Analysing automatic descriptions of intonation with ICARUS

Katrin Schweitzer, Markus Gärtner, Arndt Riester, Ina Rösiger, Kerstin Eckart, Jonas Kuhn, Grzegorz Dogil

Introduction

Research on Intonation
- often based on manual annotation → very time consuming
- automatic descriptions often not directly and/or intuitively accessible to users
- often elaborate in terms of typical “speech tools” but separate from elaborate text-based tools (e.g. parsing, tagging, co-reference resolution)

Interactive Research Platform: ICARUS
- tool for searching/analysing large text corpora
- handles dependency-parses, POS tags, co-reference annotation
- offers elaborate search and analysis features

Gärtner et al. [2013], Thiéle et al. [2014], Gärtner et al. [2014]

Research goals
- bridge the gap between manual analysis of small datasets and large-scale analyses of automatically derived features
- analyse tonal parameters conjoing with other annotation levels → incorporate automatically derived tonal descriptions in ICARUS

Automatic analysis of intonation

The PaIntE model

- approximation of a peak in the $F_0$-contour
- employs a model function with 6 parameters on a 3-syllable window:
  - $a_1$: steepness of rise and fall
  - $b$: location of peak
  - $c_1$: amplitude of rise and fall
  - $d$: absolute height of peak

ICARUS for Intonation

Features
- reads in PaIntE parameters along with any other linguistic information available, e.g. in tabular format
- here: DIRNDL corpus as an example
- Eckart et al. [2012], Björkelund et al. [2014]
- provides various ways of visualising and searching the data
- provides various ways of audio-playback
- provides various ways to export search results

Data exploration

- allows for various ways of audio-playback
- allows for convenient data exploration of different linguistic levels conjointly
- can foster interdisciplinary corpus-based research

ICARUS for Intonation

PaintE editor
- provides users with no or little knowledge about the PaintE model with the possibility to see the direct impact of changes in PaintE parameters
- tonal contours can be saved and used in search (e.g. similarity search)

Sample applications

Co-reference resolution and intonation
- phonetic features up to now not taken into account in automatic co-reference resolution
- ongoing work: do phonetic features improve co-reference resolution
- evidence that givenness and (lack of) pitch-accenting correlate Terken and Hirschberg [1994]
- task: investigate whether automatically derived tonal parameters good candidates to be used in automatic co-reference resolution

Investigation with ICARUS
- employ feature tonal prominence: find peaks that exceed a customizable Hertz value (default 50Hz)
- use grouping operator $\ll$ displays values of categorical features along with their frequency distribution in the corpus

Intonation of adjective-noun sequences
- recent study investigated ADJ-NN sequences with respect to their prominence
- main interest: cases where ADJ is more prominent than noun

Investigation with Icarus
- find cases where the amplitude of the peak on ADJ is at least 50Hz higher than on NN
  - employ feature Difference(painte_maxc1) compares pitch excursions on two tokens
  - use dependency syntax structure to define directly adjacent words
  - result shows: nominal modifiers to the noun receive the nuclear pitch accent
  - refine search by using POS tagging and syntax to exclude cases where the noun is modified by another noun

PaintE editor
- provides users with no or little knowledge about the PaintE model with the possibility to see the direct impact of changes in PaintE parameters
- tonal contours can be saved and used in search (e.g. similarity search)

ICARUS for Intonation

Graphical search

<table>
<thead>
<tr>
<th>Data extraction</th>
<th>Difference(painte_maxc1) $\ll$ 50.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\ll$</td>
<td>Difference(painte_maxc1) $\ll$ 50.0</td>
</tr>
<tr>
<td>$\leq$</td>
<td>Difference(painte_maxc1) $\leq$ 50.0</td>
</tr>
</tbody>
</table>

Result

ICARUS for intonation

provides easy access, visualisation and of automatically derived tonal parameters together with other annotation layers
- allows for various ways of audio-playback

Summary

ICARUS for intonation

provides easy access, visualisation and of automatically derived tonal parameters together with other annotation layers
- allows for various ways of audio-playback