Entity Linking

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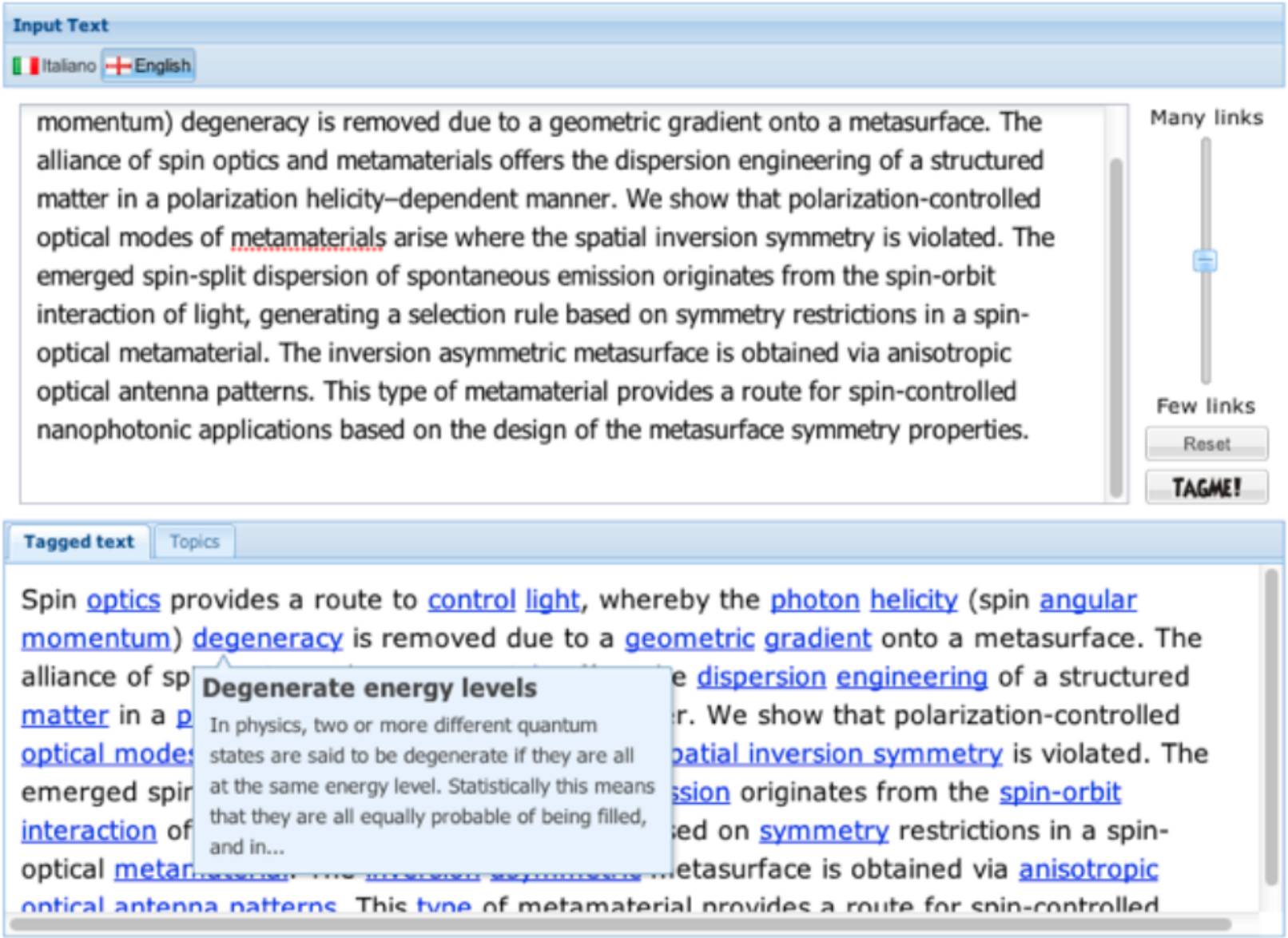
What is Entity Linking?



What is Entity Linking?

Iranian POW negotiator holds talks with Iraqi ministers

The head of **Iran**'s **prisoner of war** commission met with two **Iraqi** Cabinet ministers Saturday in a bid to glean information about thousands of Iranian POWs allegedly in Iraq, the official Iraqi News Agency reported.

Iraqi Foreign Minister **Mohammed Saeed al-Sahhaf** told Abdullah al-Najafi that the two states needed to ``speed up the closure of what remains from the POW and Missing-In-Action file,'' INA said.

The issue of POWs and missing persons remains a stumbling block to normalizing relations between the two neighbors.

Iraq has long maintained that it has released all Iranian prisoners captured in the **1980**-88 **Iran-Iraq War**. The countries accuse each other of hiding POWs and preventing visits by the **International Committee of the Red Cross** to prisoner camps.

The ICRC representative in **Baghdad**, Manuel Bessler, told The **Associated Press** that his organization has had difficulty visiting POWs on both sides on a regular basis.

In April, Iran released 5,584 fied as civil law detainees in the largest exchange since **1990**.

More than 1 million people w

Baghdad

Baghdad is the capital of Iraq and of Baghdad Governorate. With a metropolitan area estimated at a population of 7,000,000, it is the largest city in Iraq. It is the second-largest city in the Arab world (after Cairo) and the second-largest city in southwest Asia (after Tehran).

open in wikipedia

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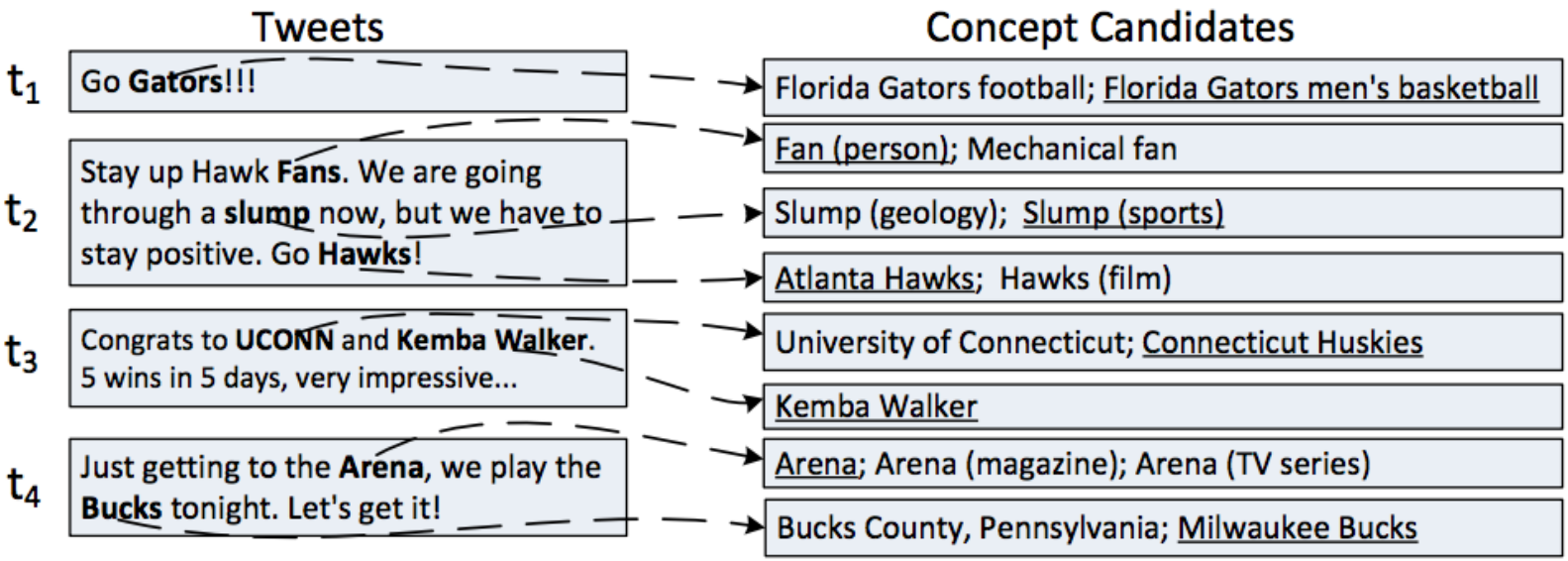

Entity Linking: Common Steps

Determine "linkable" phrases

mention detection - **MD**

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Rank/Select candidate entity links

link generation - **LG**

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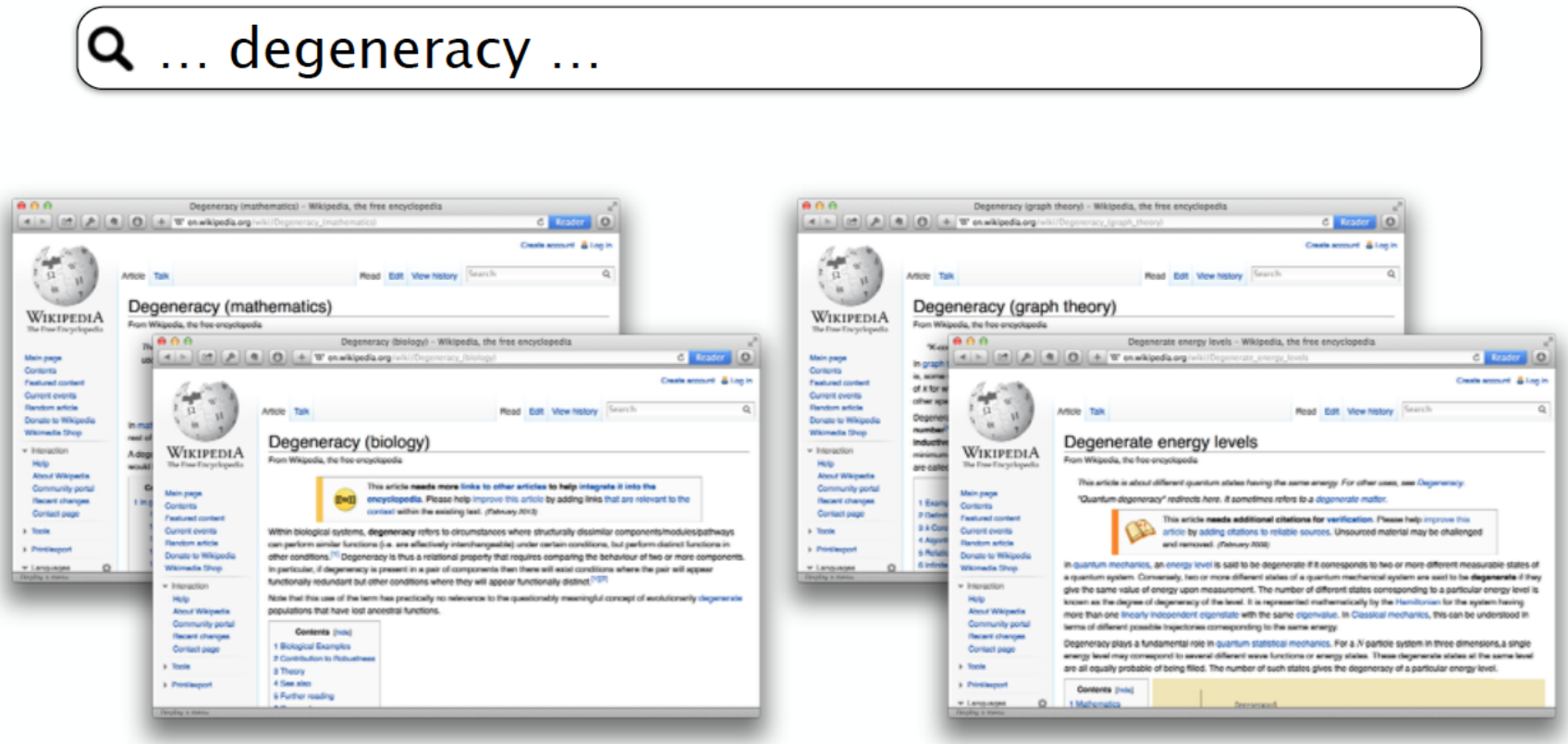
Use "context" to disambiguate/filter/improve

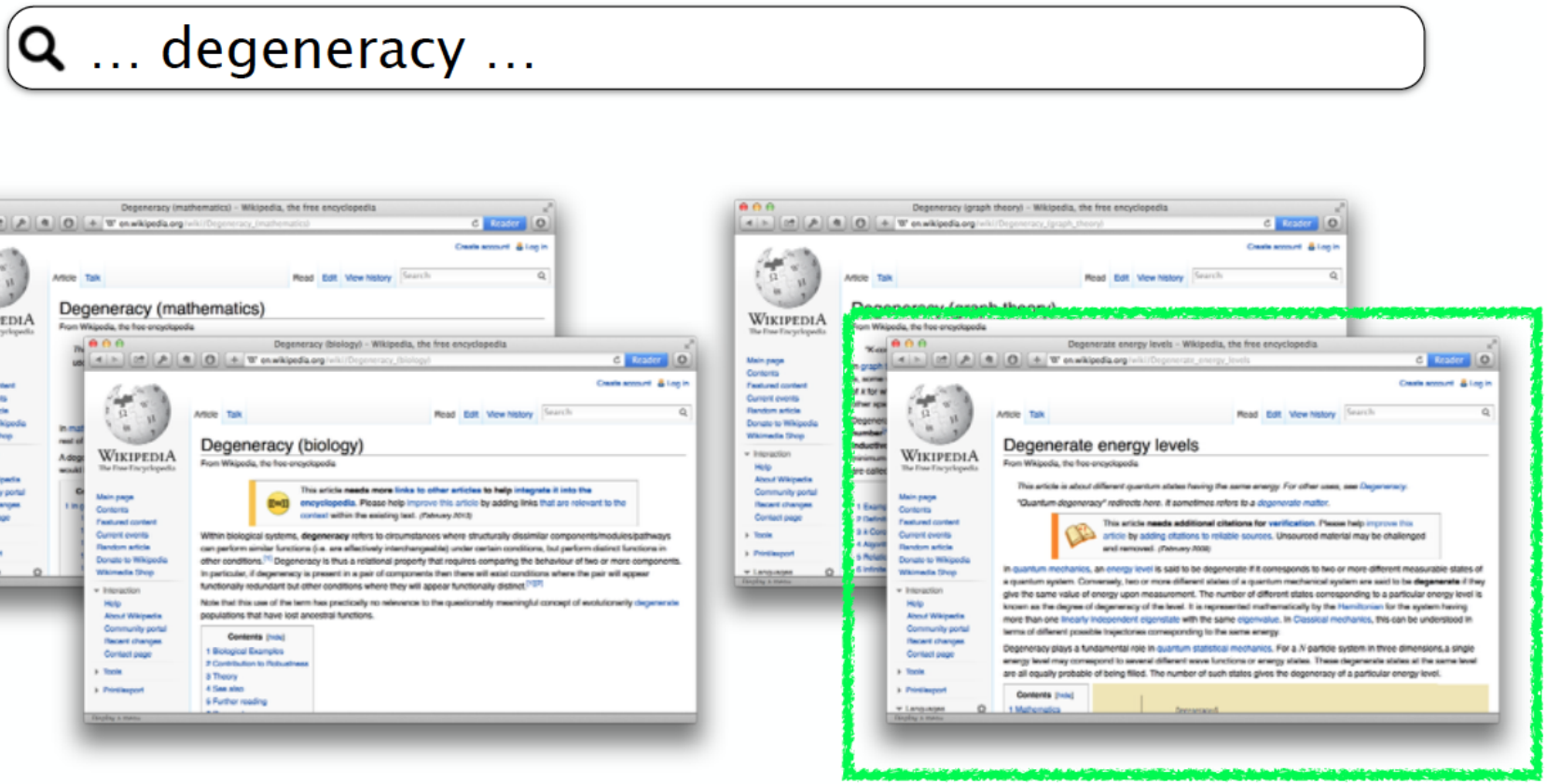
disambiguation - **DA**

Mention Detection (MD)

Link Generation (LG)



Disambiguation (DA)



Preliminaries: Wikipedia

- Basic element: article (proper)
- But also
  - redirect pages
  - disambiguation pages
  - category/template pages
  - admin pages
- Hyperlinks
  - use “unique identifiers” (URLs)
    - [[United States]] or [[United States|American]]
    - [[United States (TV series)]] or [[United States (TV series)|TV show]]

Preliminaries: Disambiguation Pages

- Senses of an ambiguous phrase
- Short description
- (Possible) categorization
- Non-exhaustive

Some Statistics

WordNet

- 80k entity definitions
- 142k senses (entity - surface forms)

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Wikipedia

- 4M entity definitions
- 24M senses

Wikipedia based methods

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$$\frac{\mathrm{CF}(w_l)}{\mathrm{CF}(w)}$$

Collection frequency
term w as a link to another Wikipedia article

Collection frequency
term w

Wikipedia based methods

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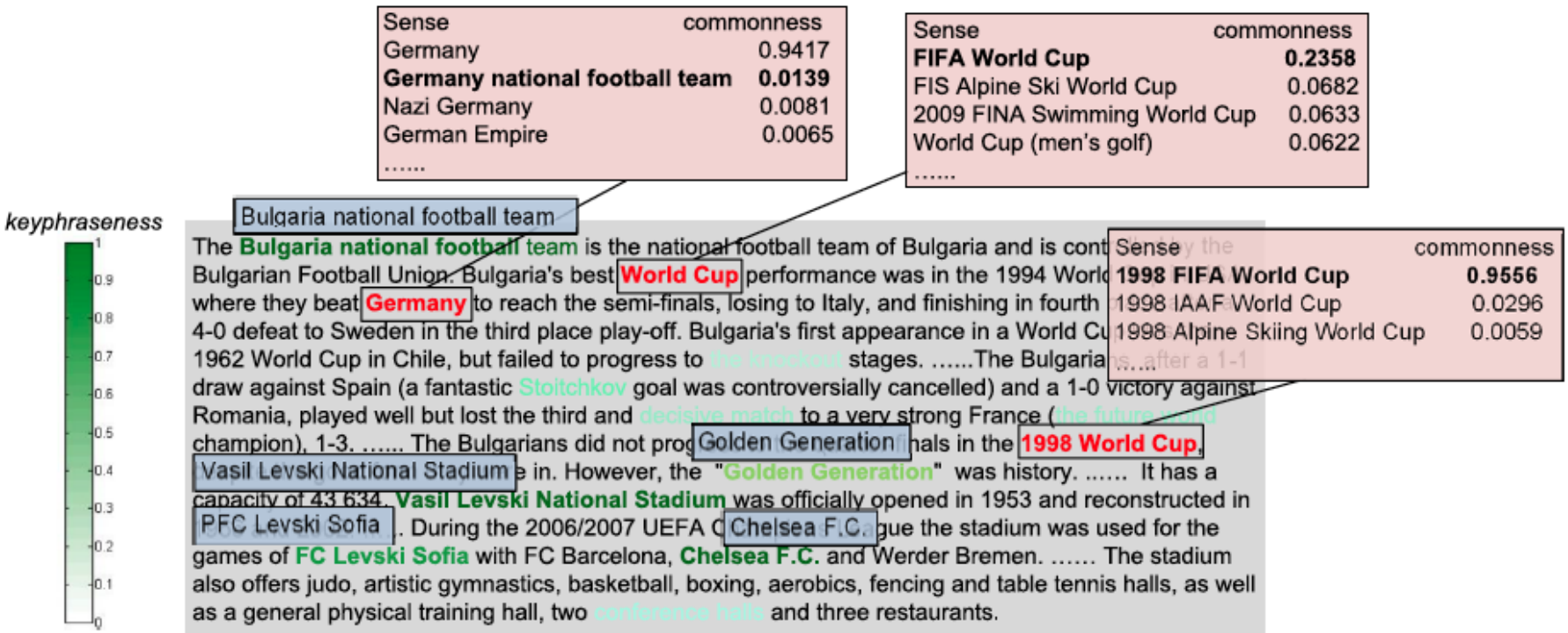
commonness(w, c)

The fraction of times, a particular sense is used as a destination in Wikipedia.

$$\frac{|L_{w,c}|}{\sum_{c'} |L_{w,c'}|}$$

Number of links
with target c' and anchor text w

Commonness and keyphraseness



Always the best decision?

Depth-first search

From Wikipedia, the free encyclopedia

Depth-first search (**DFS**) is an algorithm for traversing or searching a tree tree structure or graph. One starts at the root (selecting some node as the root in the graph case) and explores as far as possible along each branch before backtracking.

Formally, DFS is an uninformed search that progresses by expanding the first child node of the search tree that appears and thus going deeper and deeper until a goal node is found, or until it hits a node that has no children. Then the search backtracks, returning to the most recent node it hadn't finished exploring. In a non-recursive implementation, all freshly expanded nodes are added to a LIFO stack for exploration.

sense	commonness	relatedness
Tree	92.82%	15.97%
Tree (graph theory)	2.94%	59.91%
Tree (data structure)	**2.57%**	**63.26%**
Tree (set theory)	0.15%	34.04%
Phylogenetic tree	0.07%	20.33%
Christmas tree	0.07%	0.0%
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Using Relatedness: Basic Idea

- In a sufficiently long text, one finds terms that do not require disambiguation at all.
- Use every unambiguous link in the document as context to disambiguate ambiguous ones.

Finding Relatedness: A link-based measure

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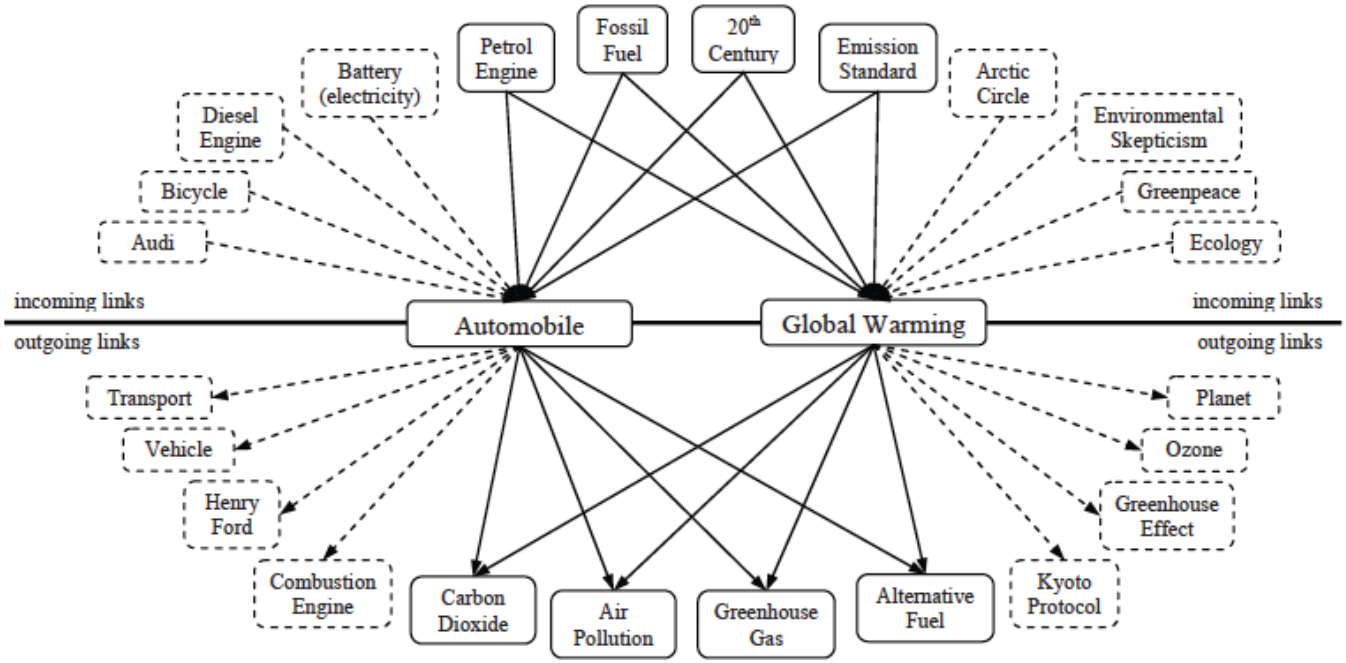
relatedness(c, c')

Using the intersection among incoming as well as outgoing links of two Wikipedia pages



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How to give different weights to the context terms?

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These two variables - link probability and relatedness - are averaged to provide a weight for each context.

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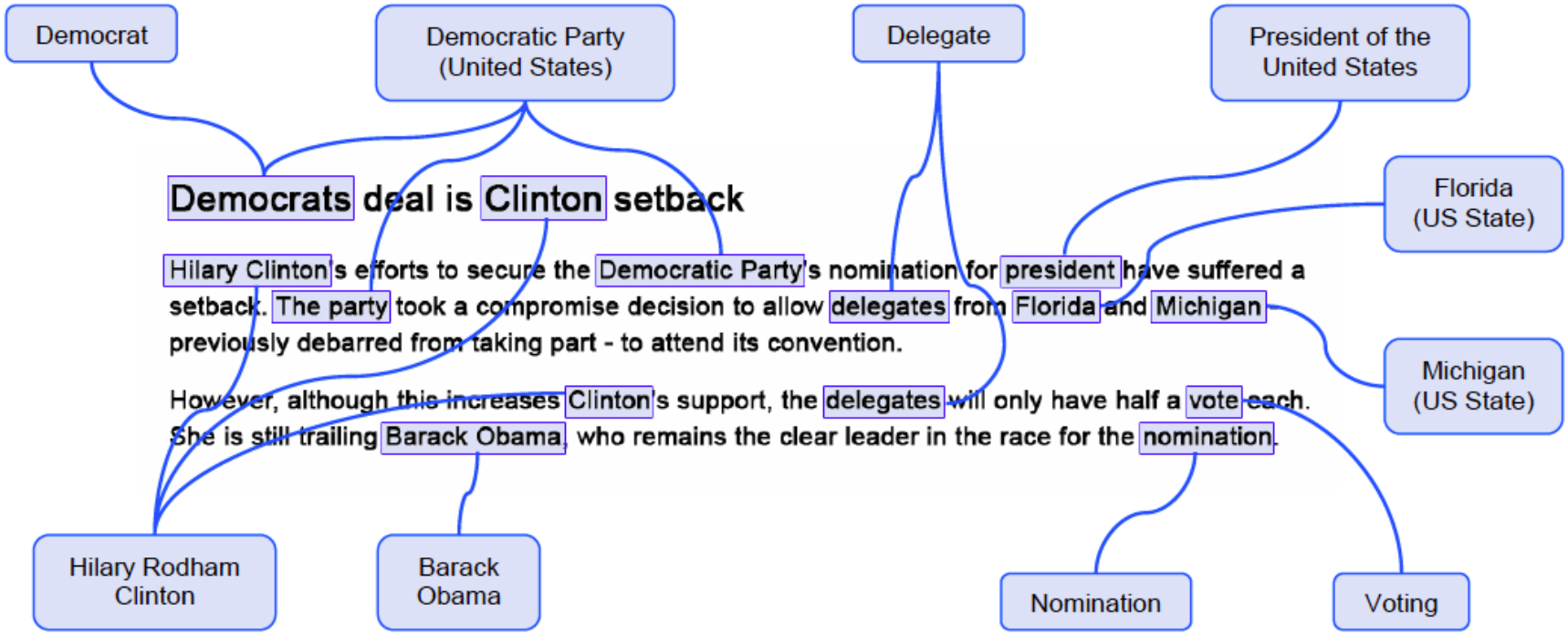
Can you use this to learn – which concepts should be linked?

Example


Democrat
Democratic Party (United States)
Delegate
President of the United States
Florida (US State)
Michigan (US State)
Democrats deal is Clinton setback
Hilary Clinton's efforts to secure the Democratic Party's nomination for president have suffered a setback. The party took a compromise decision to allow delegates from Florida and Michigan previously debarred from taking part - to attend its convention.
However, although this increases Clinton's support, the delegates will only have half a vote each. She is still trailing Barack Obama, who remains the clear leader in the race for the nomination.
Hilary Rodham Clinton
Barack Obama
Nomination
Voting

The Learning Problem: Which topics should be linked?

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- The automatically identified Wikipedia articles provide training instances for a classifier.
- Positive examples are the articles that were manually linked to, while negative ones are those that were not.
- Features of these articles – and the places where they were mentioned – are used to inform the classifier about which topics should and should not be linked.

What are the features?

- **Link Probability:** Average as well as maximum of link probability of the link locations – (e.g. Hillary Clinton and Clinton)
- **Relatedness:** Topics which relate to the central thread of the document are more likely to be linked
- **Disambiguation Confidence:** The confidence score of the classifier for disambiguation
- **Generality:** Defined as the minimum depth at which it is located in Wikipedia's category tree. More useful for the readers to provide links for specific topics.
- **Location and Spread:** Where are these mentioned? First occurrence, last occurrence and the spread.

References

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- Milne, David, and Ian H. Witten. “Learning to link with wikipedia.” Proceedings of the 17th ACM conference on Information and knowledge management. ACM, 2008.