Visualisation and Exploration of High-Dimensional Distributional Features in Lexical Semantic Classification

Maximilian Köper[1], Melanie Zaiß[2], Qi Han[2], Steffen Koch[2], Sabine Schulte im Walde[1]

[1]Institut für Maschinelle Sprachverarbeitung

[2]Institut für Visualisierung und Interaktive Systeme

Universität Stuttgart, Germany

[1] {maximilian.koeper,schulte}@ims.uni-stuttgart.de

[2] {firstname.lastname}@vis.uni-stuttgart.de

Abstract

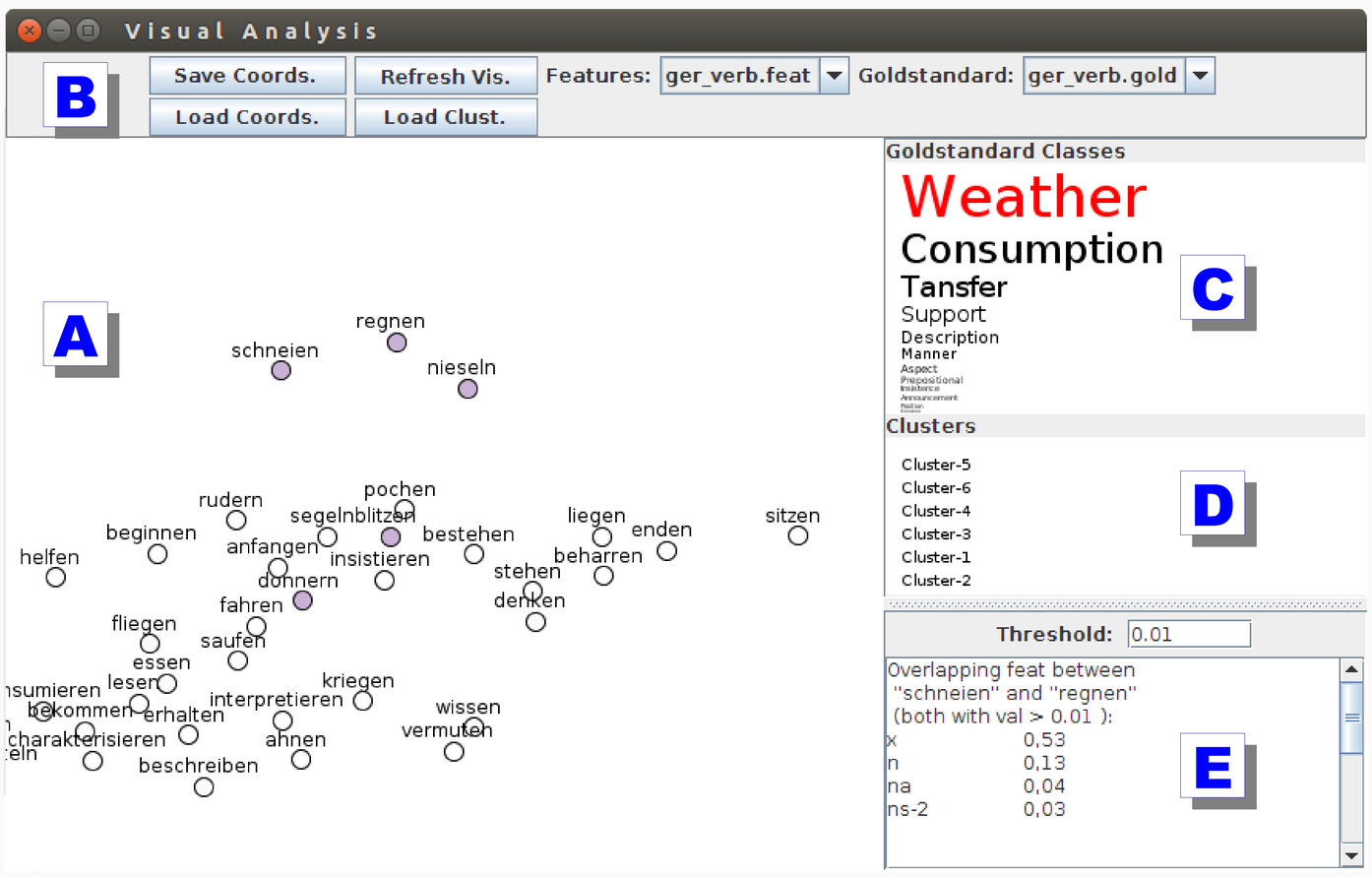
Vector space models and distributional information are widely used in NLP. The models typically rely on complex, high-dimensional objects. We present an interactive visualisation tool to explore salient lexical-semantic features of high-dimensional word objects and word similarities. Most visualisation tools provide only one low-dimensional map of the underlying data, so they are not capable of retaining the local and the global structure. We overcome this limitation by providing an additional trust-view to obtain a more realistic picture of the actual object distances. Additional tool options include the reference to a gold standard classification, the reference to a cluster analysis as well as listing the most salient (common) features for a selected subset of the words.

Input

- As input, the tool requires a text file with the high-dimensional objects and features, relying on three comma-separated columns per line:
- ⟨word, feature, co-occurrence frequency⟩
- Optionally, the user may provide text files with the gold standard and/or automatic class assignments, relying on two comma-separated columns per line: ⟨word, class⟩.

Test the Demo Version on this Laptop here!

System Overview



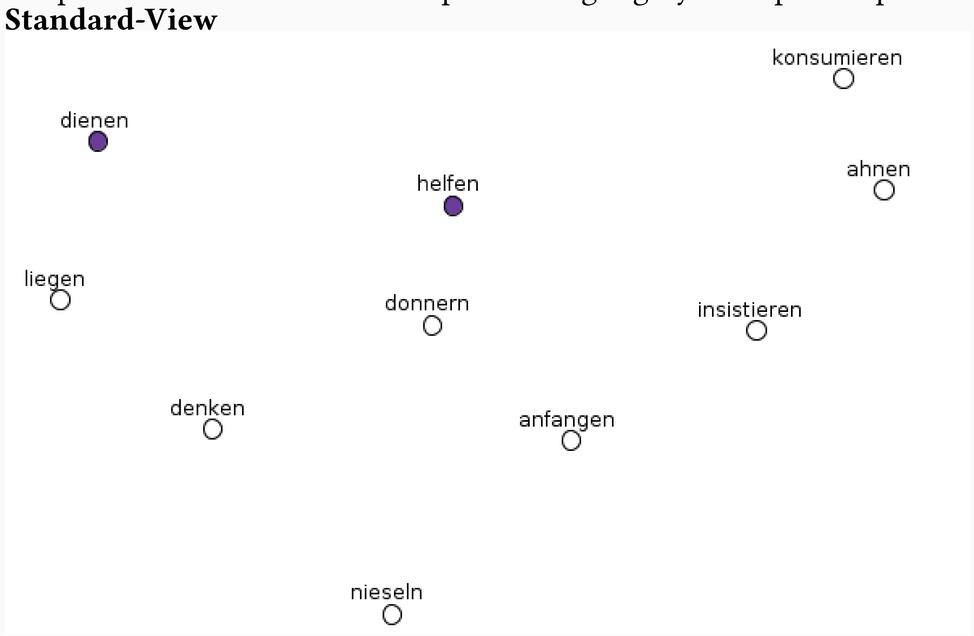
- **[A]** Main Window: The main window presents the visualisation of the T-SNE-reduced two-dimensional data points. The main window enables the user to get an overview of the spatial locations of the target objects, and their distances from each other
- **[B]** Navigation Bar: allows saving and loading previous coordinates as well as generating a new visualisation (`Refresh`). Further one can select another underlying feature set and goldstandard.
- **[C]** Goldclass Assignments: displays the gold standard class labels. Selecting a label marks all elements in window [A] with the same colour.
- **[D]** Optional Cluster Assignments: if a cluster analysis file is loaded, this window allows highlighting cluster memberships.
- **[E]** Common Features Display: When selecting an individual element in the main window [A], the entire main window freezes. Clicking on an addi- tional element then displays common features of the selected elements in window [E], i.e. words that co-occur with both elements. These features are sorted according to feature scores

L.J.P. van der Maaten and G.E. Hinton (2008).
Visualizing High-Dimensional Data Using t-SNE
In *Journal of Machine Learning Research 9(Nov):2579-2605*

Trust-View

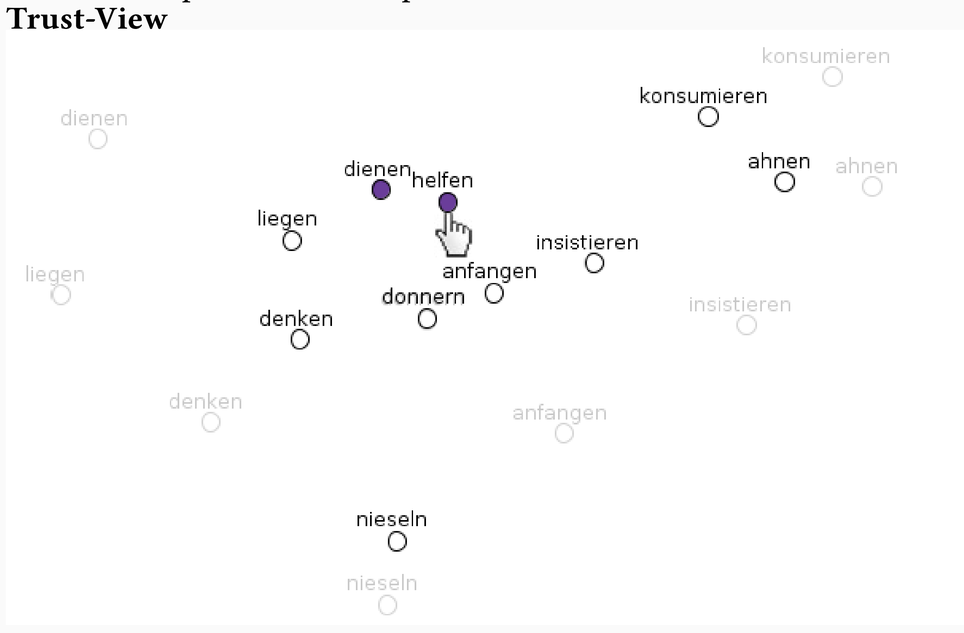
- Dimensional reduction comes at the cost of information loss, leading to distortions in the displayed distances of vectors in the low dimensional space
- To diminish this problem, the *trust-view* lets users inspect a vector interactively by hovering it with the mouse
- In response to this interaction, all other word vector representations are moved radially to the hovered element in an animation, since showing correct distances
- the original position of moved items is depicted in light gray to help users preserve their mental map of the initial representation

Standard-View



Standard view, with distances based on T-SNE

Trust-View



Trust-View with respect to the position verb helfen ‘to help’