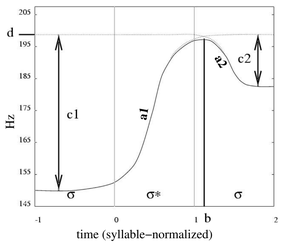
Multi-modal Visualization and Search for Text and Prosody Annotations

Markus Gärtner, Katrin Schweitzer, Kerstin Eckart and Jonas Kuhn
Institute for Natural Language Processing, University of Stuttgart
firstname.lastname@ims.uni-stuttgart.de

University of Stuttgart
Germany

Parametric Representation of Intonation Events (PaIntE)

PaIntE Model [1]

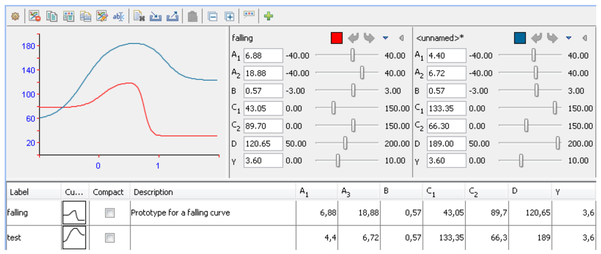


Parameters:

a1/a2	steepness of rise and fall
b	location of peak
c1/c2	amplitude of rise and fall
d	absolute height of peak

- Approximation of a peak in the F_0 contour
- Employs a model function on a 3-syllable window
- 6 linguistically meaningful float parameters
- Language independent

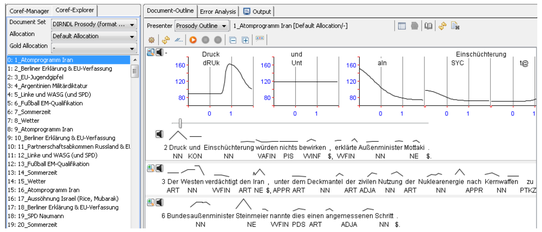
PaIntE Editor



- Visualizes multiple sets of PaIntE parameters
- Helps users to get familiar with PaIntE curves
- Supports import and export of parameter sets
- Provides a persistent storage of PaIntE curves with identifiers and description

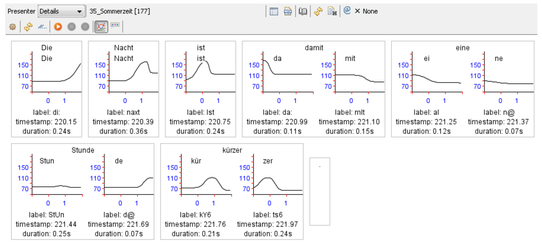
Exploration Views

Document Outline



- Compact view of an entire document
- Preview visualization of the F_0 contour per sentence
- Foldout panels for each sentence, providing a detailed view

Sentence Outline



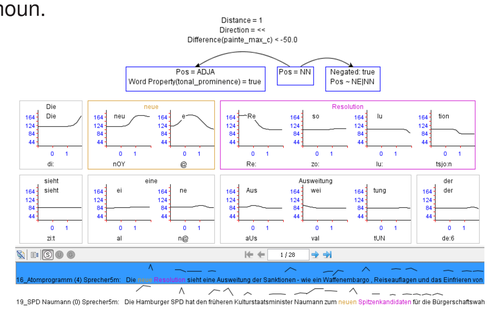
- Detailed view of a single sentence
- Focus on visualization of the F_0 contour
- Grouping of PaIntE curves for each word

Both of the above views support *Label Patterns* to customize text content. Those patterns are strings that define the format according to which various text areas will be displayed. They grant access to all annotation layers, allowing them to be used as label text (e.g. the pattern `{word:form}\n{word:pos}`, which is the default word level pattern for the document outline, extracts the full surface form and part-of-speech annotation of the current word and displays them separated by a line break).

Search

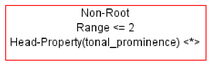
ICARUS for intonation integrates the ability to query syllable-based annotations into the existing search engine of the ICARUS platform, allowing to use syllable constraints for both dependency and coreference search. Queries can be defined graphically or in plain text and a variety of syllable constraints is available. Below are examples of how intonation-based search constraints can be combined with existing features of the search engine (screenshots include graphical queries and snippets of the result outlines).

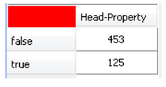
Search query for adjective-noun sequences, where the adjective is tonally more prominent than the adjacent noun.



- Prosodic constraints available for both nodes and edges (nodes in the graph represent words)
- Sentence outline as result view (switch to tree visualization for syntax with a click)
- Highlighting of matches

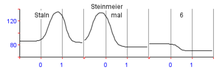
Query to collect the distribution of "tonally prominent" mentions that are *given* (already introduced) in a discourse. The Boolean *tonal prominence* property relies purely on the peak excursion (with a customizable threshold) of the head word of each mention.



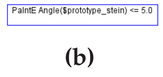


- *grouping operator* <∗> generates frequency list
- Aggregated result visualization (clicking on frequency values opens list of respective instances)
- Document outline as result view, with full access to alternative coreference visualizations (text, tree or entity-grid view)
- Save/Load entire search via a simple XML format
- Export result data in a very flexible format to generate input for other tools

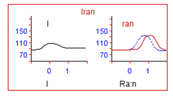
Example-based search making use of one of the similarity measures available for PaIntE constraints.



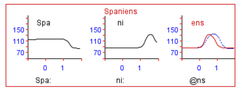
(a)



(b)



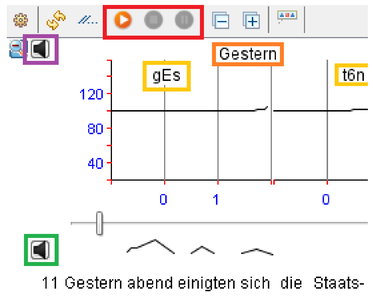
(c)



(d)

- PaIntE curves found in the data (2a) can be used as targets for constraints (2b)
- Available similarity measures include Euclidean distance and cosine similarity
- Result highlighting includes the original constraints to provide feedback on "visual proximity"

Audio-Playback



- Play parts of the original audio data directly from within the visualizations
- Available for both exploration views
- Reads Waveform Audio File Format (*.wav)
- Very fine-grained playback (on either `document`, `sentence`, `scope`, `word` or `syllable` level)
- Uses common timestamp annotations to extract the desired audio section

Summary

- Visualization of F_0 contours using the PaIntE model
- Interactive graphical interface integrated in ICARUS [2, 3]
- Supports fine-grained audio-playback on different levels
- Highly customizable visualization and search features
- Flexible reader for tabular formats
- Java-based, platform independent, requires no installation

The latest version can be found here:
http://www.ims.uni-stuttgart.de/data/icarus.html

References

[1] Gregor Möhler. Improvements of the PaIntE model for F_0 parametrization. Technical report, Institute of Natural Language Processing, University of Stuttgart, 2001. Draft version.

[2] Markus Gärtner, Gregor Thiele, Wolfgang Seeker, Anders Björkelund, and Jonas Kuhn. ICARUS – an extensible graphical search tool for dependency treebanks. In *Proceedings of the 51st Annual Meeting of the Association for Computational Linguistics: System Demonstrations*, pages 55–60, Sofia, Bulgaria, August 2013. Association for Computational Linguistics.

[3] Markus Gärtner, Anders Björkelund, Gregor Thiele, Wolfgang Seeker, and Jonas Kuhn. Visualization, search, and error analysis for coreference annotations. In *Proceedings of 52nd Annual Meeting of the Association for Computational Linguistics: System Demonstrations*, pages 7–12, Baltimore, Maryland, June 2014. Association for Computational Linguistics.

This work has been funded by the German Research Foundation (DFG) via Project INF of the SFB 732 and by the German Federal Ministry of Education and Research (BMBF) via project No. 01UG1120F, CLARIN-D center Stuttgart.