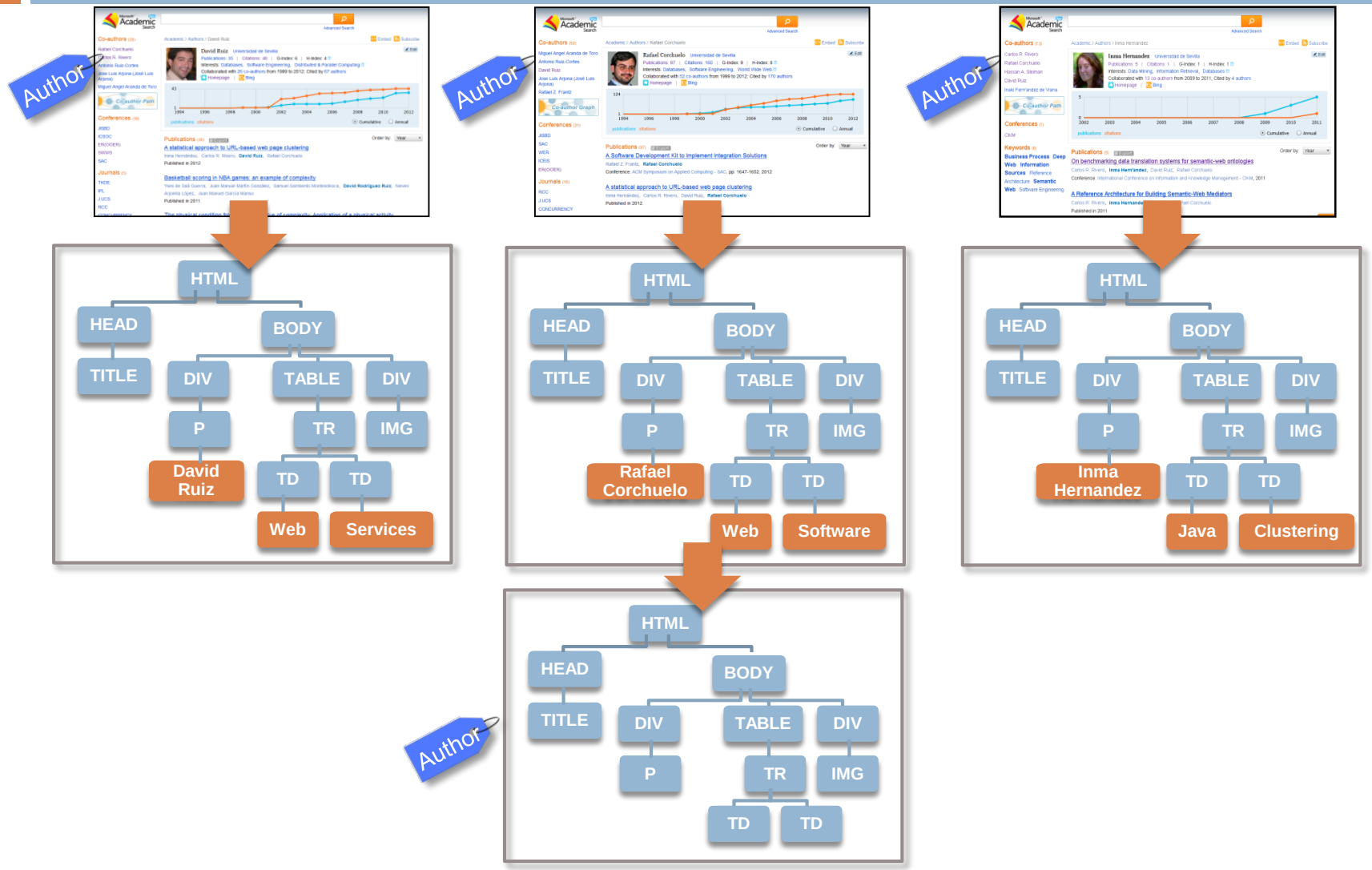
K-Nearest neighbours

Visual-based features

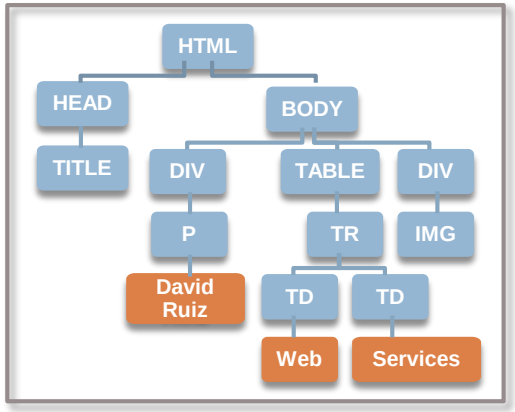
Kovacevic et al. (2007)

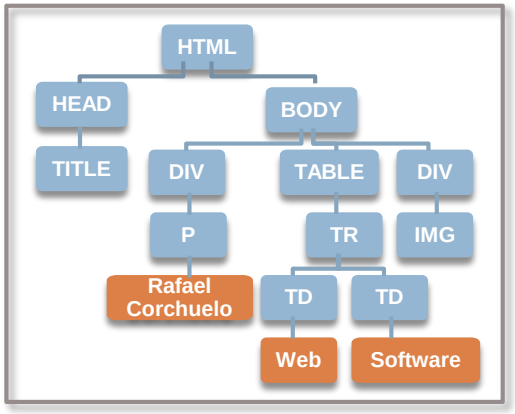


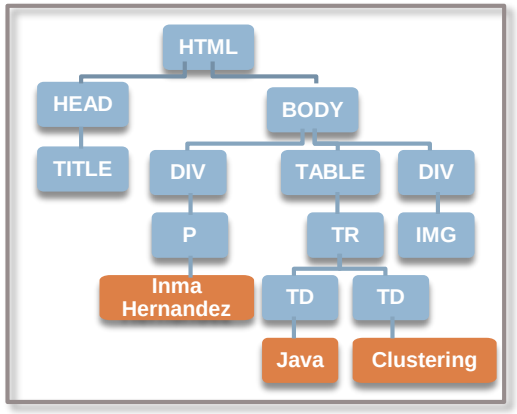
Structure-based features



Blanco et al. (2007)



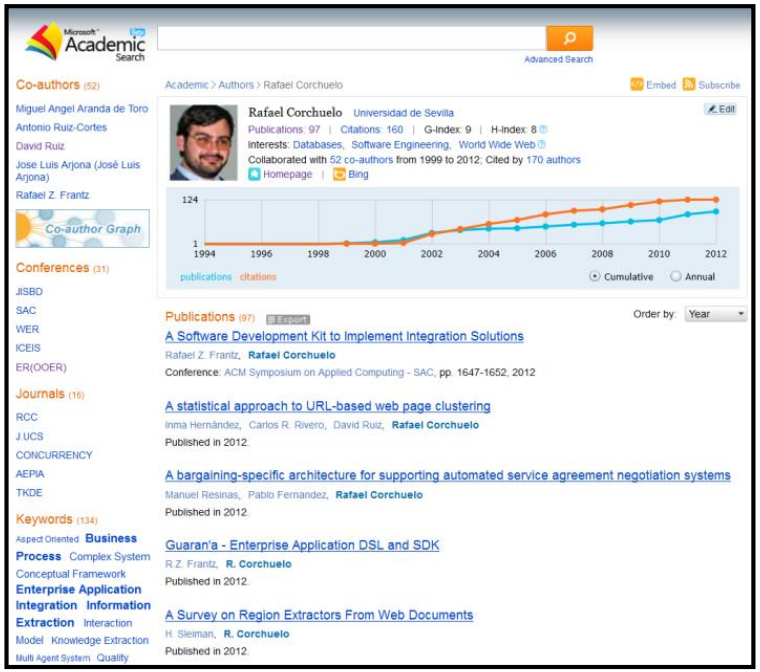




frequency = 3 (once per page)

frequency = 1 (not present in every page)

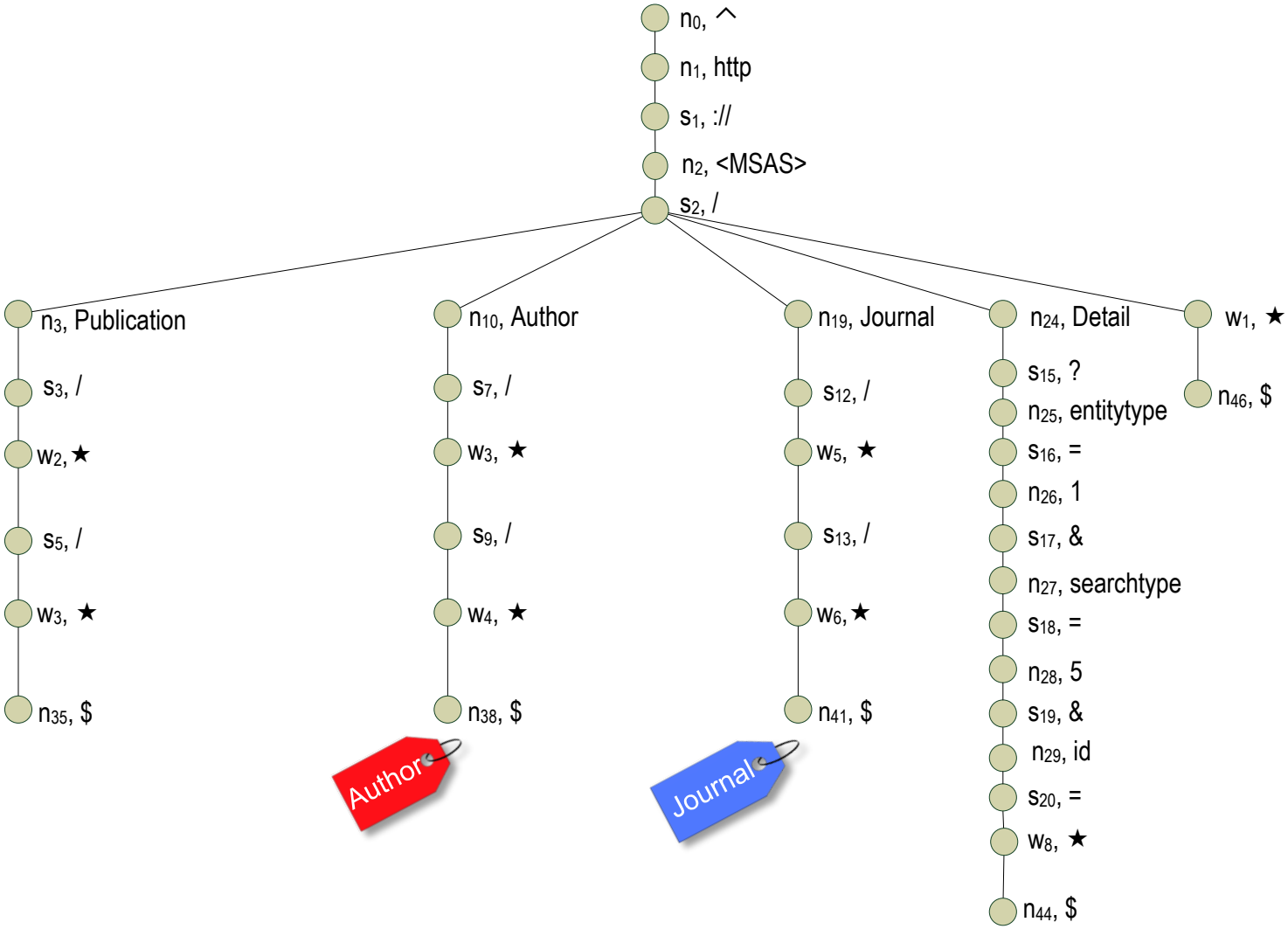
URL-based features



Author

http://academic.research.microsoft.com/Author/138280/rafael-corchuelo

CALA (2012)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s1, ://
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n35, $
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w3, ★
s9, /
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n38, $
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s12, /
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s18, =
n28, 5
s19, &
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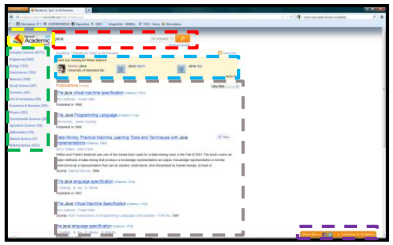
n46, $
Author
Journal

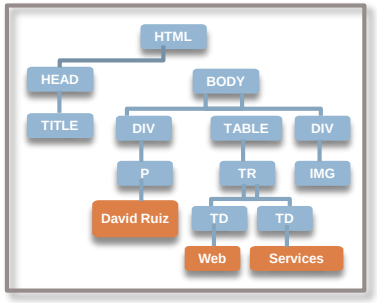
To sum up

Content-based

Link-based



Visual-based



Structure-based

URL-based

ROADMAP

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CALA (2012)

Evaluation

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CALA (2012)

Microsoft Academic Search Beta

Inma Hernández | All Domains

Advanced Search

- Medicine (16)
- Environmental Sciences (5)
- Biology (2)
- Physics (1)
- Computer Science (1)
- Multidisciplinary (12)

Academic > Results for "Inma Hernández" in All Domains

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Publications (37)

any time

Integrating Deep-Web Information Sources (Citations: 1)

Iñaki Fernández de Viana, **Inma** Hernández, Patricia Jiménez, Carlos R. Rivero, Hassan A. Sleiman

Deep-web information sources are difficult to integrate into automated business processes if they only provide a search form. A wrapping agent is a piece of software that allows a developer to query such information sources without worrying about the details of interacting with such forms. Our goal is to help software engineers construct wrapping agents that interpret queries written ...

Published in 2010.

Current Activities and Status of the ESA/ESTEC-Industry Wireless Onboard Spacecraft Working Group (Citations: 1)

Rodger Magness, **Inma** Hernandez

Commercial Wireless, both optical and RF have significant implications for the future of intra-spacecraft data handling as well as inter-instrument communications as applied in a planetary science context. This paper summarizes current Wireless WG activities underway to further define, refine and develop these technologies for space application, as well as broadening current understanding of the potential benefits of ...

Actas del Taller de Trabajo Zoco'09/JISBD

J. L.'Alvarez, J. L. Arjona, I. F. de Viana, R. Corchuelo, D. Ruiz, C. Rivero, H.A. Sleiman, I. Hern'andez, E. M. Rojo, L. Vicente

http://academic.research.microsoft.com/Publication/39292533/integrating-deep-web-information-sources

URL templates

http://<MSAS>/Author/*/*

< >

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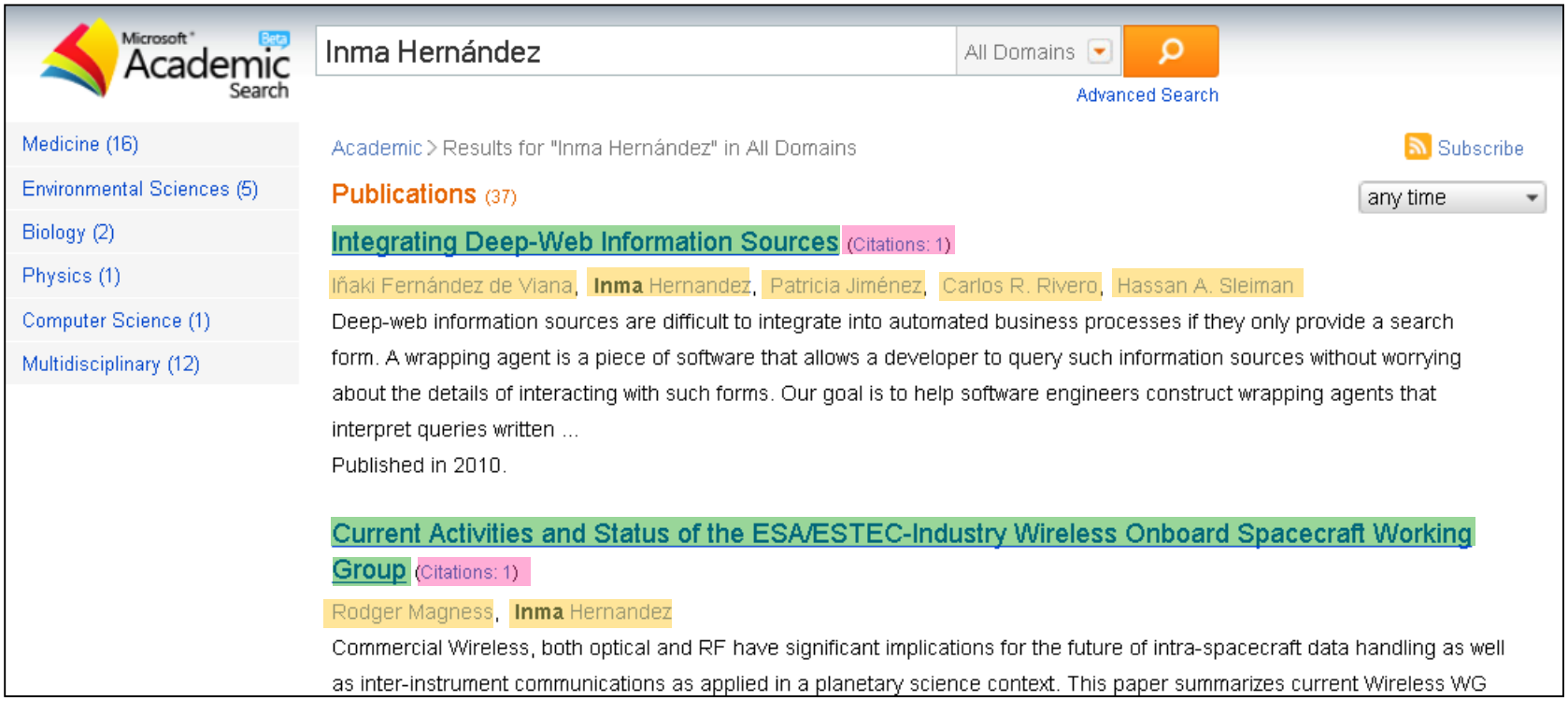
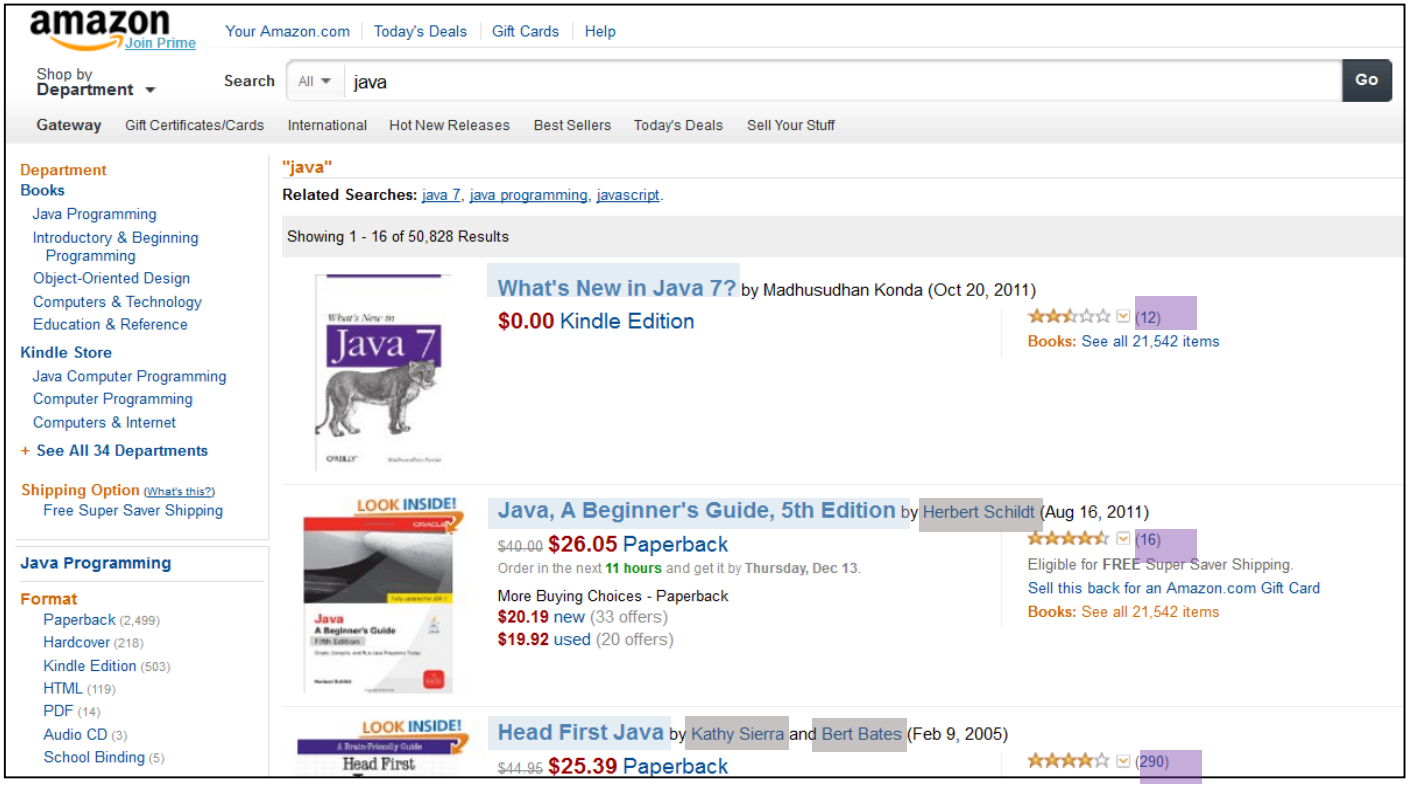
URL patterns



Papers	http://<MSAS>/Publication/★/★
Authors	http://<MSAS>/Author/★/★
Citations	http://<MSAS>/Detail?entitytype=1&searchtype=5&id=★

URL patterns



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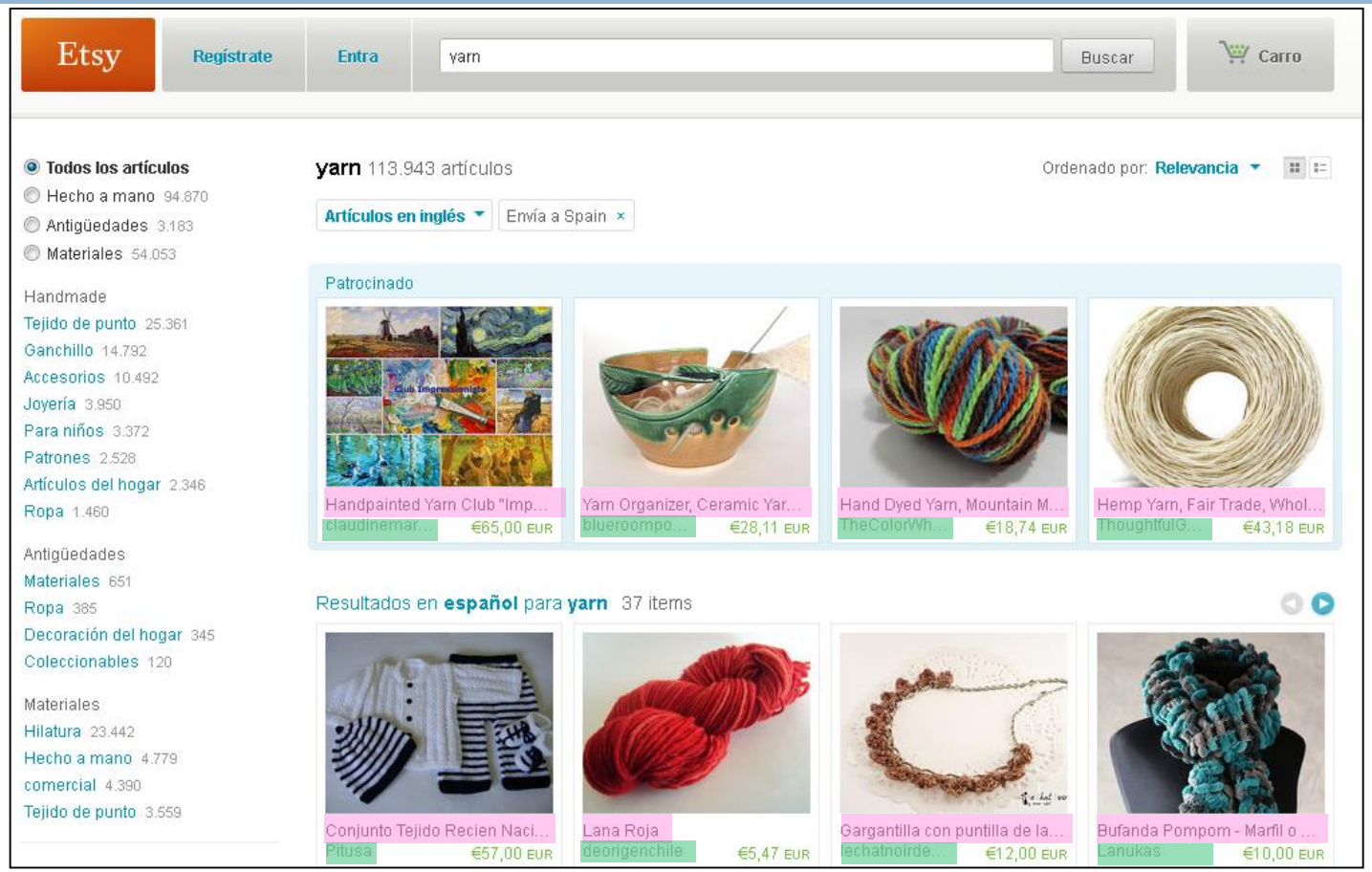
URL patterns



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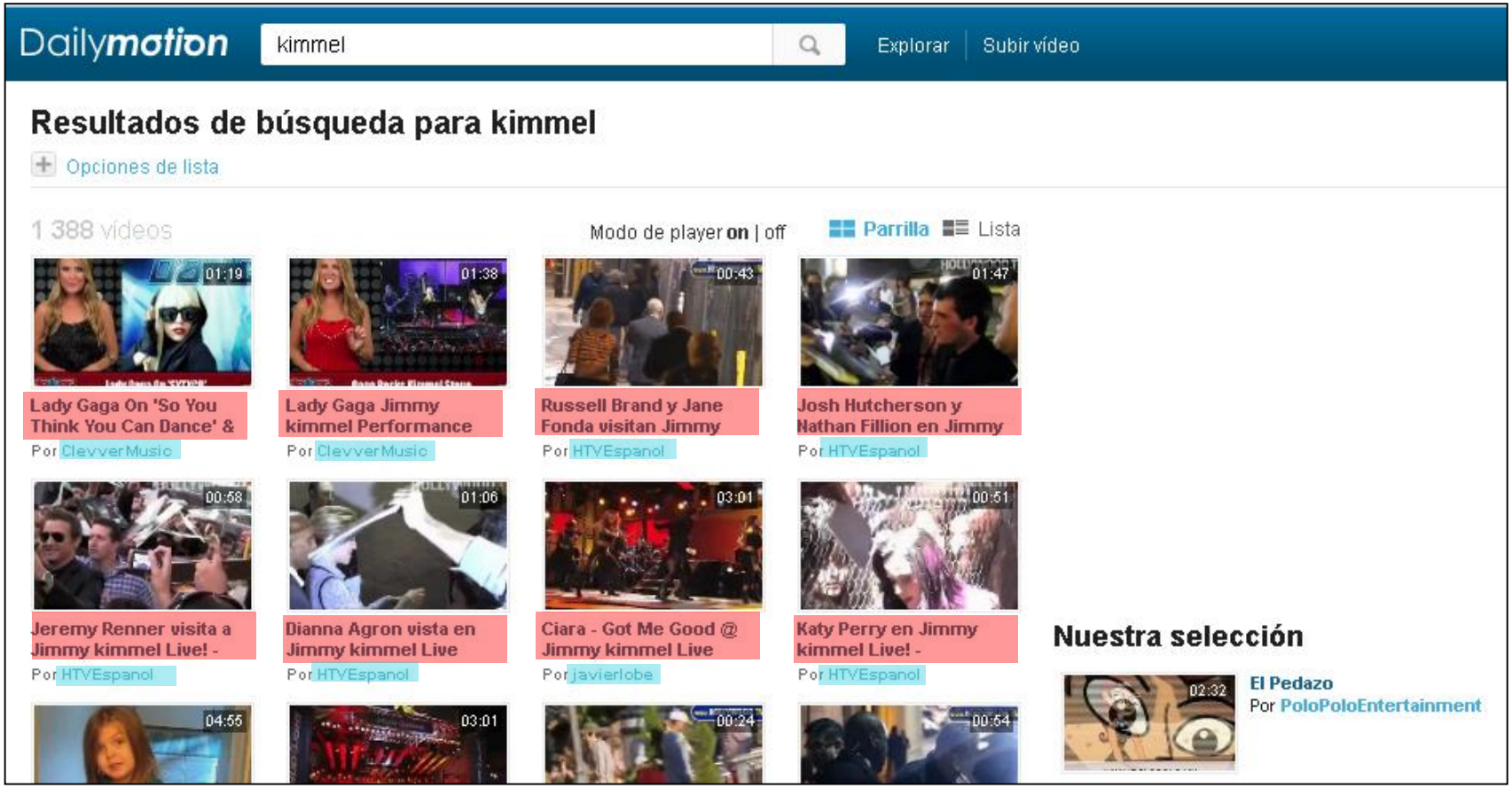
Shops	http://<ETSY>/shop/★? ga_search_query=★&gsearch_type=all

URL patterns



Videos	http://<DLMTN>/video/★?search_algo=2
Users	http://<DLMTN>/★

ROADMAP

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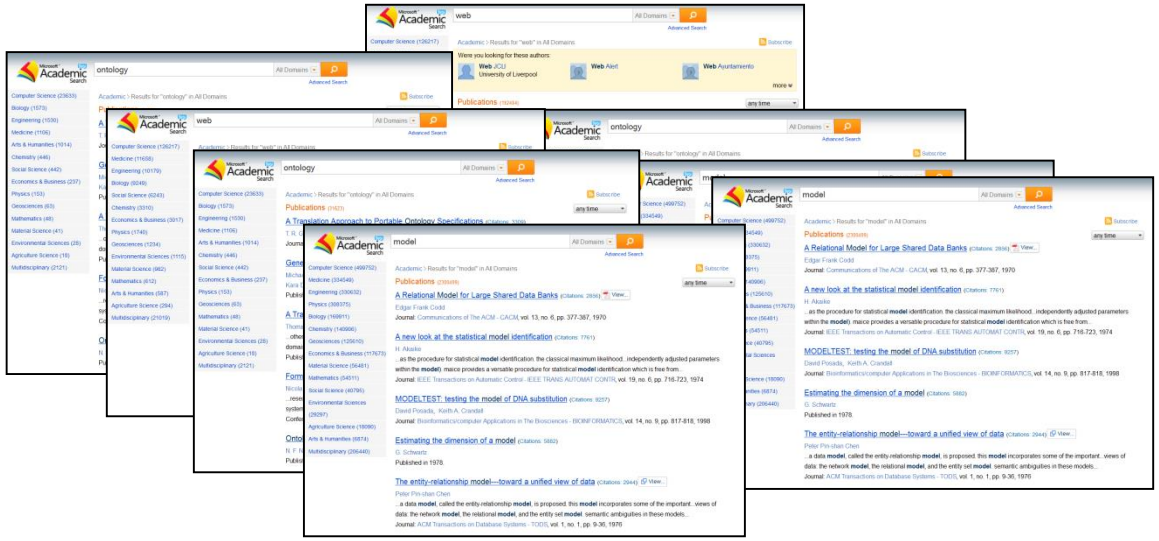
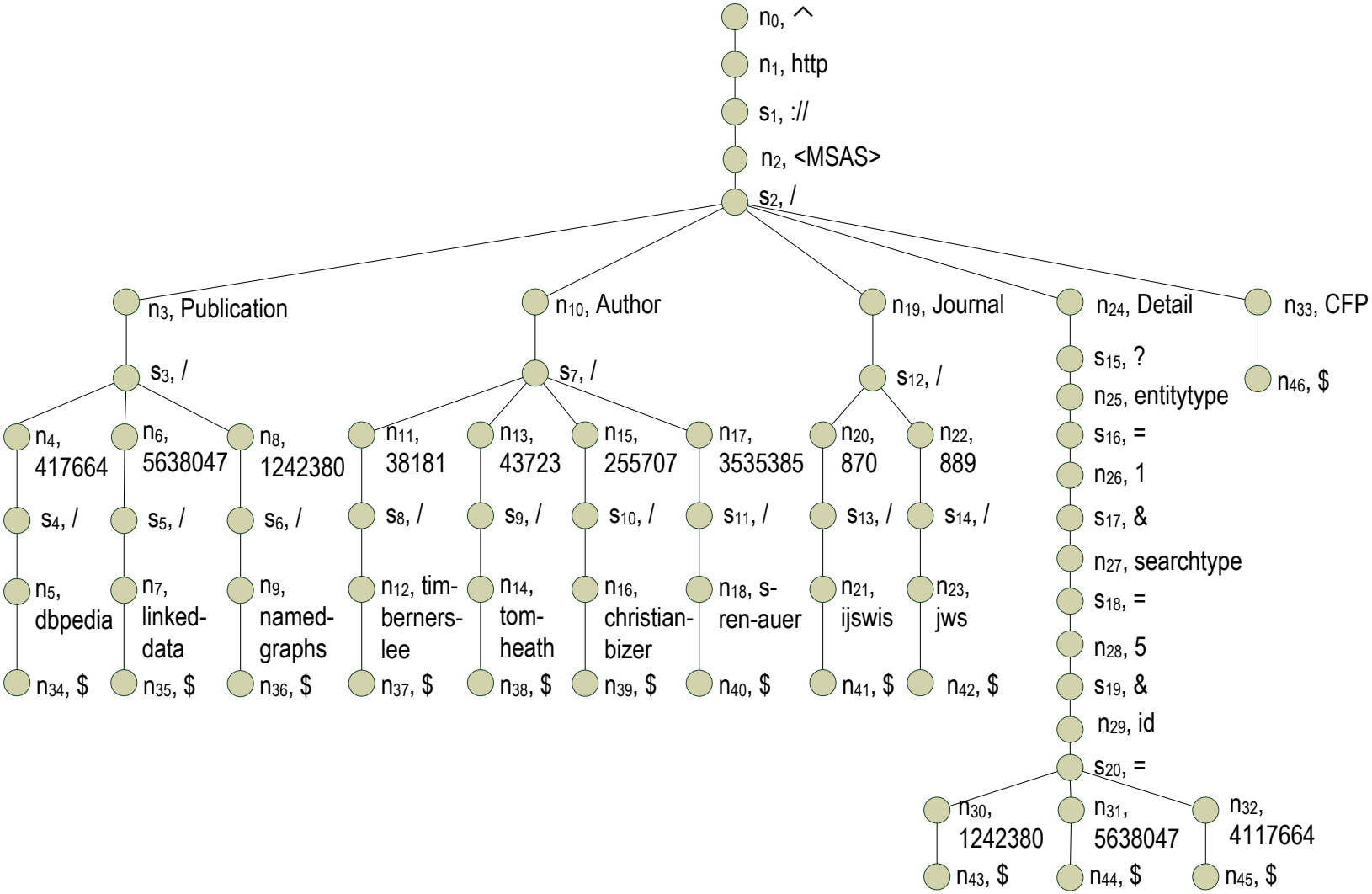
Initial prefix set



URLS

URL prefixes

Prefix tree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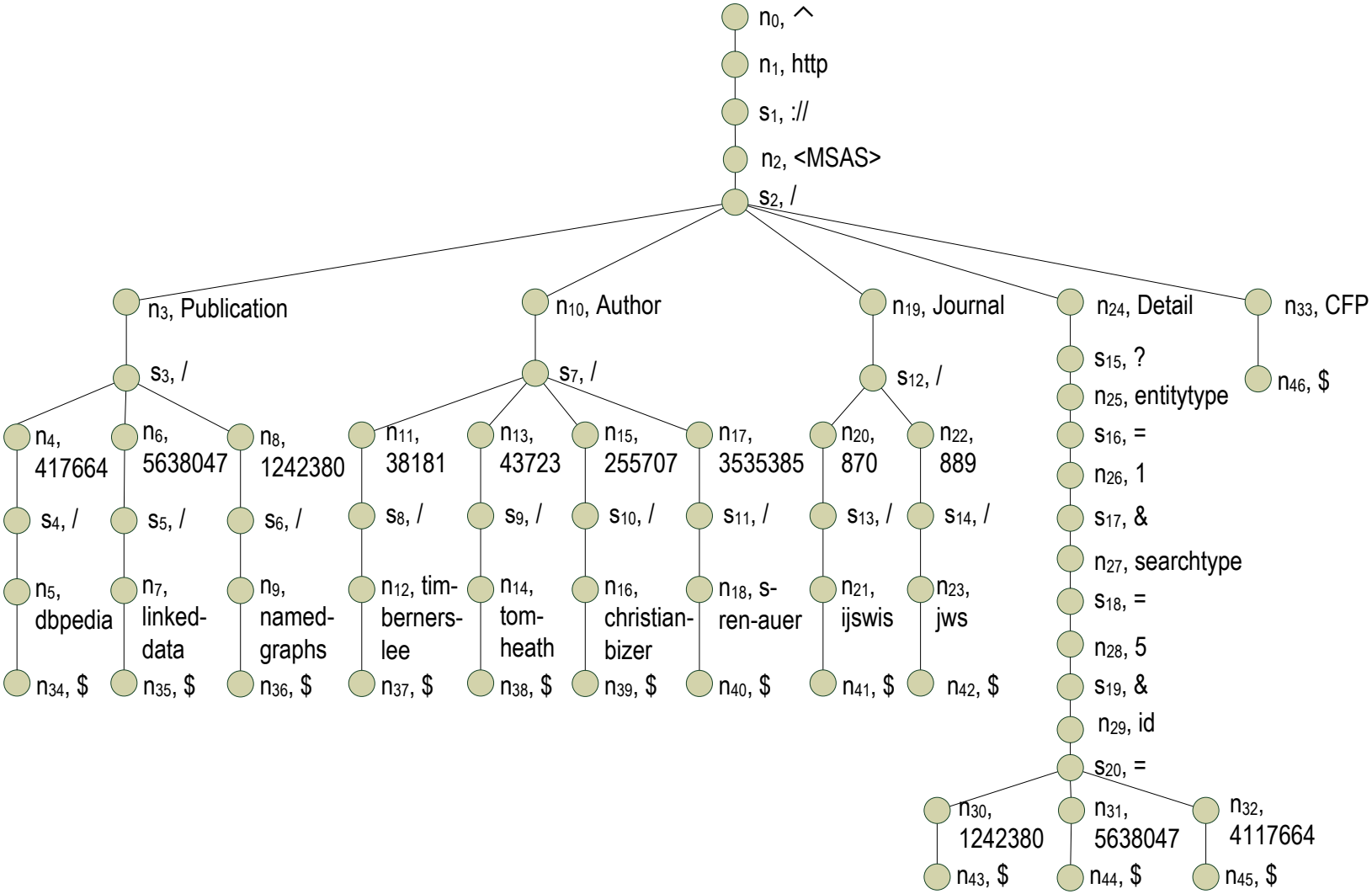
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n31, 5638047
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n43, $
n44, $
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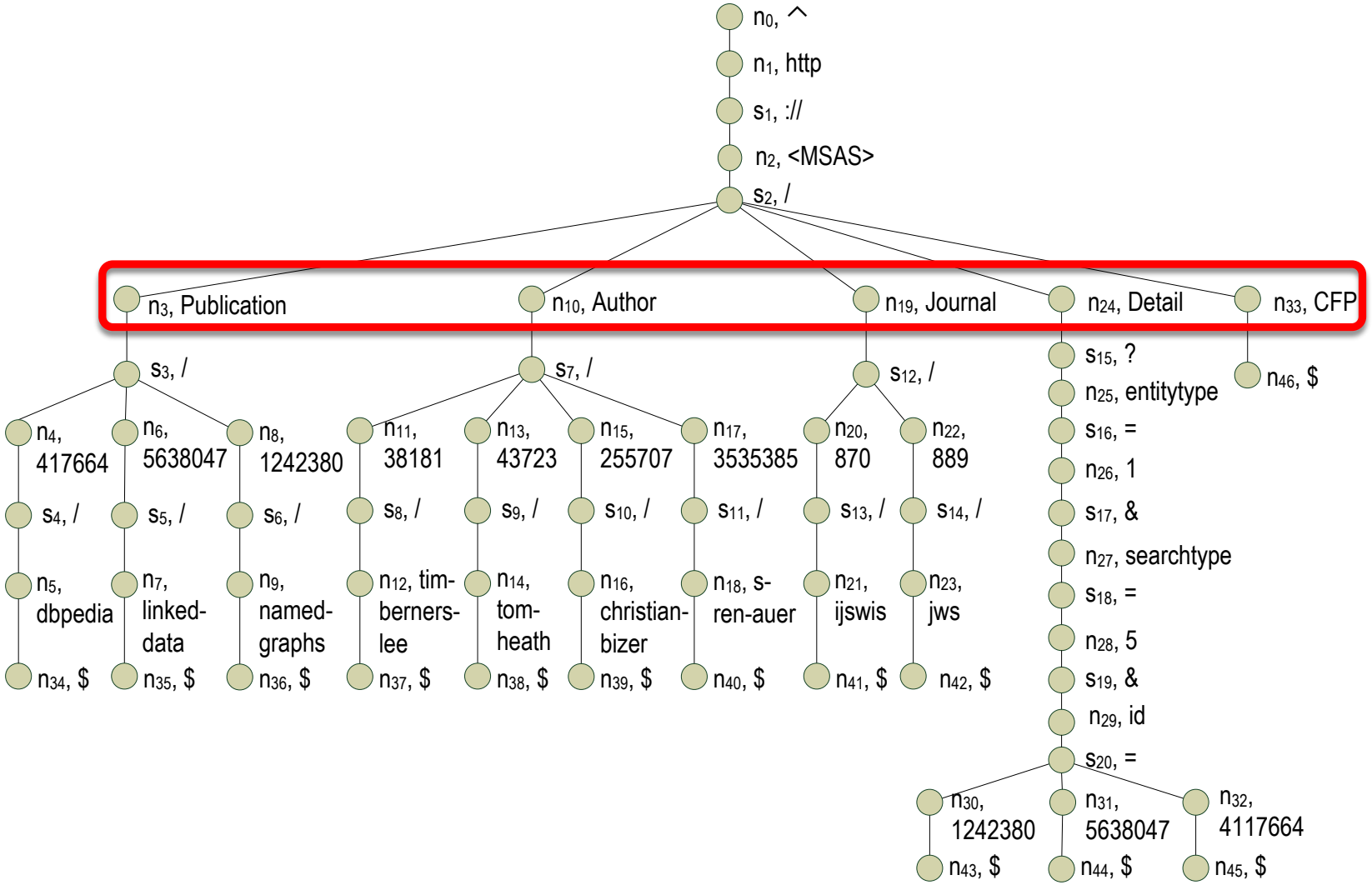
Example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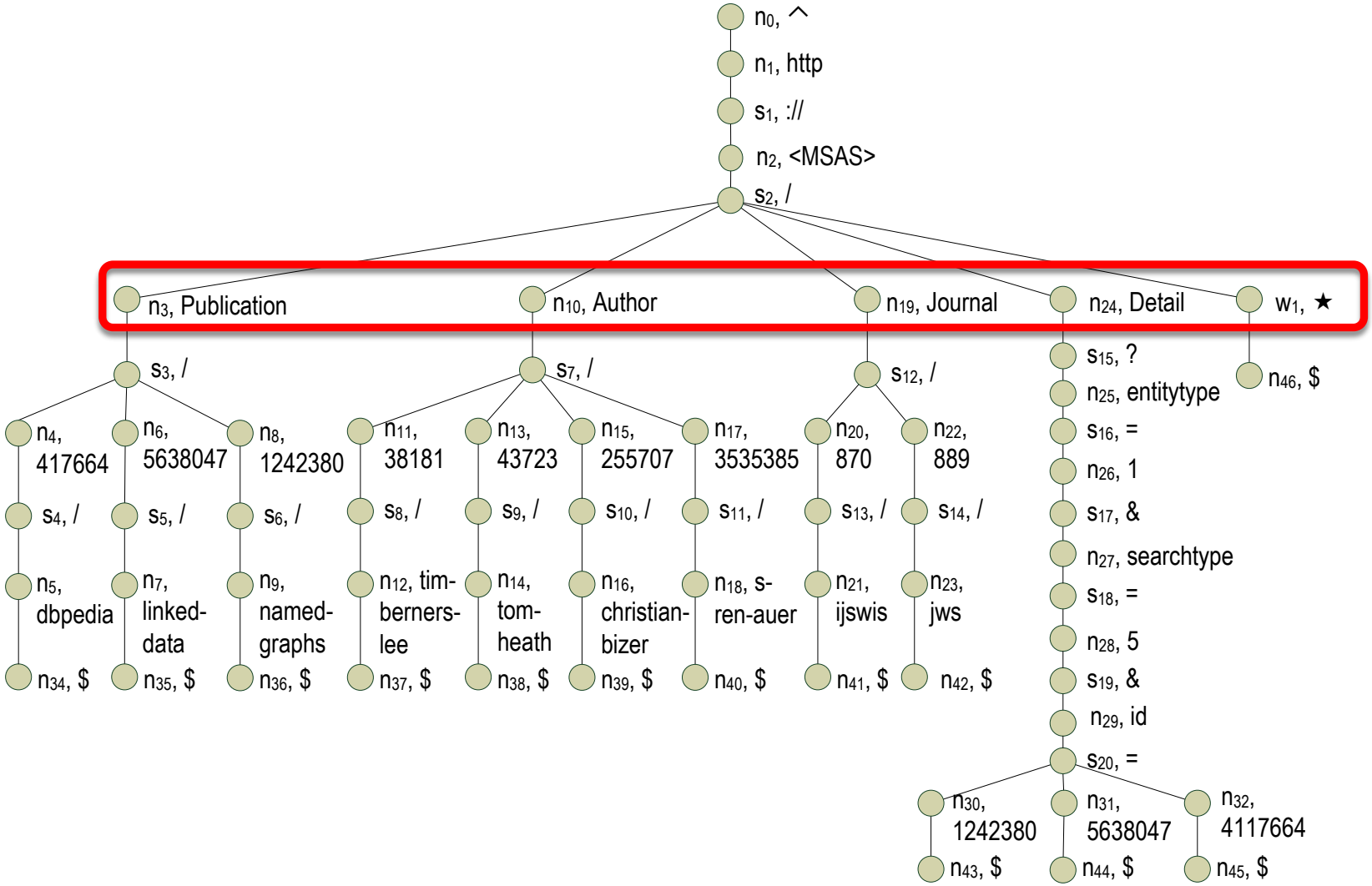
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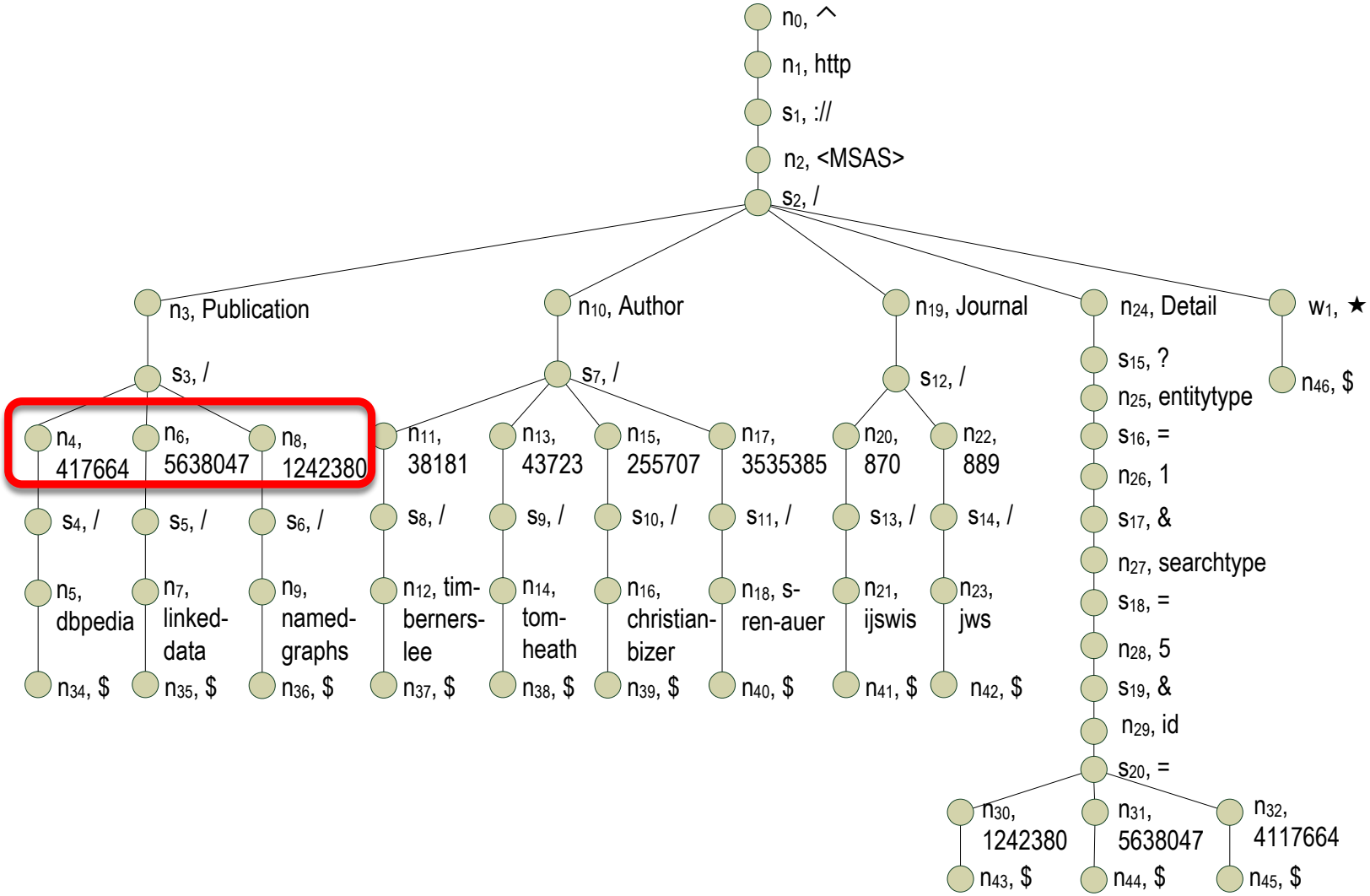
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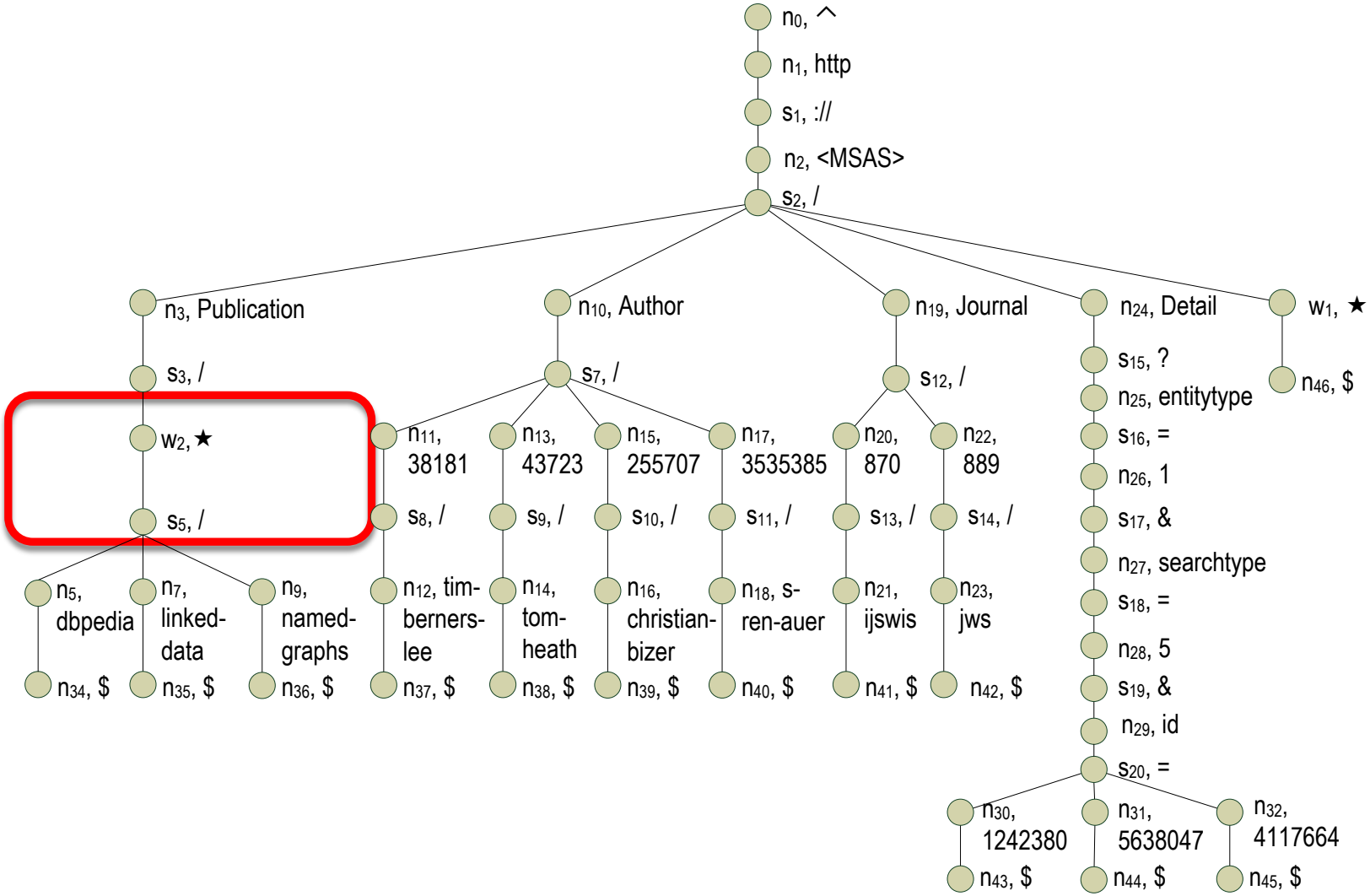
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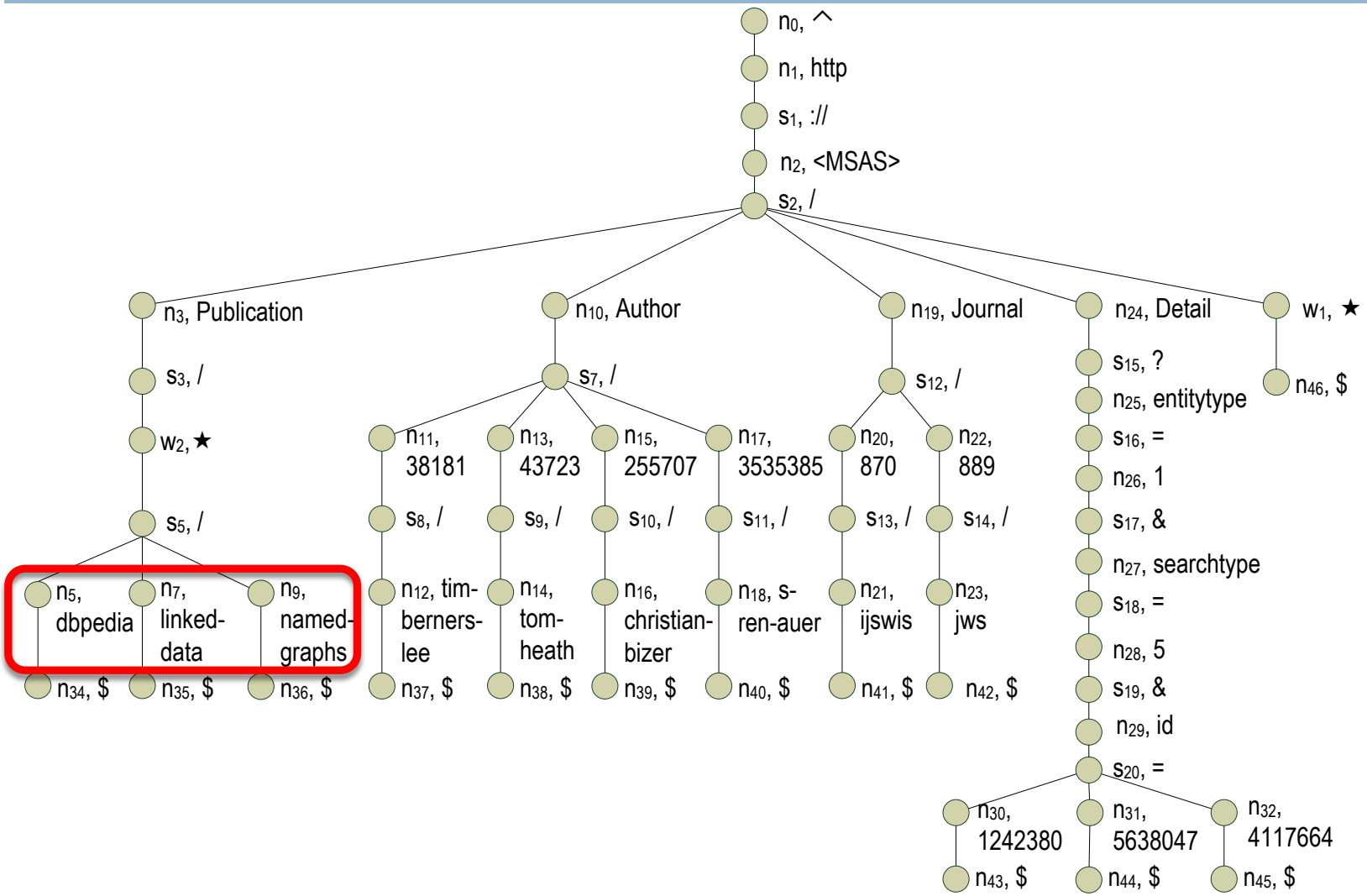
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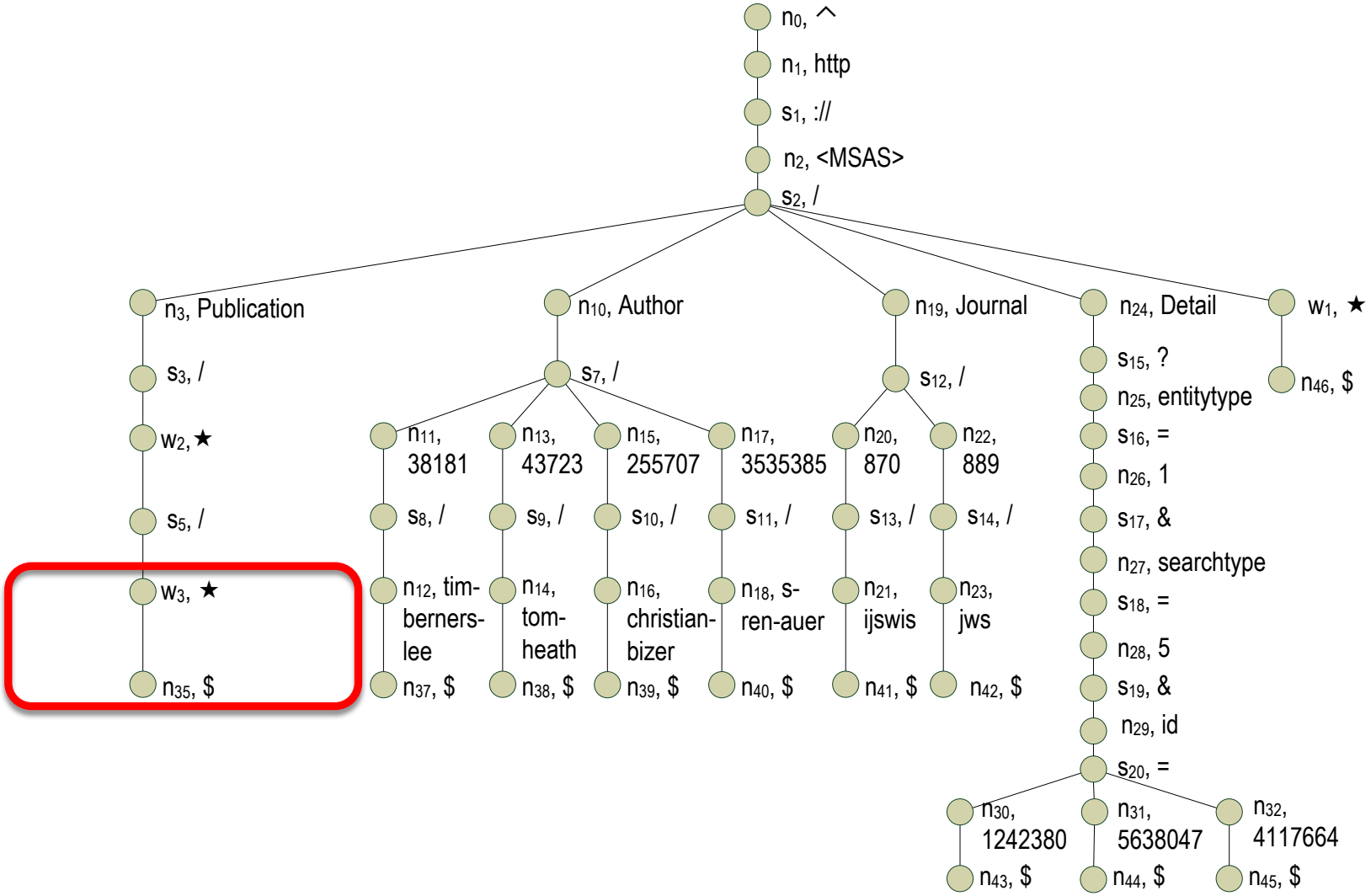
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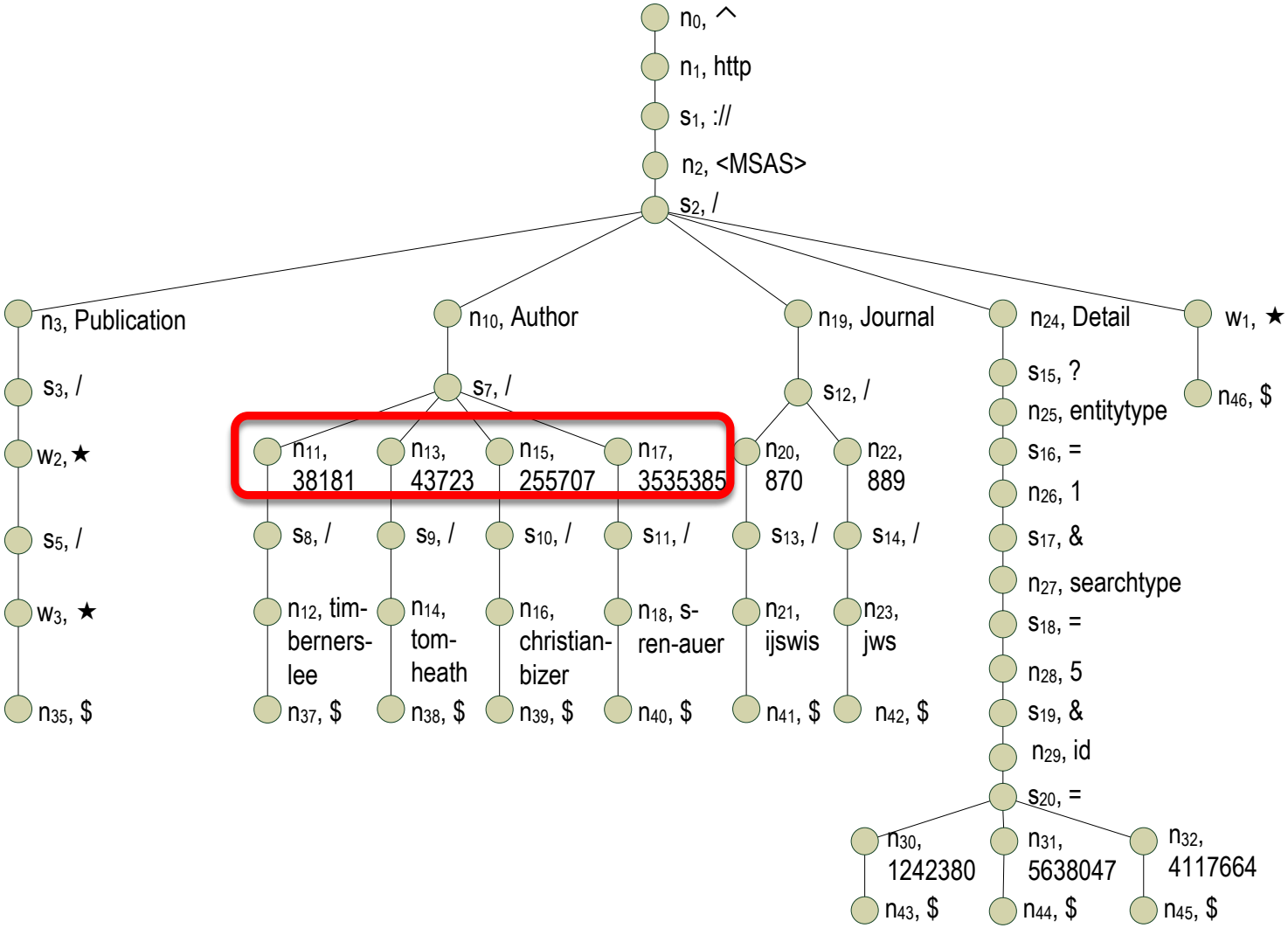
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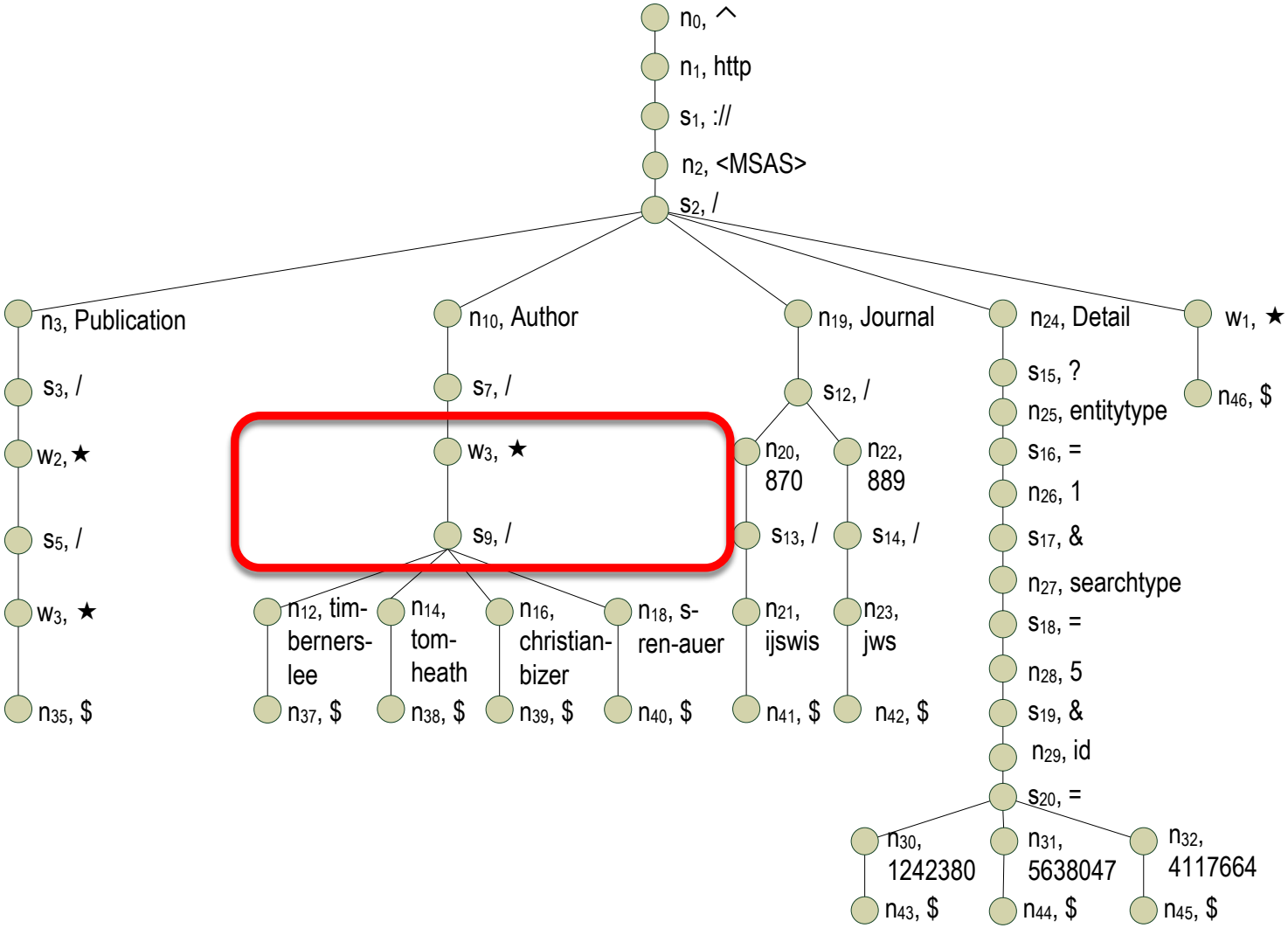
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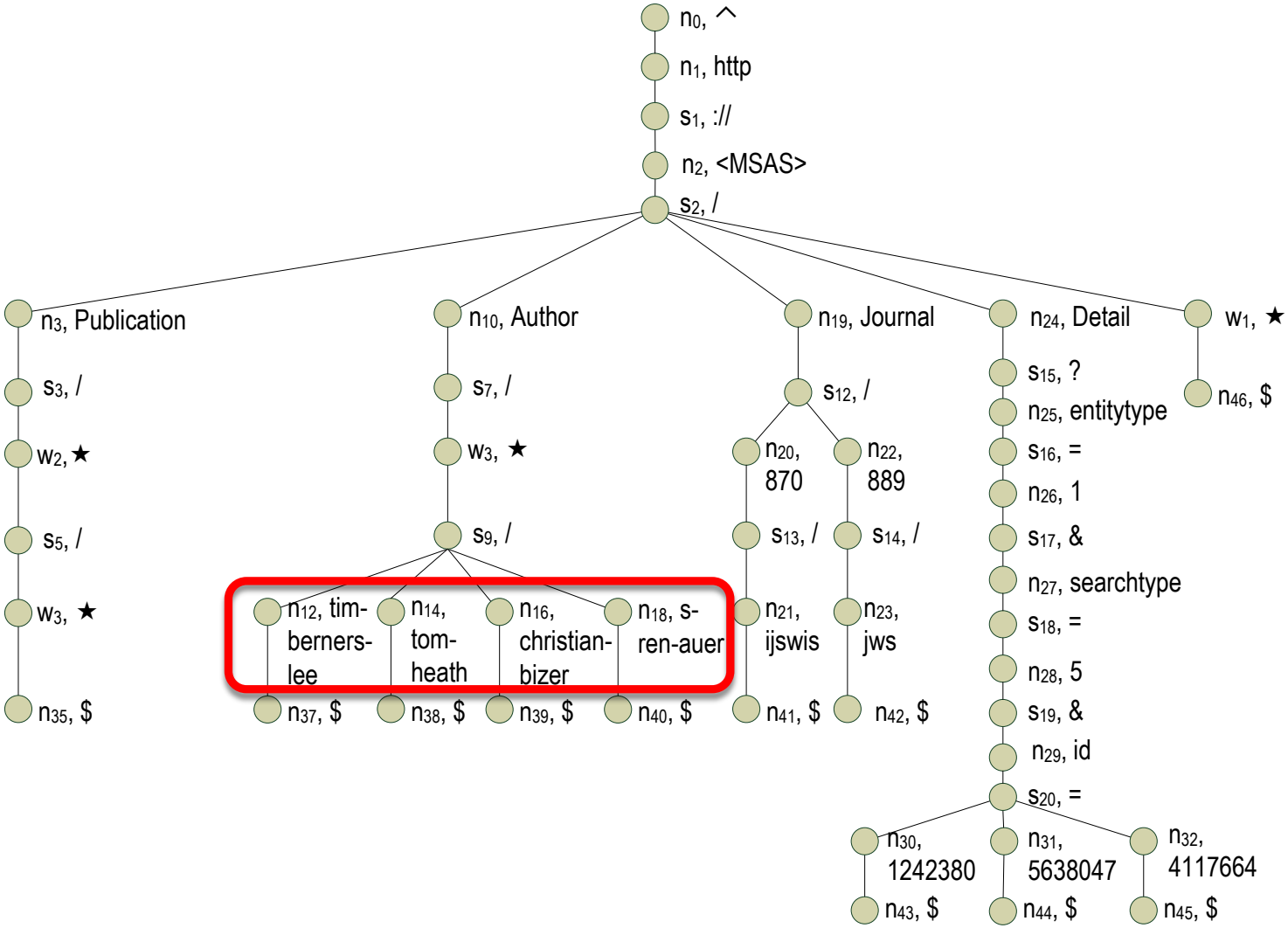
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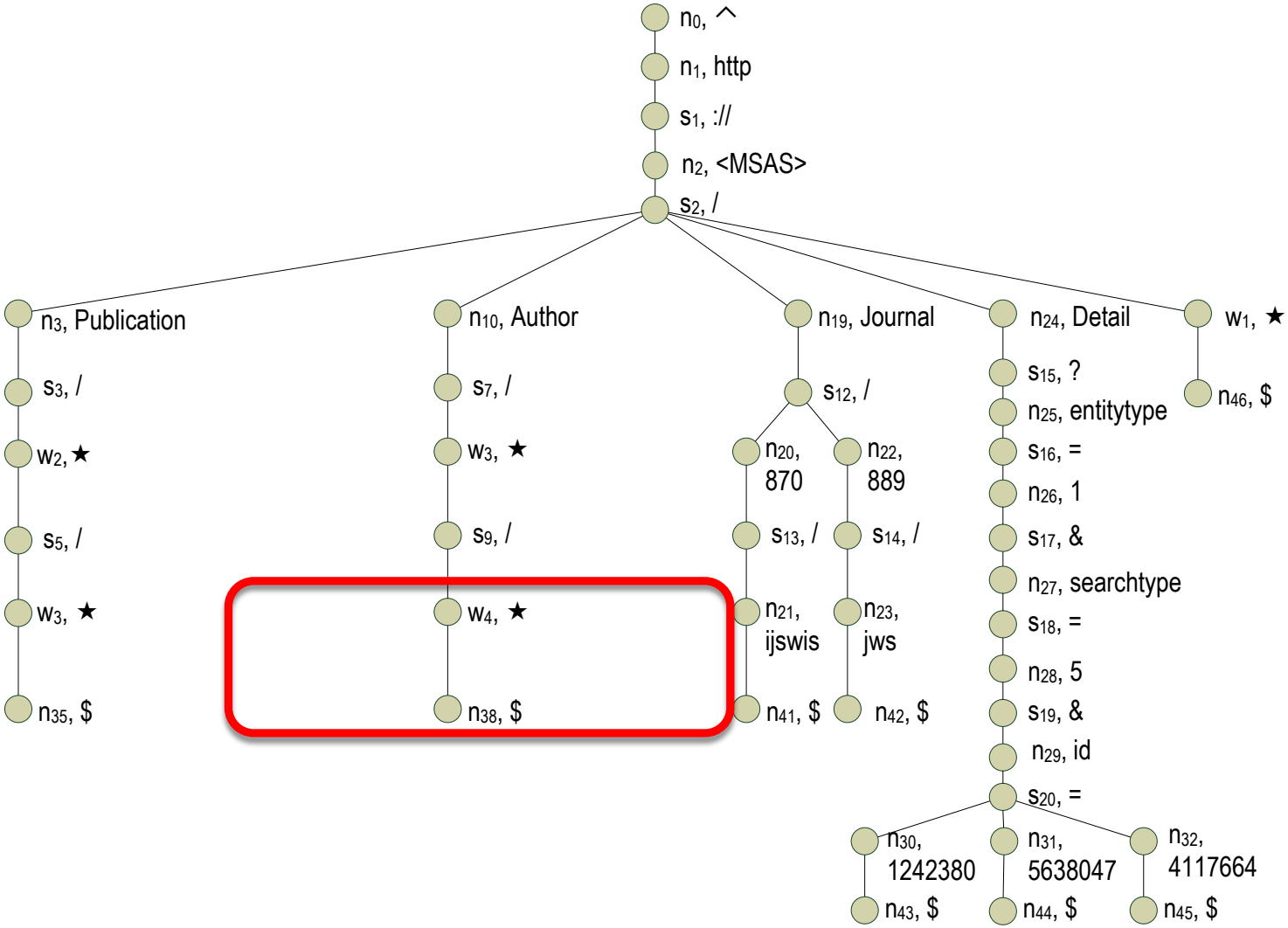
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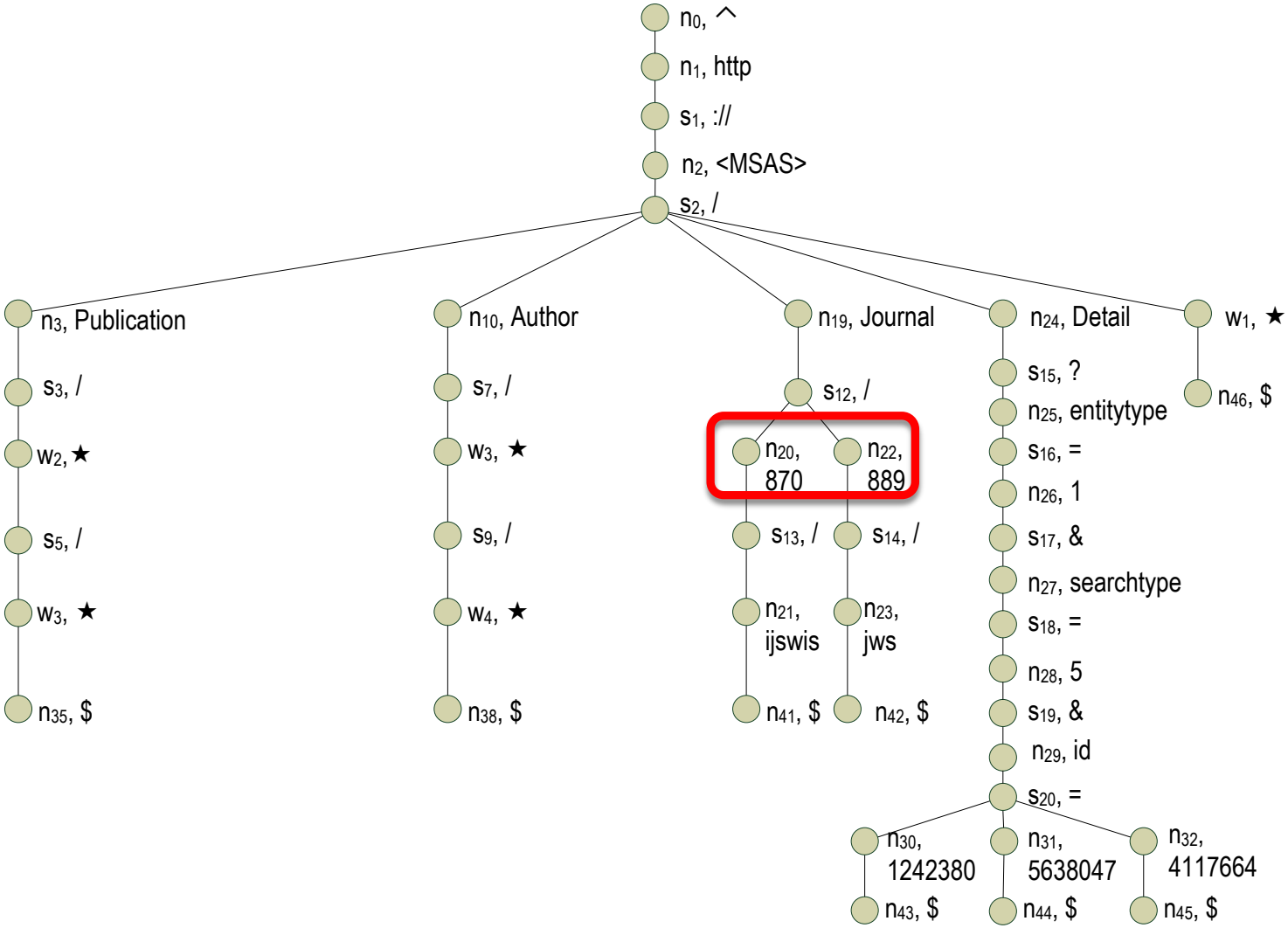
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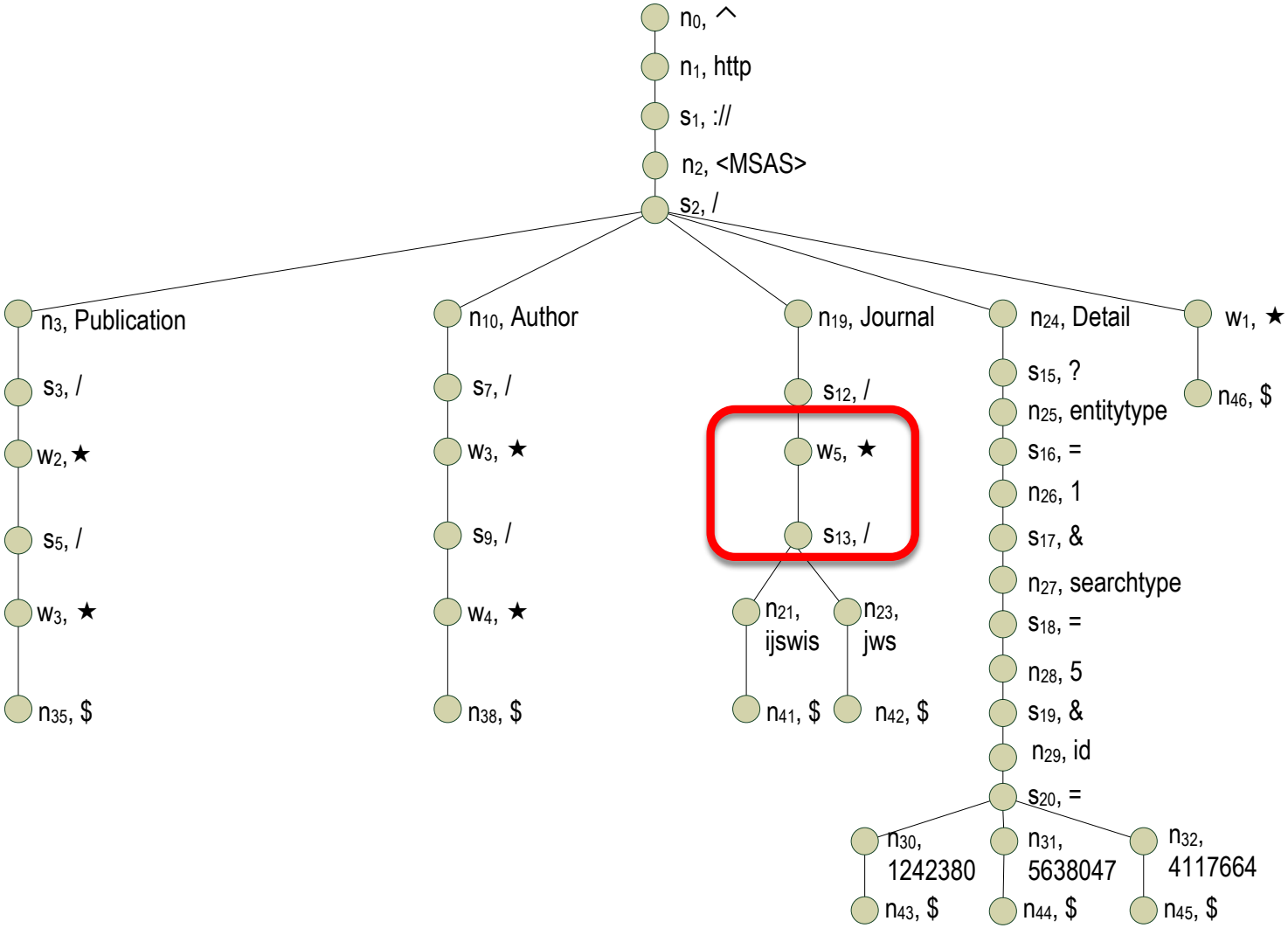
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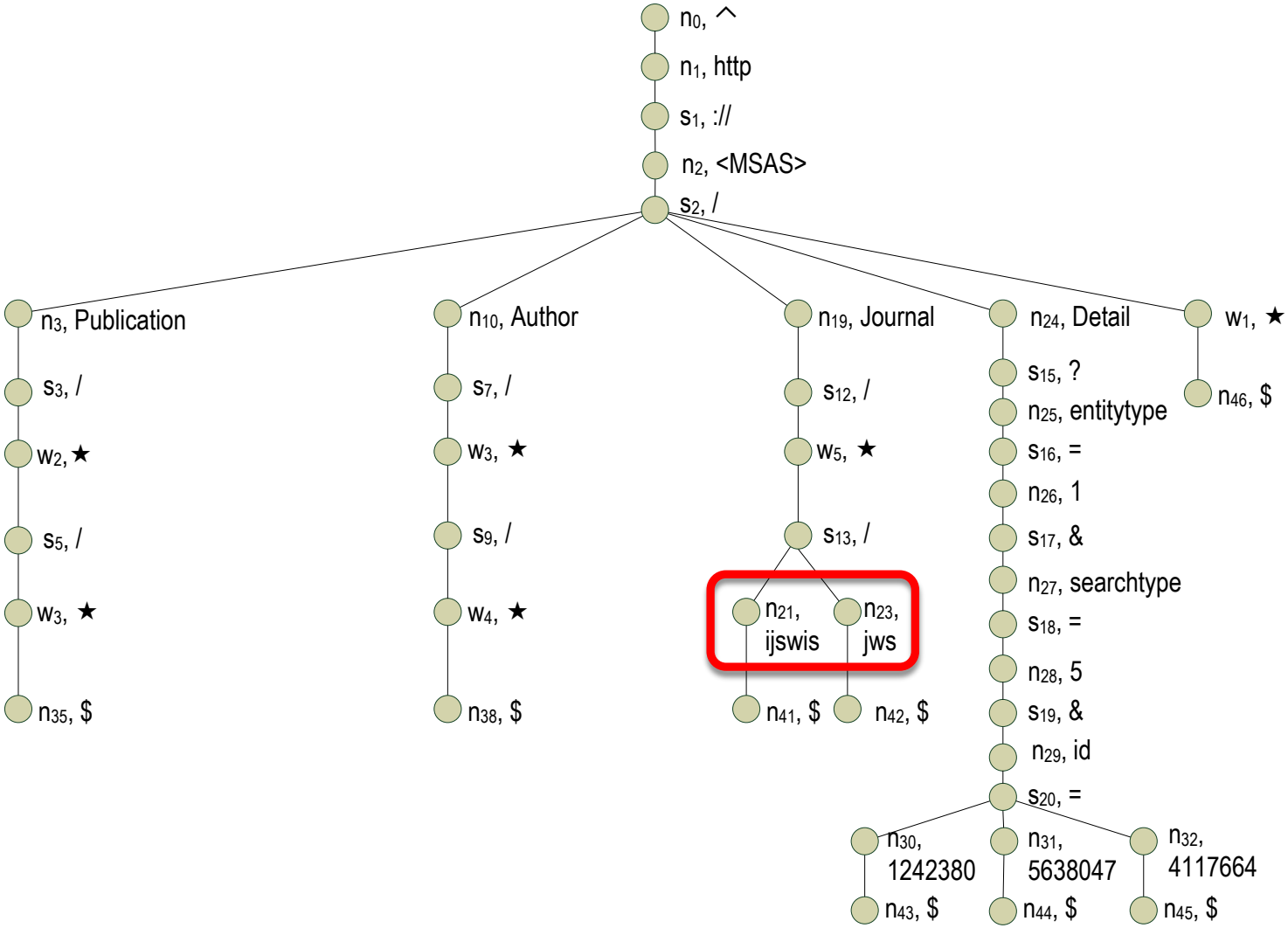
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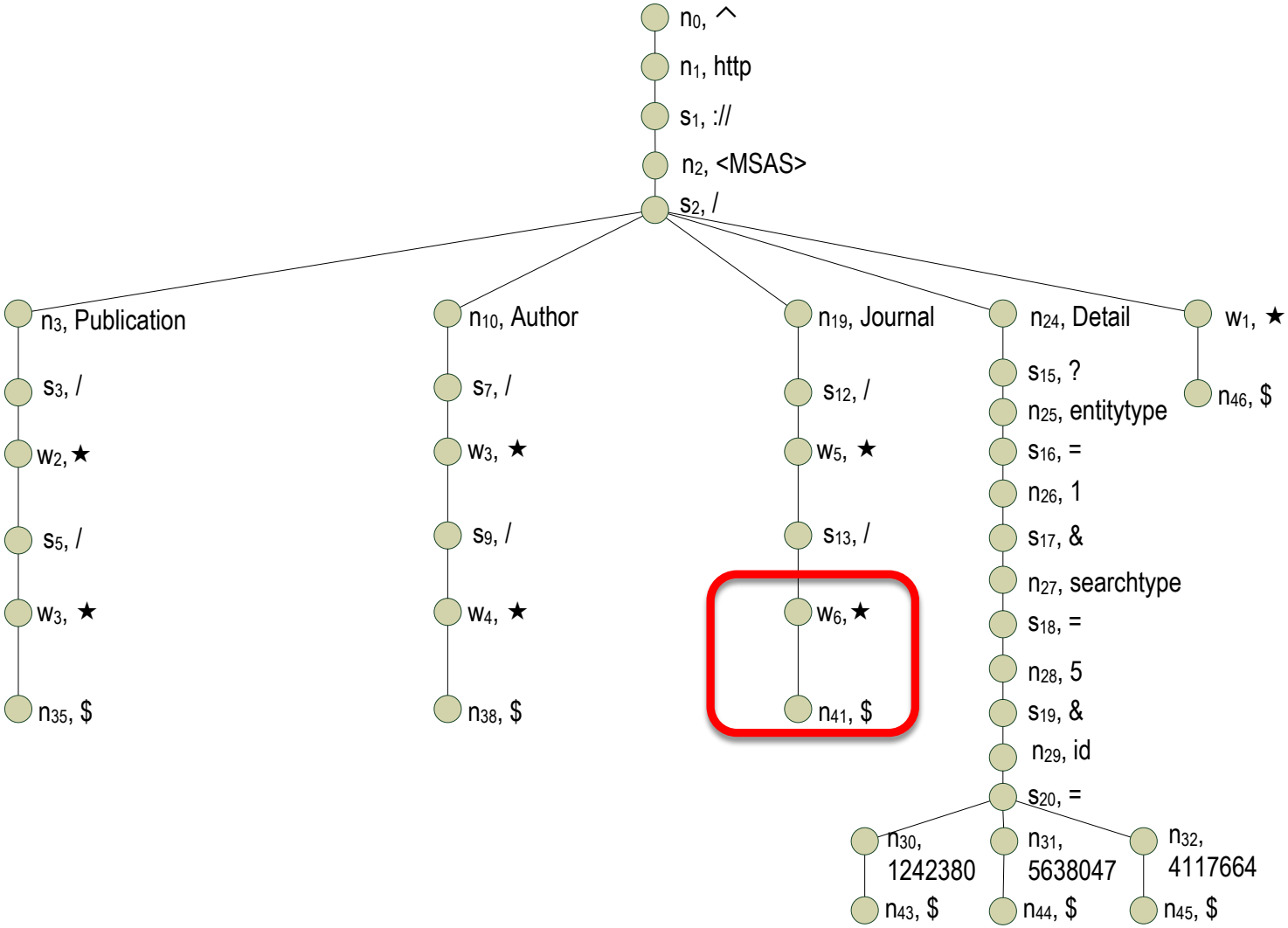
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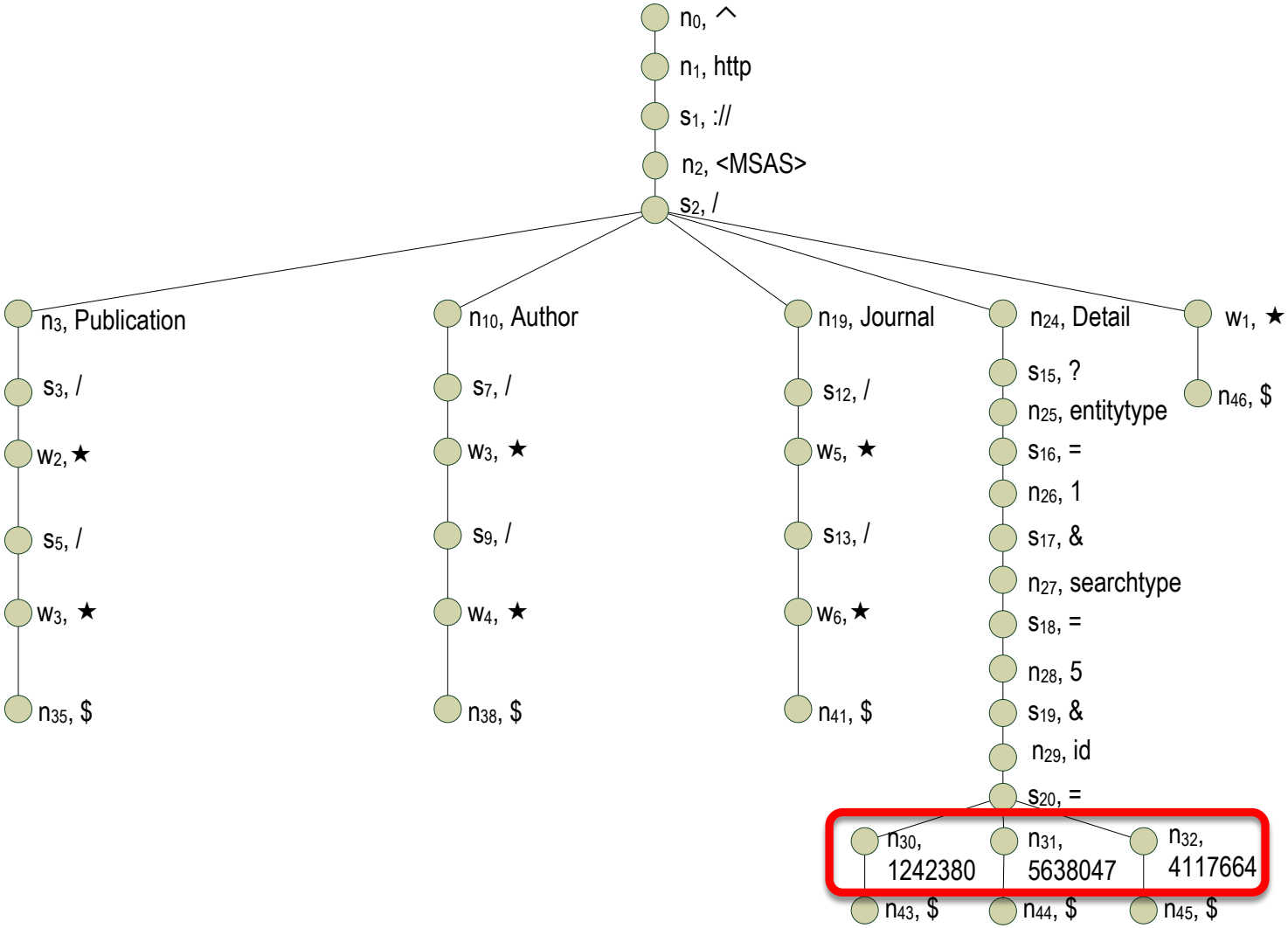
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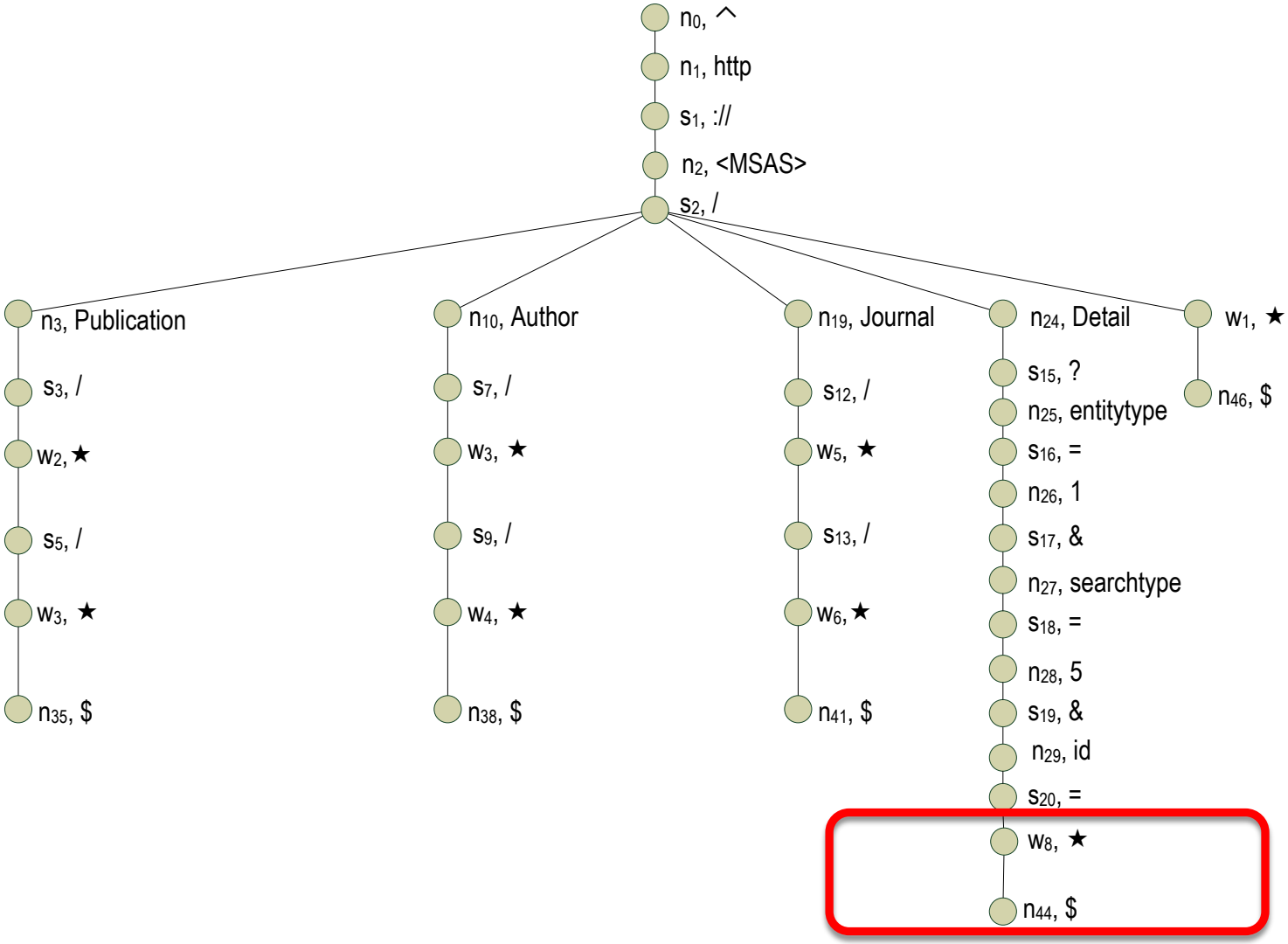
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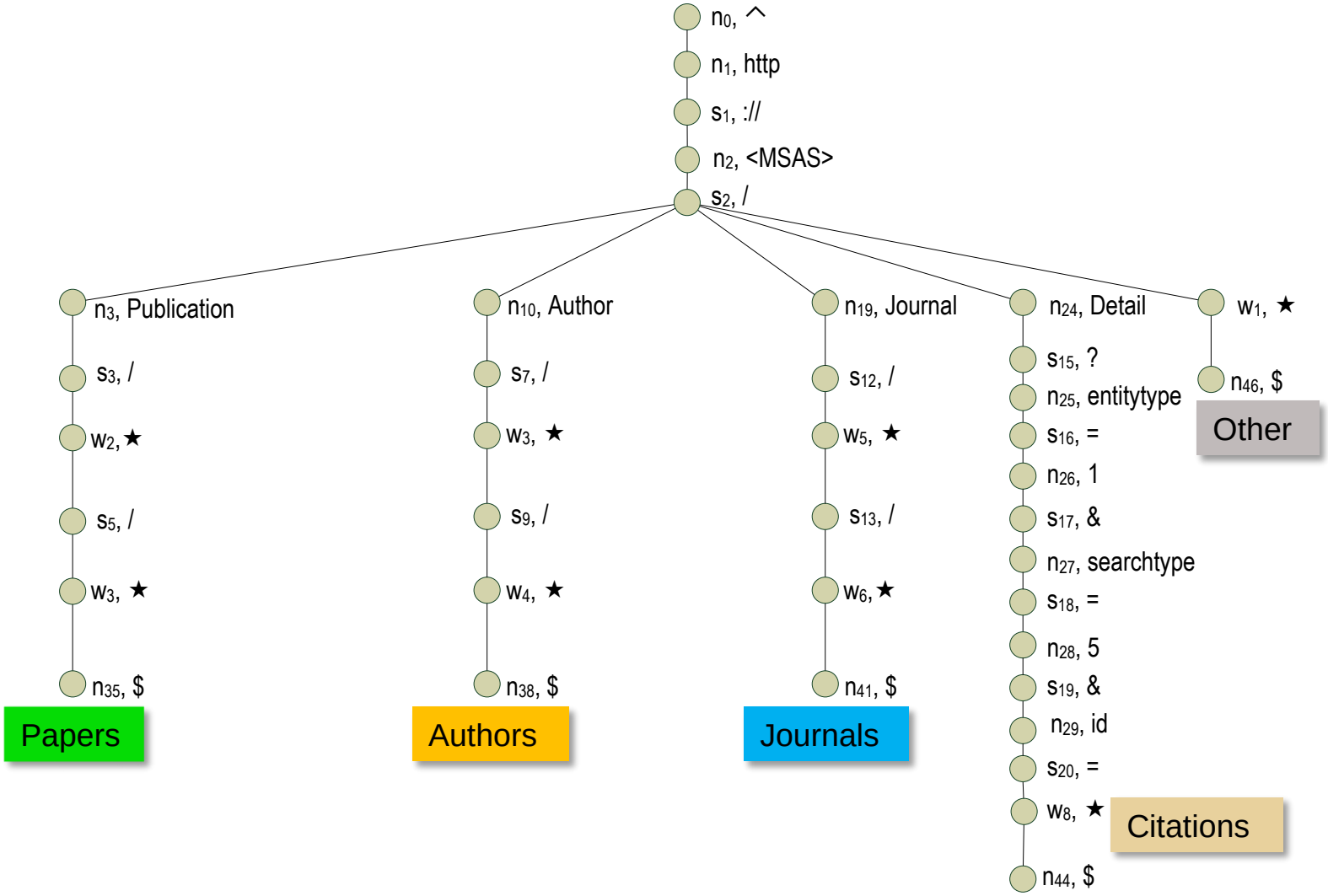
Example


n0, ^
n1, http
s1, ://
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s2, /
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w2, ★
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w6, ★
n41, $
Journals
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s15, ?
n25, entitytype
s16, =
n26, 1
s17, &
n27, searchtype
s18, =
n28, 5
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Citations
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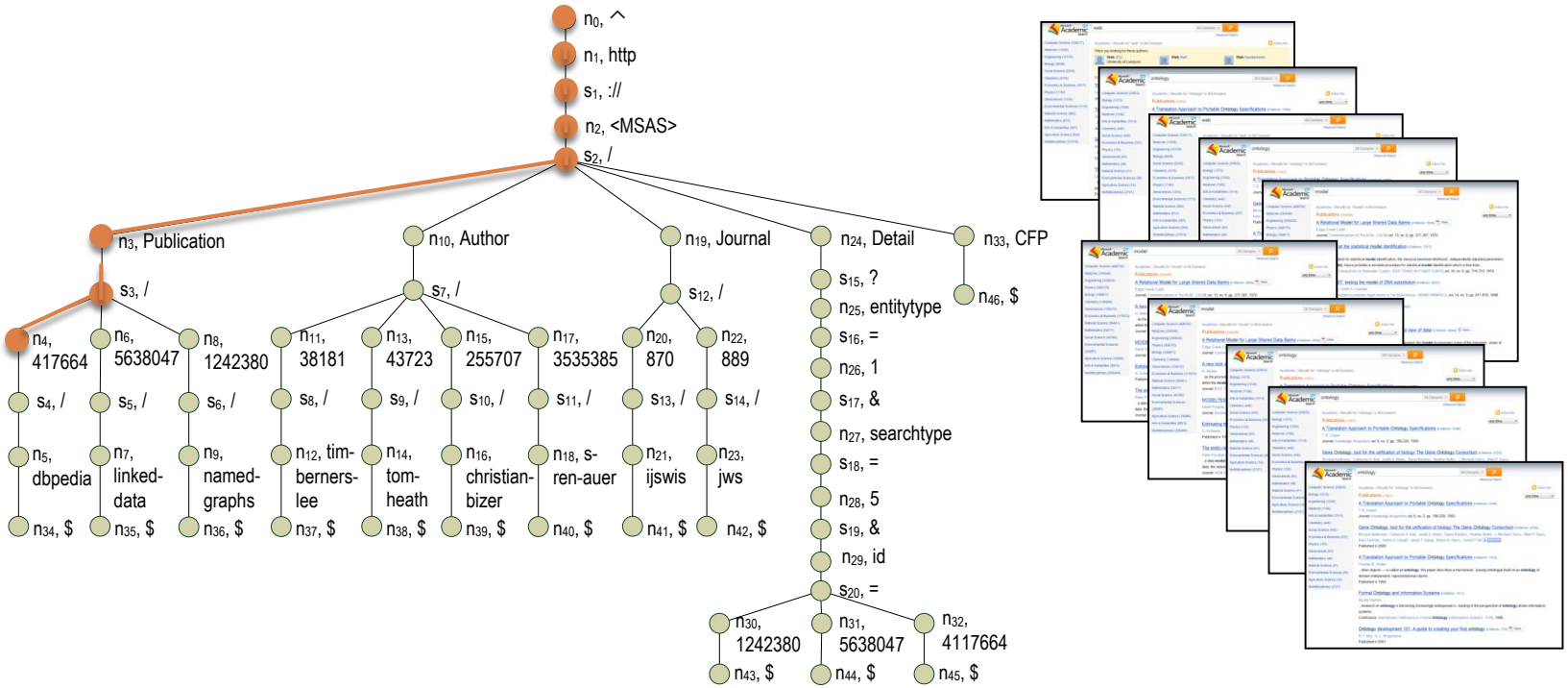
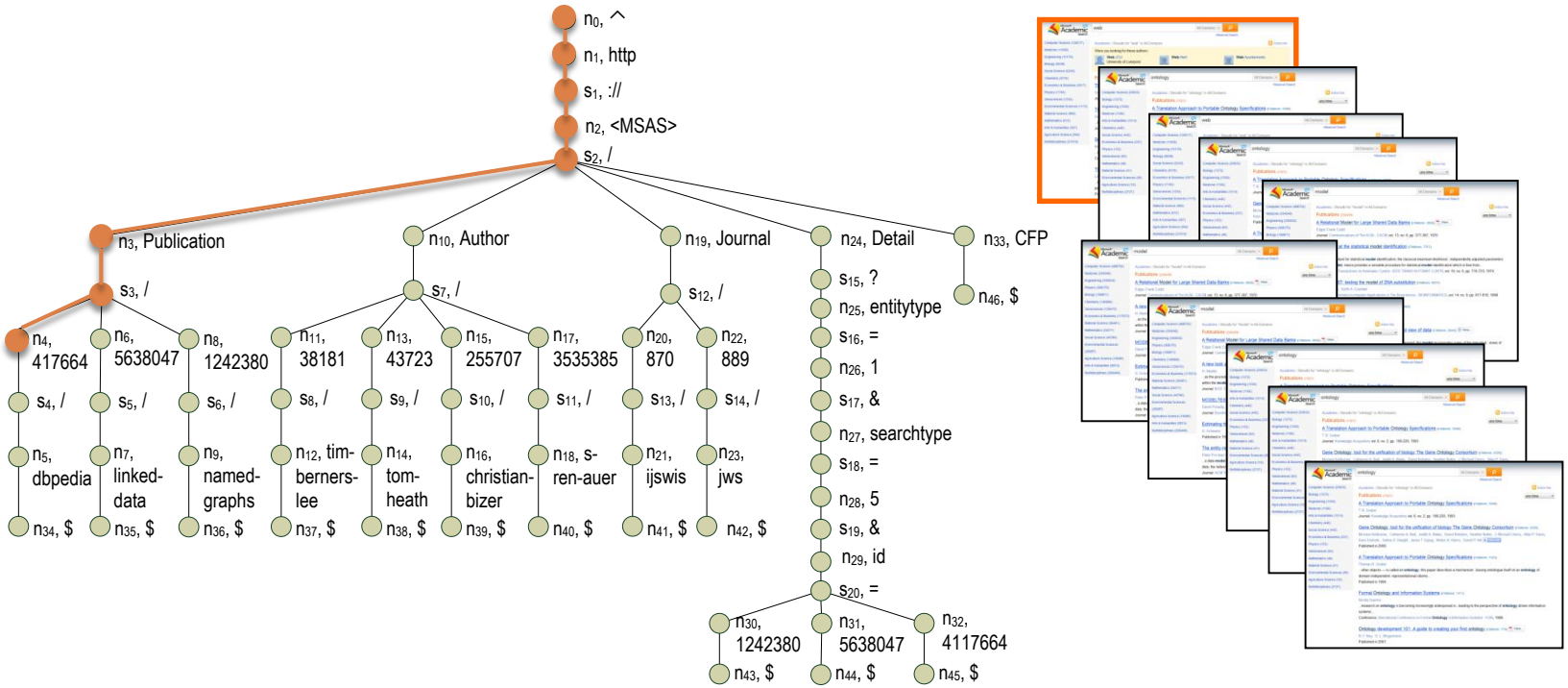
Other

P-estimators



http://<MSAS>/Publication/417664

P-estimators



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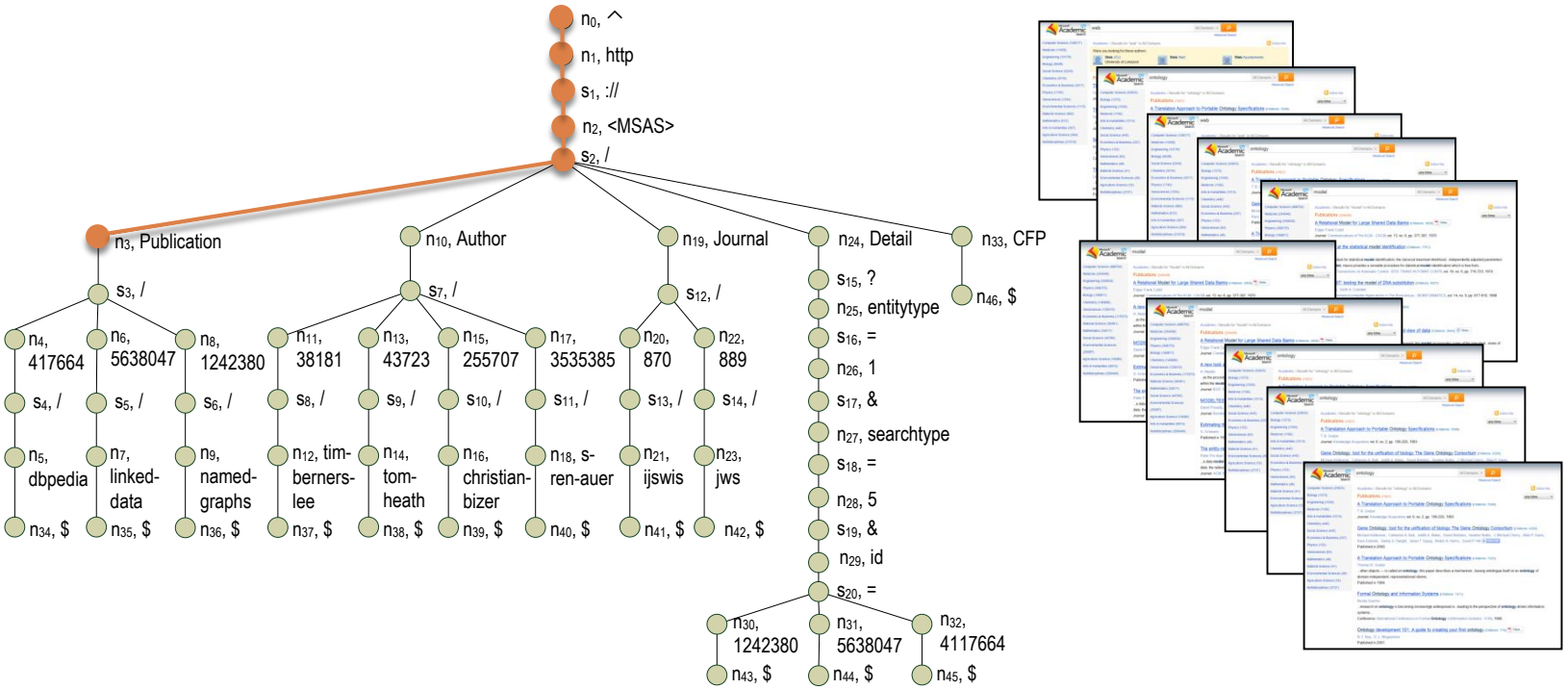
P-estimator = 1/10 = 0.1

P-estimators



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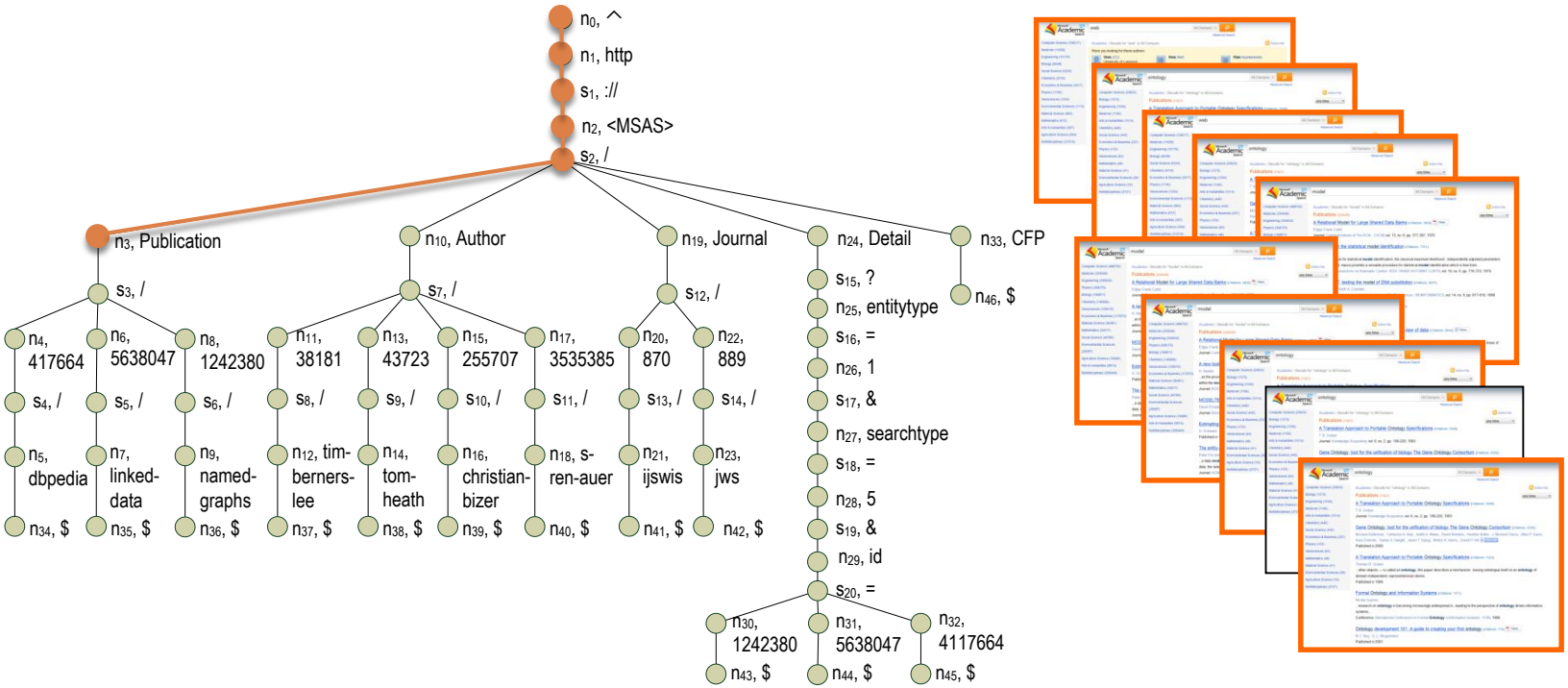
P-estimators



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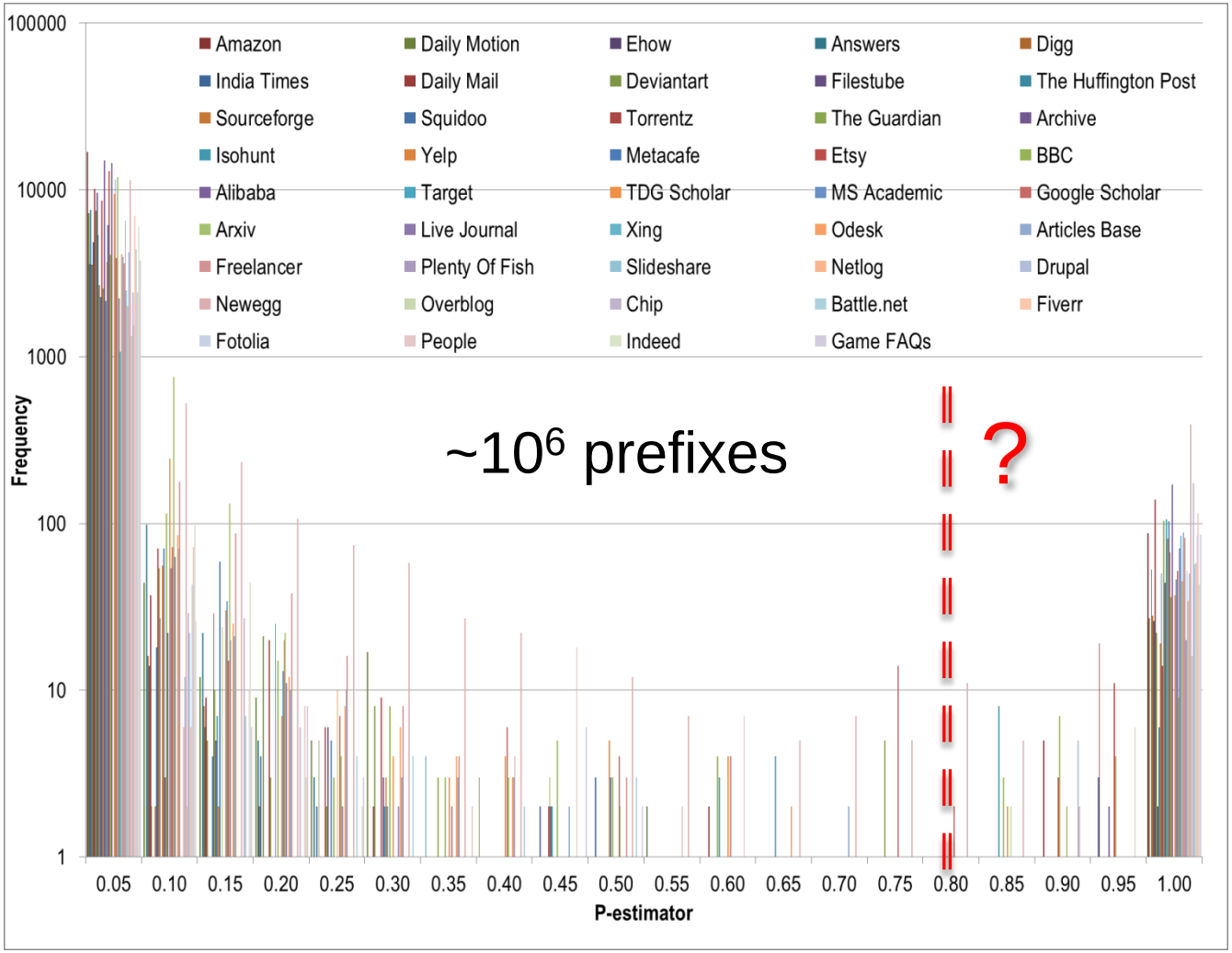
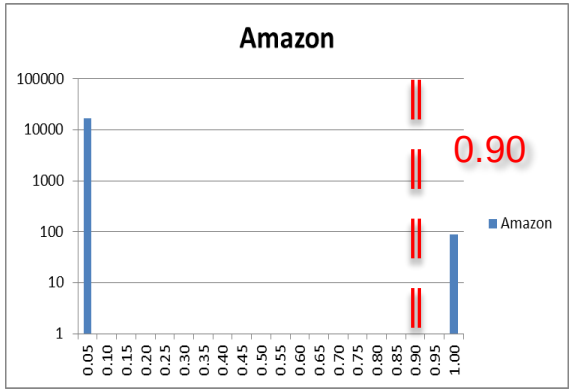
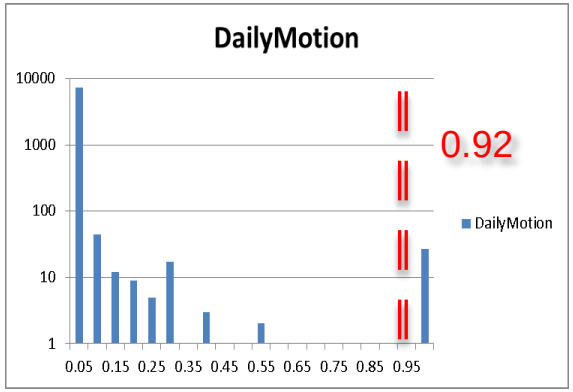
P-estimator = 9/10 = 0.9

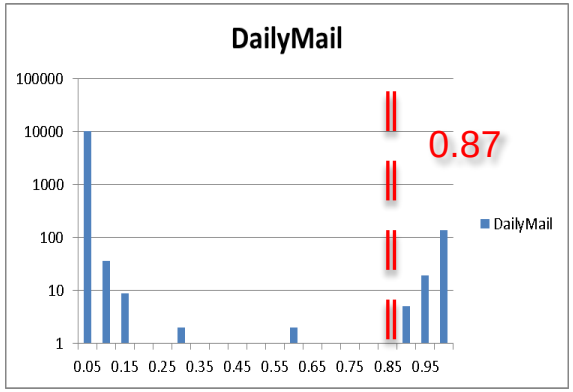
P-estimators distribution

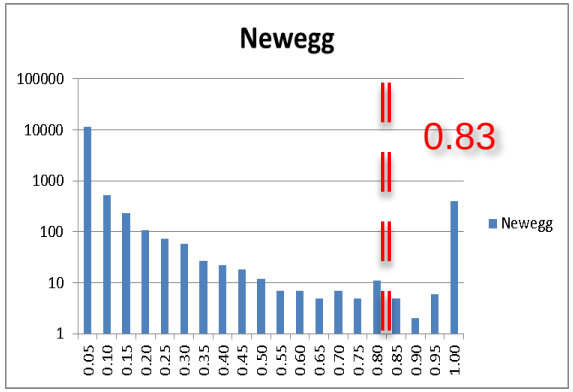


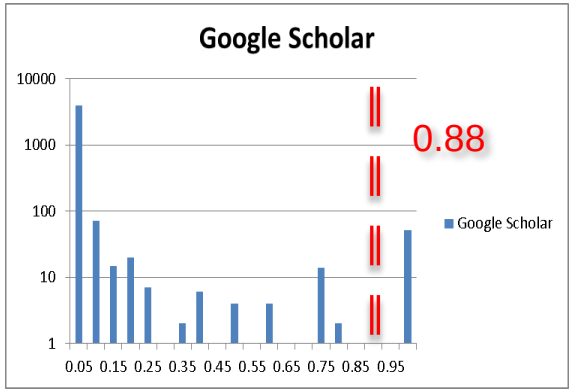
Wildcarding threshold

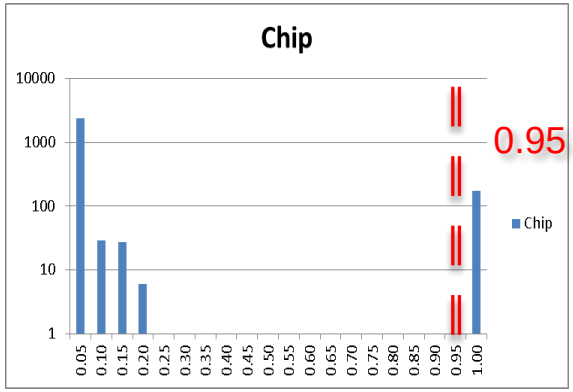












ROADMAP

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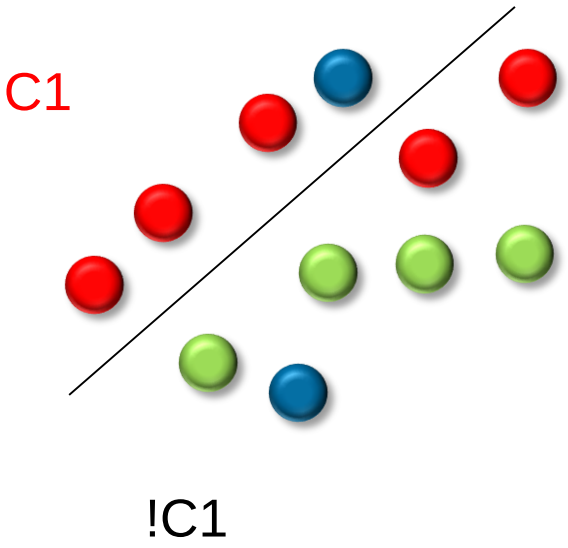
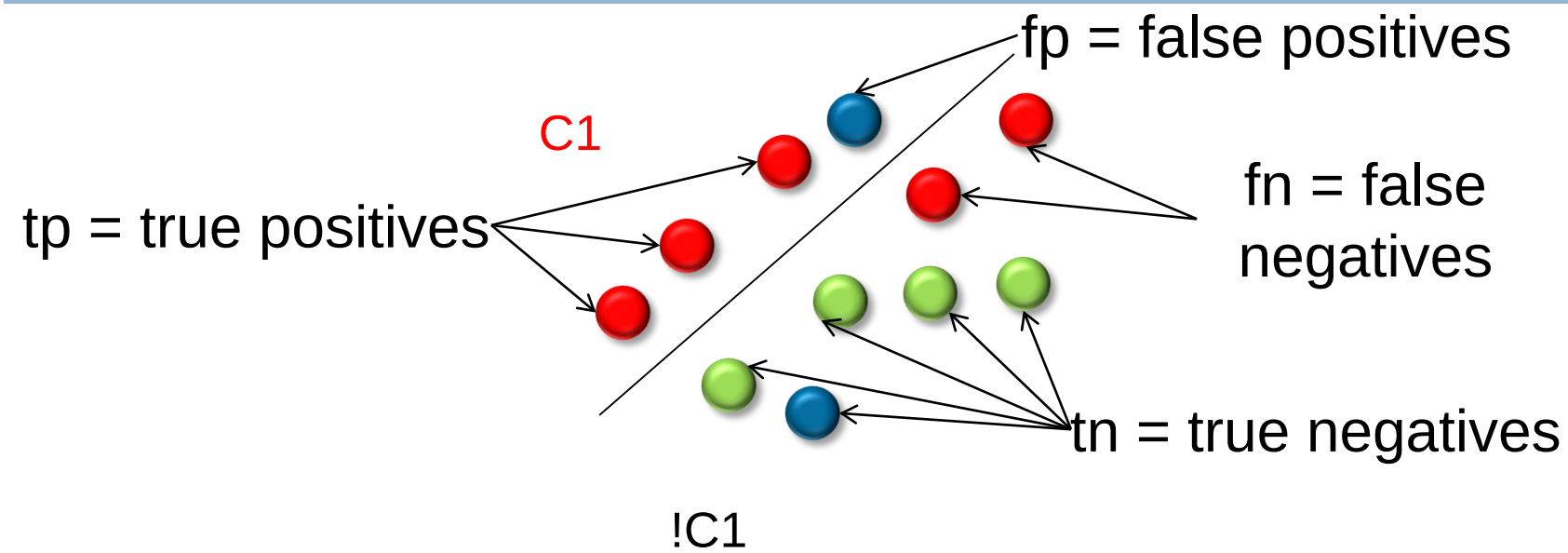
Evaluation Measures

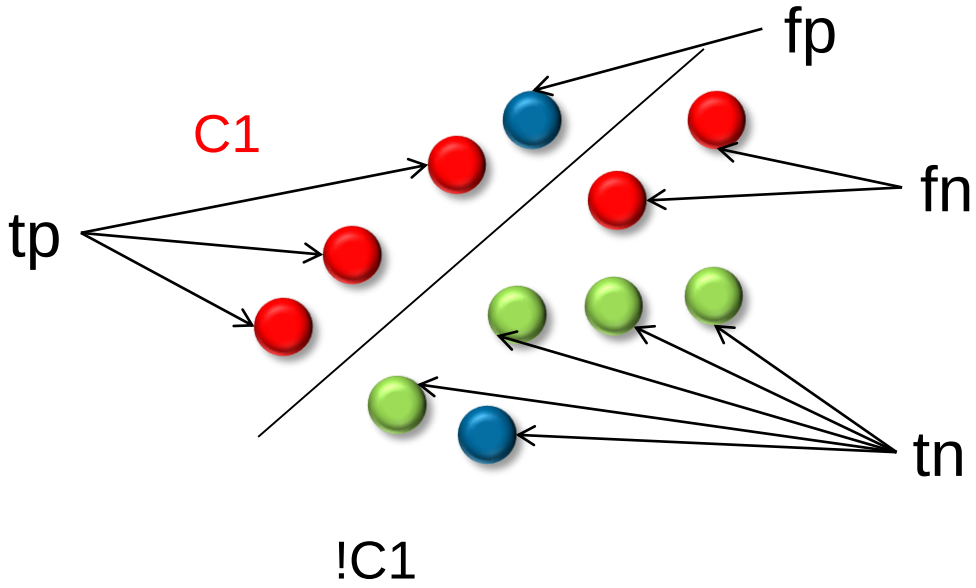


Precision



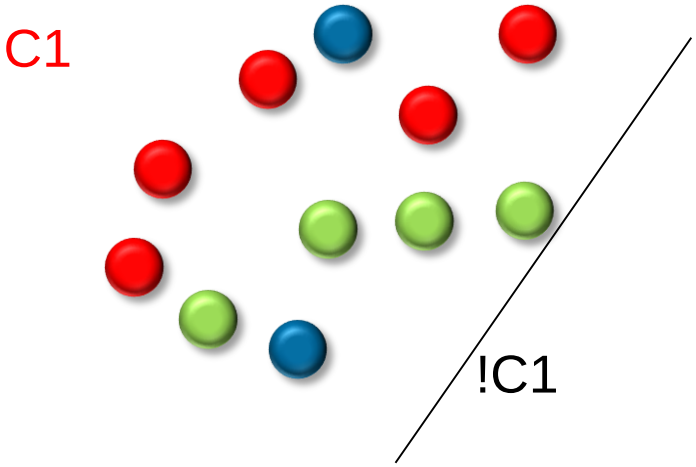
$$Precision = \frac{tp}{tp+fp} = \frac{3}{4} = 0.75$$

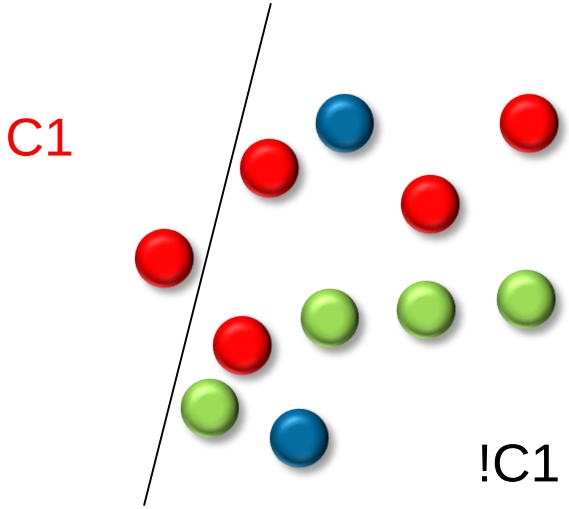
Recall



$$Recall = \frac{tp}{tp+fn} = \frac{3}{5} = 0.60$$

Precision / Recall trade-off

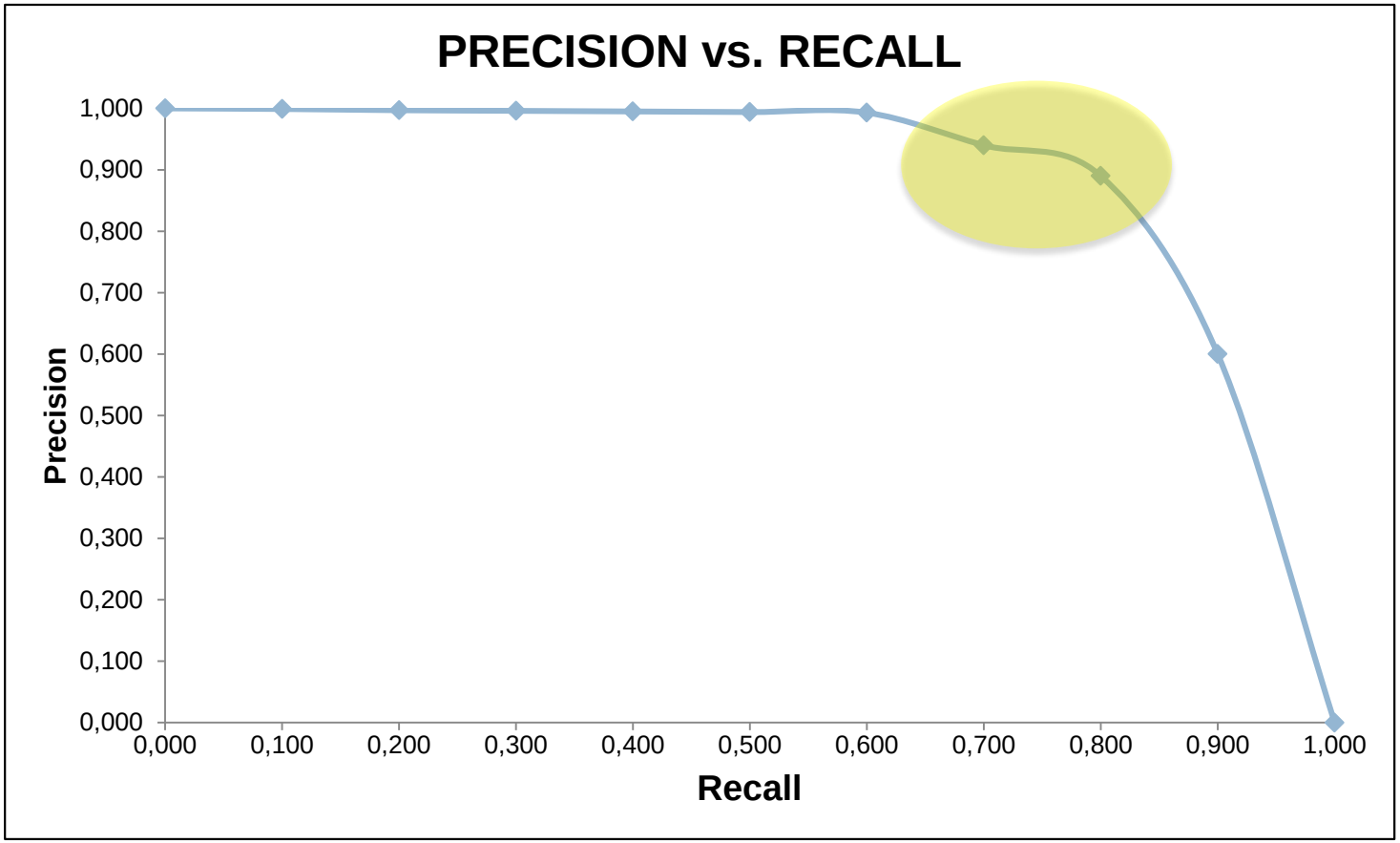




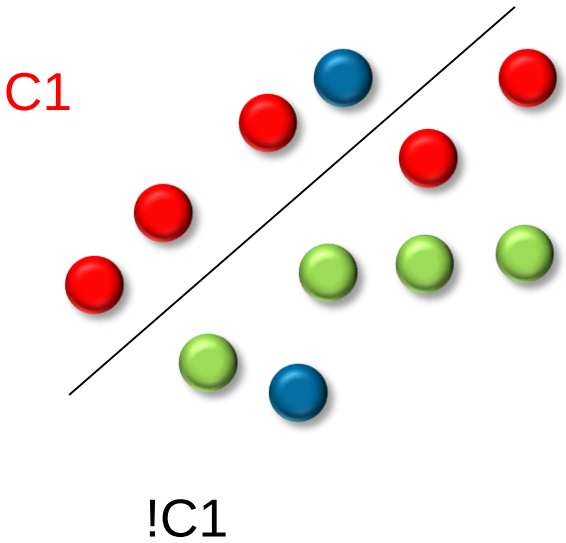
Precision = 0.45, Recall = 1.00

Precision = 1.00, Recall = 0.20

Precision / Recall optimisation

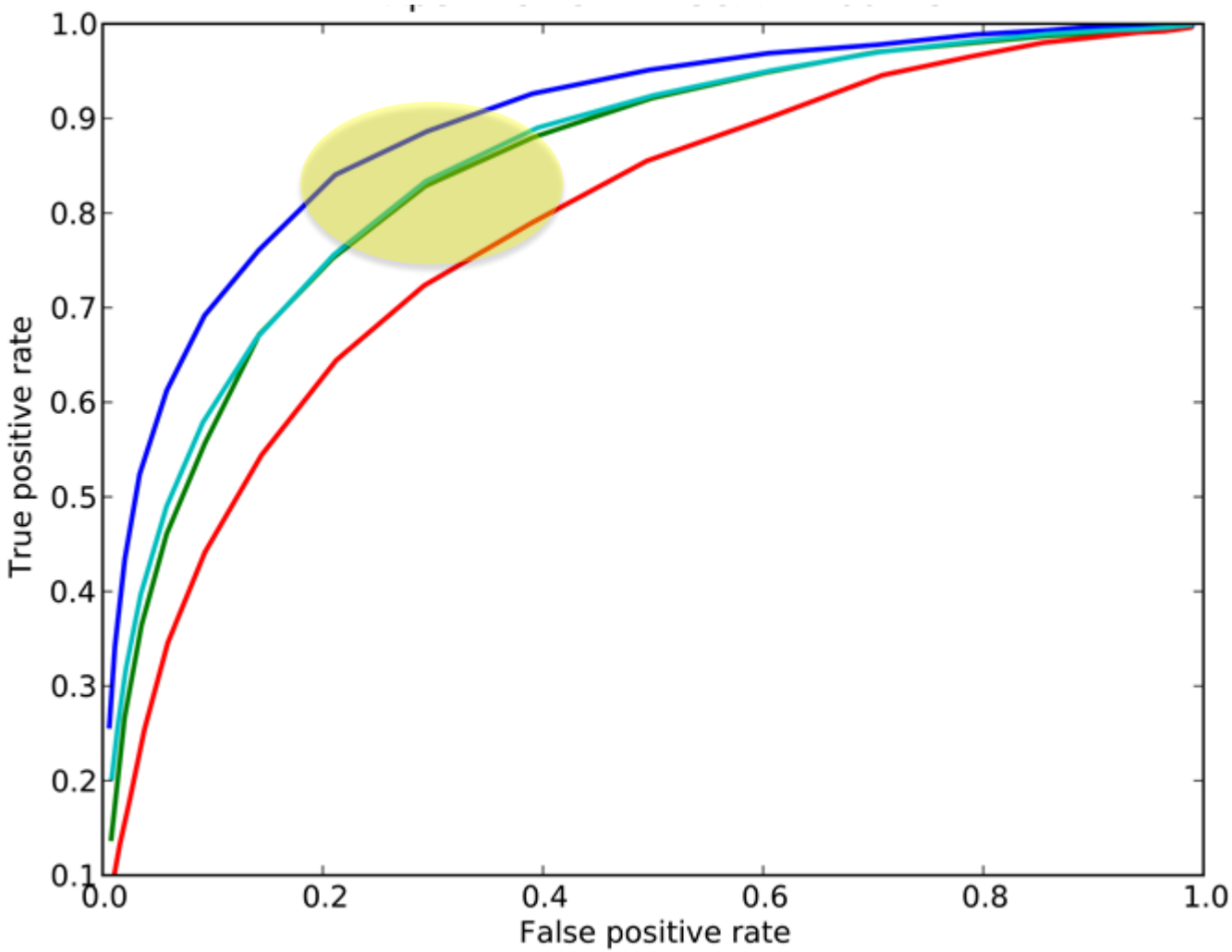


F1-measure



$$F1 = 2 * \frac{precision \ * recall}{precision + recall} = 2 * \frac{0.75 * 0.60}{0.75 + 0.60} = 0.67$$

ROC Curve


1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
True positive rate
0.0
0.2
0.4
0.6
0.8
1.0
False positive rate

Other measures

$$Sensitivity = \frac{tp}{tp + fn}$$

$$Specificity = \frac{tn}{tn + fp}$$

$$Accuracy = \frac{tp + tn}{tp + fp + fn + tn}$$

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Conclusions

- Wrappers in EII context need to distinguish between different classes of web pages
- Web page classifiers can be supervised or unsupervised
- Classifiers use a set of features from a training set of pages to create a classification model
- The main types of features used to classify web pages are: content-based, structural, link-based, visual and url-based
- The most usual measures to validate a classifier are precision, recall and F1
  - Precision: % of elements that are correct from those that are classified
  - Recall: % of elements that are classified from those that are correct

Bibliography

- S. Bhagat, G. Cormode, and I. ozenbaum. Applying link-based classification to label blogs. In WebKDD/SNA-KDD, pages 97–117, 2007.
- L. Blanco, V. Crescenzi, and P. Merialdo. Structure and semantics of data-intensive web pages: An experimental study on their relationships. J. UCS, 14(11):1877–1892, 2008.
- A. Selamat and S. Omatu. Web page feature selection and classification using neural networks. Inf. Sci., 158:69–88, 2004.
- M. Kovacevic, M. Diligenti, M. Gori, and V. M. Milutinovic. Recognition of common areas in a web page using visual information: a possible application in a page classification. In IEEE International Conference on Data Mining, pages 250–257, 2002.
- I. Hernández, C. R. Rivero, D. Ruiz, and R. Corchuelo. CALA: An Unsupervised URL-Based Web Page Classification System. Knowledge-Based Systems (To be published), 2013.

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Thanks!

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