Building Speech Databases of Mandarin Chinese

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Overview

1. Introduction
2. Spoken version of Chinese Treebank
3. Speech Database for mental disorders
4. Acknowledgements
5. References
1. Introduction

- Spoken version of Chinese Treebank
  - Collaborated with LDC
  - Finished
  - Preliminary research work

- Speech Database for mental disorders
  - One part of Major Program of National Social Science Foundation of China
  - Under construction
  - Seek advice for improvements
2. Spoken version of Chinese Treebank

Background
- Proposed and guided by Mark Liberman
- Text materials selected by Jiahong Yuan from Chinese Treebank
- Recorded by SJTU team by Hongwei Ding
  - Recruited more than 20 speakers (Class 2 Level 1 or better on *Putonghua Shuiping Ceshi* (national standard Mandarin proficiency test))
  - Only 16 speakers finished (100 hours)
- Automatically aligned by assistants of Mark Liberman
- Ready for research work

Potential Investigations
- To learn correlation between syntactic analysis and prosodic features
- To improve parsing by adding speech-derived features
- To predict prosody from text for TTS
- To study phonetics and phonology of Mandarin Chinese
Investigation of Tones in Text

- Word segmentation
  - Automatically conducted with tools
  - Manually corrected
  - Compared with results in Treebank (will be done)

- Text-to-pinyin conversion
  - Automatically conducted with tools
  - Manually corrected

- Measurement of occurrences of tones in text
  - Each tone in isolation → Tone 4 most frequent
    - (Hou & Huang, 2020)
  - Disyllabic tones → 2\textsuperscript{nd} syllable is usually Tone 4 with 4+4 as most frequent
2.2 Investigations of Tone 4

Questions
- Why does Tone 4 appear so frequently in Mandarin Chinese?

Possible explanations
- Tone 4 is distinctive from other Tones
- Tone 4 is easy to segment when heard in sequence

Evidence from other Investigations
- Tone 4 (high-falling) → most salient for Mandarin Chinese
  a) Tone 4 alone can produce observed language differences between English and Mandarin Chinese (Keating & Kuo, 2012)
  b) **Tone 4 is also favored by Mandarin Chinese speakers to produce alphabets in alphabetical words** (Ding et al. 2017, 2020)
  c) **Tone 4 is also responsible for Chinese-accented German and English** (Ding et al. 2012a)
  d) Tone 4 is specially difficult for German learners of Mandarin Chinese (Ding et al. 2012b)
2.2 Investigations of Tone 4

**Tonal Adaptation of Disyllabic Letter-Character Pattern in Mandarin Alphabetical Words (MAW) (Ding et al. 2020)**

Figure 1: Number of preferred tonal choices for each letter across different dialects in all tasks.

**MAW: L+C (Letter + Character)**
Adaption to Chinese phonological system is most probable

G: Guangdong
N: Northern China
S: Shanghai

For northern speakers, Tone 4 exceeded 60% for 6 (B, D, E, G, P and T) out of 13 letters, which end with front vowel /i/
2.2 Investigations of Tone 4

A Phonetic Investigation of Intonational Foreign Accent in Mandarin Chinese Learners of German (Ding et al. 2012)

- German truncates falling accents and falls do not become steeper but simply end earlier → High falling tones are rare in German speech. (Grabe, 1998)
- Mandarin L2 learners tend to use high-falling pitch accent to stress syllables, which is not popular in German.
- German sentences with high-falling tones (similar to Tone 4) produced by Mandarin learners are regarded as having Chinese-accent.
Extend Study from Text to Speech

- Acoustics in phonetics and phonology
  - Syllable level (esp. Tone 4)
  - Word level
    - Disyllabic words (e.g. Sandhi rules)
    - Trisyllabic words (e.g. 2+1, 1+2)
    - Multisyllabic words
    - Neutral tones
    - ...
  - Phrase level
  - Utterance level
1. Recordings from mental disorders
   - Patients include
     - schizophrenia
     - depression
     - bipolar disorder
     - anxiety disorder
     - Alzheimer
   - Materials include
     - Clinical interviews
     - Reading
     - Speaking

2. Recordings from controlled groups
3. Speech Database for mental disorders

- **Recordings from controlled groups (our plan)**
  - Materials include
    - Questions similar to clinical interviews
    - Reading of prosodic passages
    - Speaking (picture description)
  - Time
    - One hour per speaker
  - Materials
    - Same for all controlled groups
3. Speech Database for mental disorder

- Picture description

- Yes, they have experiences
3. Speech Database for mental disorder

- Picture description

- No, little experience
3. Speech Database for mental disorder

Questions

- Time
  - One hour per speaker?

- Materials
  - Same for all controlled groups?

- Picture description?
  - Better pictures (with Chinese elements, and for specific ages)?
  - New pictures from Mark Liberman

- Mode
  - Audio only or Audio + Visual?
Much of the work has been collaborated with

Linguistic Data Consortium
University of Pennsylvania

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Hong Kong Polytechnic University

Thanks to all those who have contributed in the work
6. References


Thank you for your attention

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