DWUG: A large Resource of Diachronic Word Usage Graphs in Four Languages

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Introduction

- traditional approach to annotate word senses are binary assignments to sense descriptions [Kilgarriff 1998]
  - ignores gradedness of word meaning
- two alternatives proposed by Erk et al. [2013]: [Erk et al. 2013]
  (i) graded judgments of word usage pairs (usage-usage)
  (ii) graded assignments of word usages to sense descriptions (usage-sense)
- judgments populate weighted graph [McCarthy et al. 2016]
- senses are not annotated directly, but **inferred** on the graph
- problems: applicability, scalability

Clustering

- correlation clustering [Bansal et al. 2004]
- optimization criterion: **minimize (weighted) number of cluster-edge conflicts** [Schlechtweg et al. 2020]

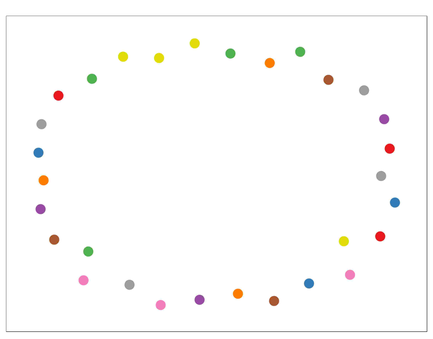
$$\arg\min_{C} L(C) = \sum_{e \in \phi_{E,C}} W'(e) + \sum_{e \in \psi_{E,C}} |W'(e)|$$

(i) finds the optimal number of clusters on its own
(ii) handles missing information (non-observed edges)
(iii) robust to errors by using the global information
(iv) respects the gradedness of word meaning
(v) dominated in simulation study

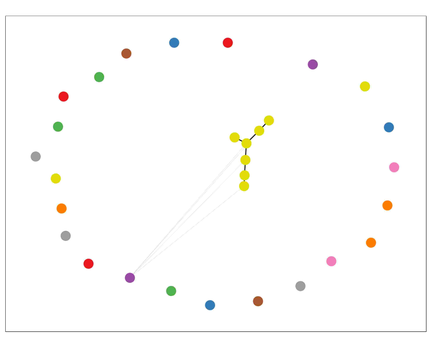
↑ 4: Identical
3: Closely Related
2: Distantly Related
1: Unrelated

DURel relatedness scale.

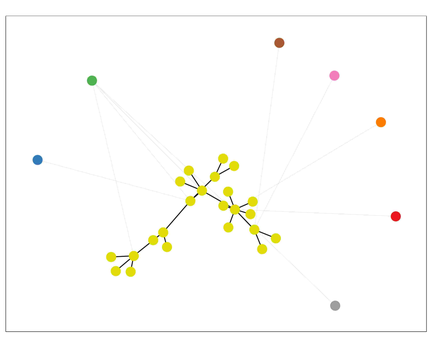
Edge Sampling



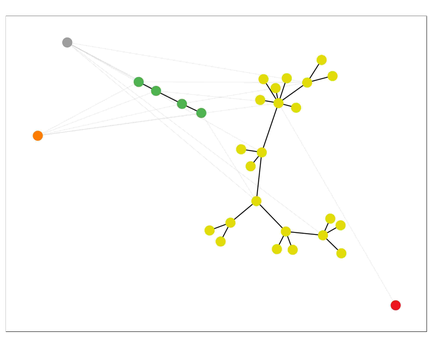
No information



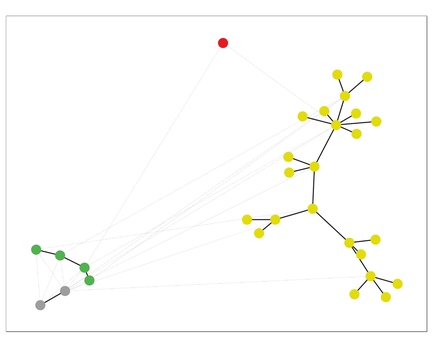
Initial clustering (exploration)



Cluster comparison (combination)



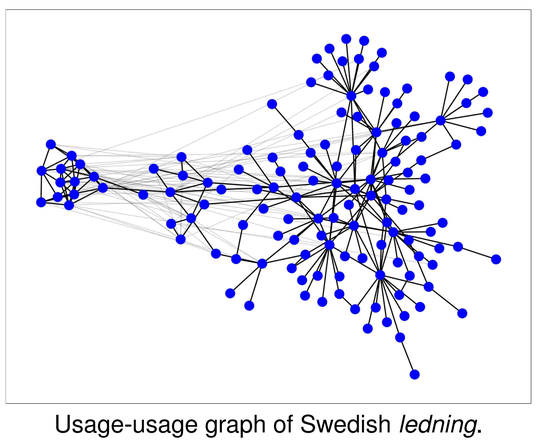
Compare non-assignable uses (exploration)



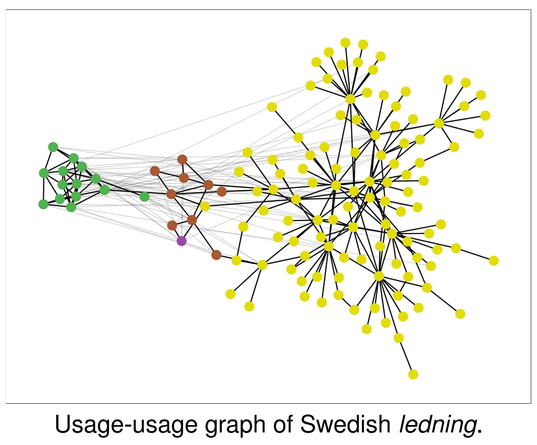
Combination and exploration

Procedure (i): Usage-Usage Graphs

(Usage) Von Hassel replied that he had such faith in the **plane** that he had no hesitation about allowing his only son to become a Starfighter pilot.
(Usage) This point, where the rays pass through the perspective **plane**, is called the seat of their representation.



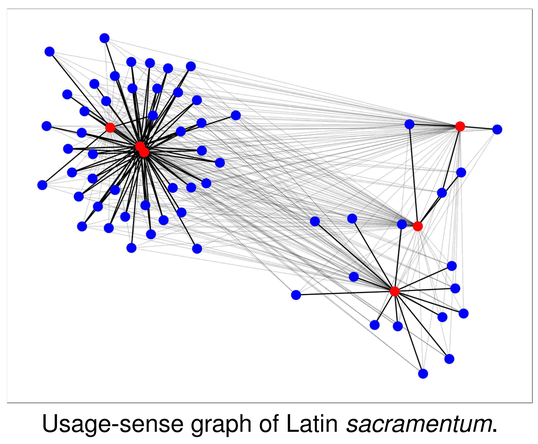
Usage-usage graph of Swedish *ledning*.



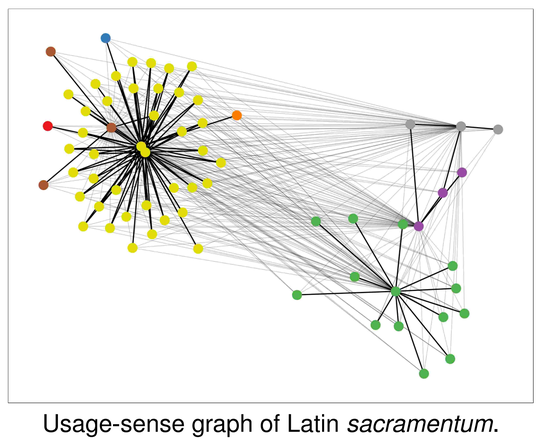
Usage-usage graph of Swedish *ledning*.

Procedure (ii): Usage-Sense Graphs

(Usage) Cum Arretinae mulieris libertatem defenderem et Cotta xviris religionem iniecisset non posse nostrum **sacramentum** iustum iudicari, [. . .]
(Sense) "a cause, a civil suit or process"

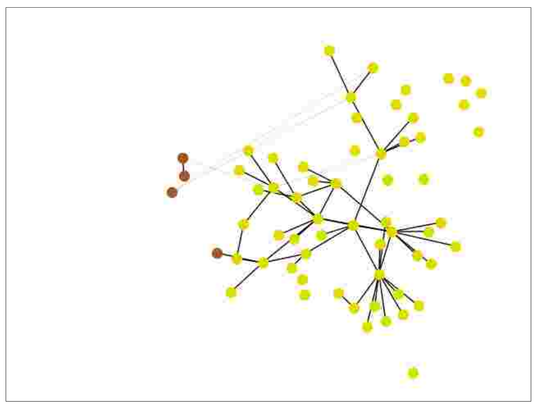


Usage-sense graph of Latin *sacramentum*.

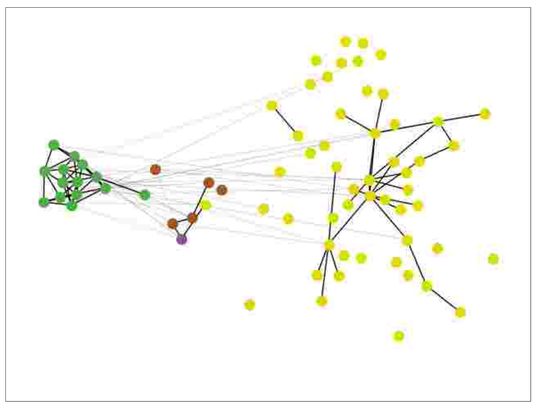


Usage-sense graph of Latin *sacramentum*.

Lexical Semantic Change



Subgraph of Swedish *ledning* for **old** subcorpus.



Subgraph of Swedish *ledning* for **new** subcorpus.

Possible Uses

- as large sets (thousands) of pairwise **semantic proximity judgments** to evaluate contextualized embeddings in multiple languages;
- the inferred change scores can be used to evaluate **semantic change detection** models;
- as **word sense disambiguation/discrimination** resources with additional aspects such as variation over time;
- graphs may be treated as research objects in their own right
- we openly release the data, clusterings, visualizations, statistics and code:

`https://www.ims.uni-stuttgart.de/data/wugs`

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