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DURel Annotation Tool

Human and Computational Measurement of Semantic Proximity, Sense Clusters and Semantic Change

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Outline

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Motivation

- **common problem**:
  - **given**: set of word uses (corpus)
  - **searched**: their meanings and their relations
- **relevant for**:
  - historical linguistics
  - lexicography
  - digital humanities
- **common approach**: researcher scans corpus himself
  - tedious
  - subjective
  - no protocol
  - bias
- **solution**: DURel Annotation Tool[1]
  - online interface
  - upload word uses for annotation
  - well-established protocol for contextual word meaning annotation

(Erk et al., 2013; Schlechtweg et al., 2020)

[1] `https://durel.ims.uni-stuttgart.de/`

Background

Data

A	1824	and taking a knife from her pocket, she opened a vein in her little **arm**,
B	1842	And those who remained at home had been heavily taxed to pay for the **arms**, ammunition;
C	1860	and though he saw her within reach of his **arm**, yet the light of her eyes seemed as far off
		...
D	1953	overlooking an **arm** of the sea which, at low tide, was a black and stinking mud-flat
E	1975	twelve miles of coastline lies in the southwest on the Gulf of Aqaba, an **arm** of the Red Sea.
F	1985	when the disembodied **arm** of the Statue of Liberty jets spectacularly out of the

Table 1: Sample of diachronic corpus.

Annotation

(A) [. . .] and taking a knife from her pocket, she opened a vein in her little **arm**, and dipping a feather in the blood, wrote something on a piece of white cloth, which was spread before her.

(D) It stood behind a high brick wall, its back windows overlooking an **arm** of the sea which, at low tide, was a black and stinking mud-flat [. . .]

Scale

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

Table 2: DURel relatedness scale.

Graph representation

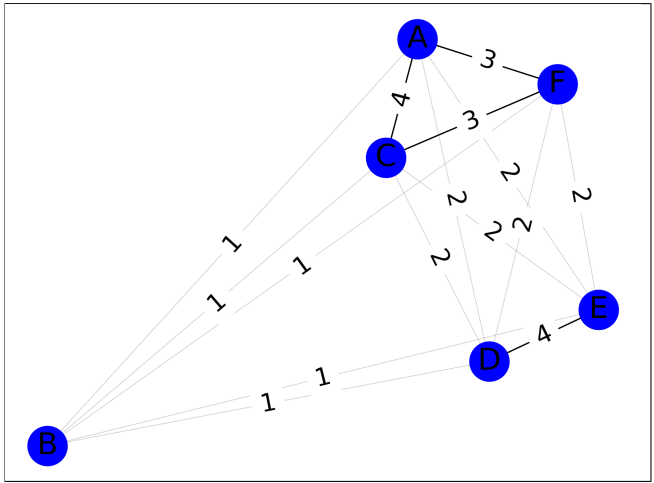


Figure 1: Word Usage Graph of English *arm*.

Clustering

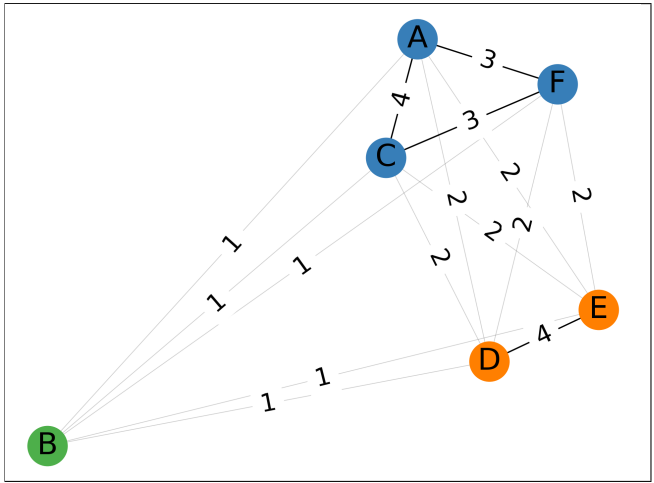
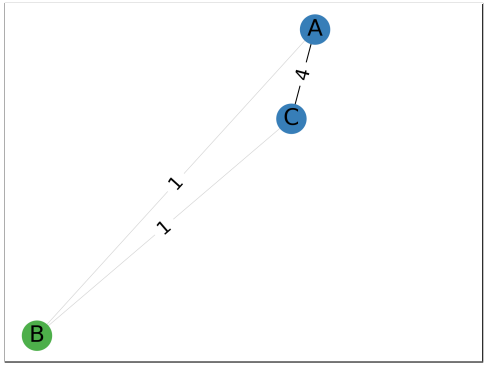


Figure 2: Word Usage Graph of English *arm*.

Lexical Semantic Change



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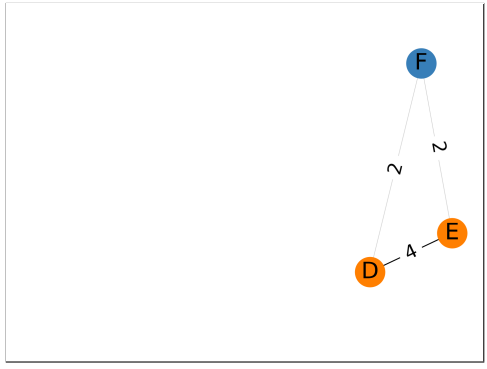

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Annotation Interface

Features

- **DURel annotation tool** (Schlechtweg, Virk, et al., 2024)
- data upload
  1. uses
  2. pairs
  3. judgments
- data inspection
- human annotation
- computational annotation
- annotator checking
- annotation statistics
- data clustering
- data visualization
- data export

Demo

- https://durel.ims.uni-stuttgart.de/

Applications

Case Study: Lexical Semantic Change Discovery

- **task**: (Kurtyigit et al., 2021)
  - discover novel word senses over time in a German diachronic corpus pair
- **use**:
  - post hoc annotate model predictions for validation
- **results**:
  - good predictions
  - reasonable agreement
  - useful visualizations
  - discovered unrecorded changes

Case Study: Lexical Semantic Change Discovery

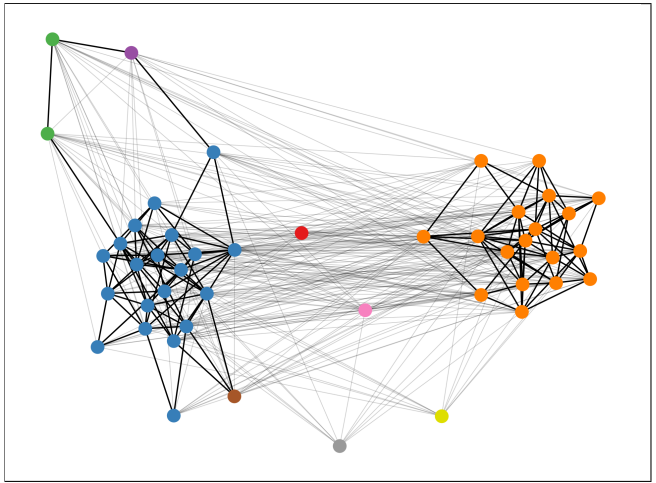
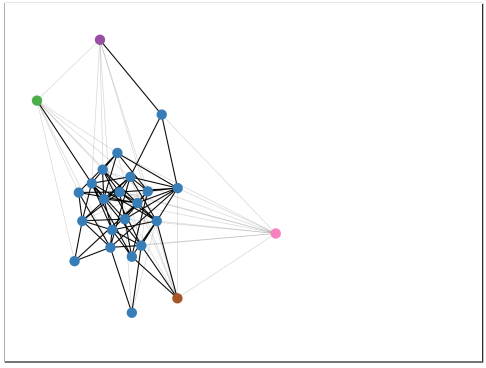


Figure 4: Word Usage Graph of German *Zehner*.

Case Study: Lexical Semantic Change Discovery



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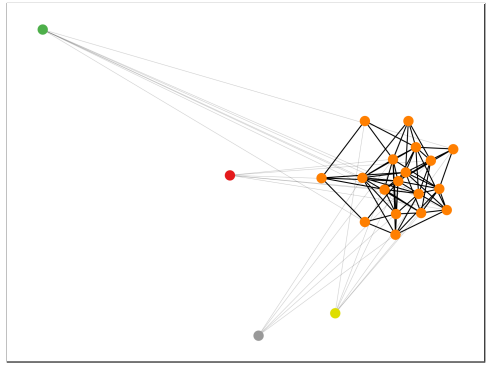

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Case study: Polysemy/Synonymy across Language Varieties

- **task**: (Baldissin et al., 2022)
  - detect diatopic lexical semantic variation in Spanish
- **use**:
  - annotate data samples from Spanish variants
  - extend DURel framework to onomasiological questions
- **results**:
  - reasonable agreement
  - nice graphs
  - annotation across lemmas works well

Case study: Polysemy/Synonymy across Language Varieties

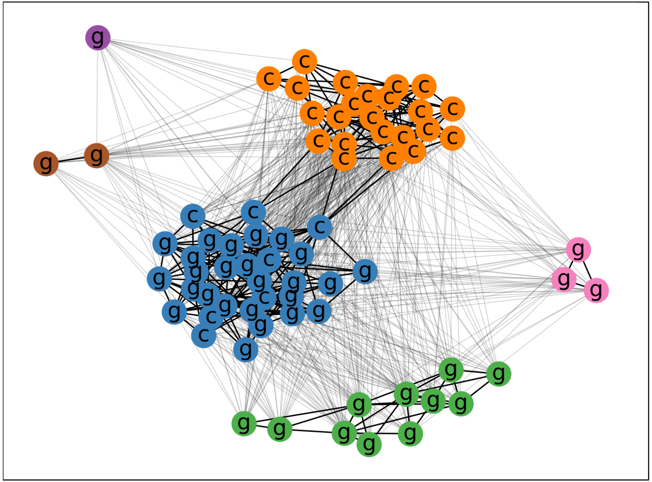
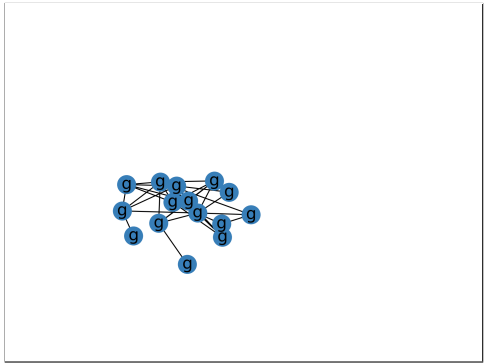
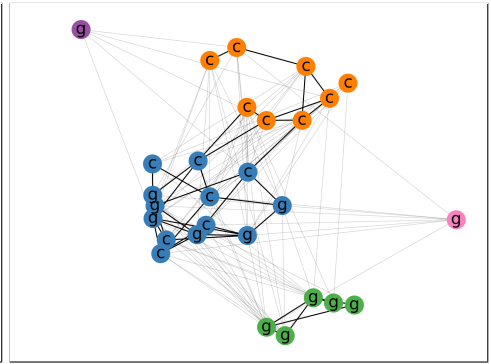


Figure 6: Word Usage Graph of Spanish *colectivo* and *guagua*.

Case study: Polysemy/Synonymy across Language Varieties



Cuba



Argentina

Case study: Automated Clustering for Dictionary Updating

- **task**: (Sander et al., 2024; Sköldberg et al., 2024)
  - reduce the workload when searching for new dictionary headword senses
- **use**:
  - cluster uses for headwords based on automatic pairwise annotations
  - compare cluster number to sense entry number in dictionary
- **results**:
  - works well
  - discovered metonymic & metaphoric uses
  - discovered proper nouns
  - scalable

Case study: Automated Clustering for Dictionary Updating

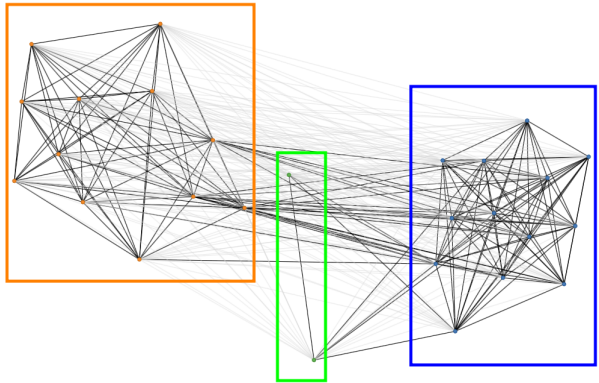


Figure 8: Usage clustering of *to seep* in three clusters. From left to right: metaphorical use, PoS-errors, literal use.

Studies

- post-hoc annotation of **German** semantic changes (Kurtyigit et al., 2021)
- **Spanish** diatopic variation dataset (Baldissin et al., 2022)
- **Spanish** LSCD dataset (Zamora-Reina et al., 2022)
- **Norwegian** LSCD dataset (Kutuzov et al., 2022)
- **Russian** WSI dataset (Aksenova et al., 2022)
- **Chinese** LSCD dataset (Chen et al., 2023)
- extended LSCD datasets for **English**/**German**/**Swedish** (Schlechtweg, Cassotti, et al., 2024)
- WSI with automatic annotators for **English**/**German**/**Swedish** (Sander et al., 2024; Sköldberg et al., 2024)
- manual WSI for **German** (Theuer Linke, 2023)
- **Dutch** LSCD data set (ongoing)
- ...

Conclusion

- **inter-subjectivity**:
  - avoids experimenter bias through standard protocol and annotation by multiple humans
  - inter-annotator agreement gives measure of reliability
- **simple**:
  - the judgment of use pair relatedness is an intuitive task for annotators generally yielding high agreement (Erk et al., 2013; Schlechtweg et al., 2018)
  - annotated data can be visualized as semantic relatedness graphs on 2D plots
- **preparation-lean**:
  - researchers only need to sample word uses
- **grounded in theory**:
  - relatedness judgments have theoretical basis in cognitive semantics (Blank, 1997; Schlechtweg et al., 2018)
- **flexible**:
  - clustering algorithm and parameters can be changed after annotation, avoiding re-annotation
- **automatatable**:
  - pairwise judgments can be done automatically for large sets of data with good performance

Future work

- optimized sampling
- annotation history + modifying previous annotations
- optimization for large-scale automated prediction
- corpus interface
- **what do you need?**
- **funding**

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