LING 120:
Language and Computers

Semester: Fall '17

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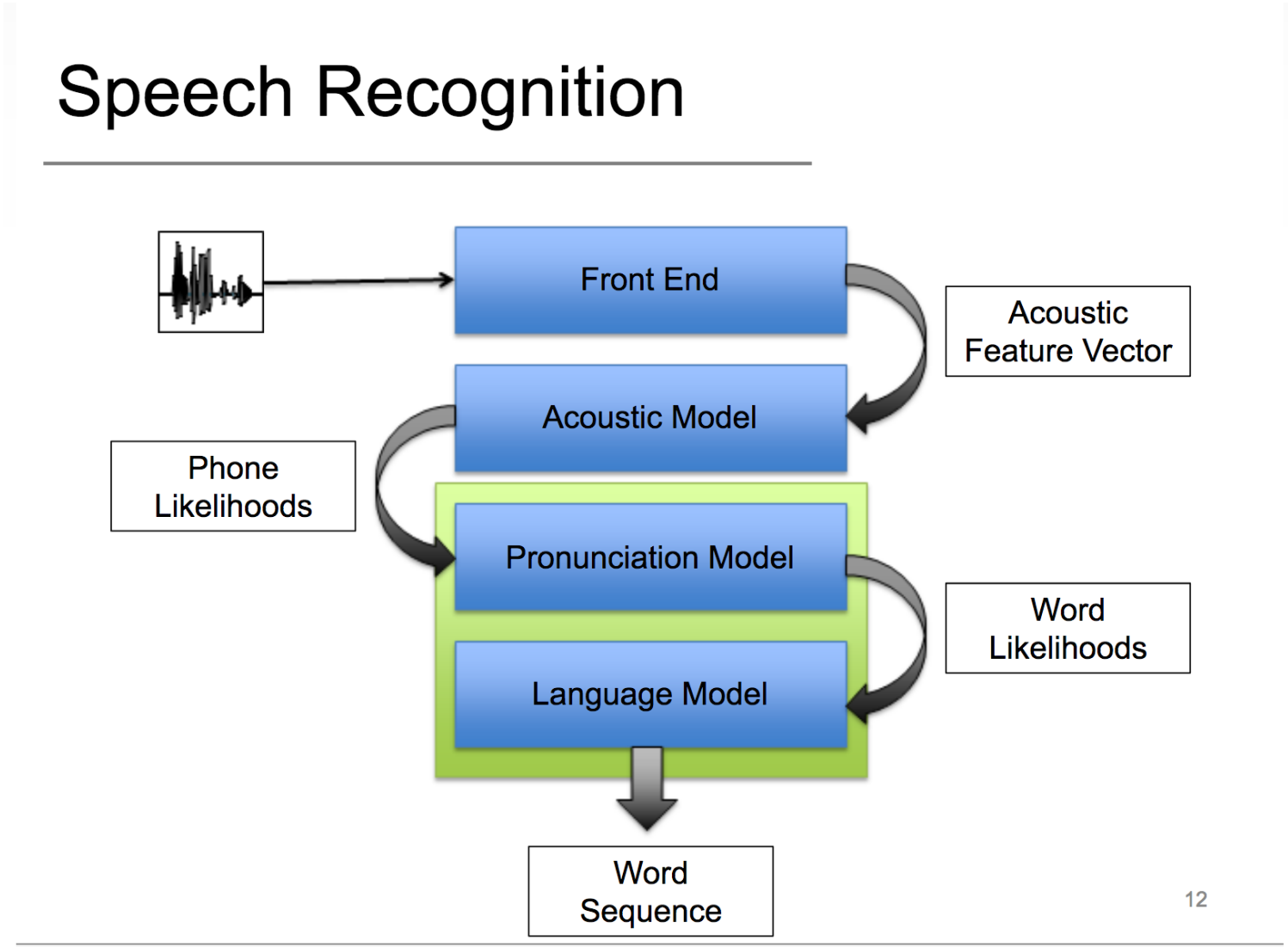
8 November 2017

Outline

- Recap of last class
- Speech Synthesis
- Group exercise on scoring speech for proficiency
- Next class: Conclusion of speech processing

Automatic Speech Recognition - Recap

ASR general process



source: Andrew Rosenburg's Speech processing lecture.

Evaluation of ASR

- Word Error Rate
- Sentence Error Rate
- In the case of dialog systems involving spoken input: concept error rate

Question from last class

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- Microsoft Research-India's CodeMixing project: `https://pocomixmaadi.wordpress.com/` and the post on Pronunciation modeling for Code-mixing - `https://goo.gl/ijiK9M`

ASR news from Yesterday

Identifying the songs that are playing in the background!

- http://mashable.com/2017/11/07/google-assistant-android-roll-out

Speech Synthesis

source: Speech Synthesis, Chapter 8 in Speech and Language Processing by Jurafsky and Martin, 2nd Edition.

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- How would we evaluate SS?

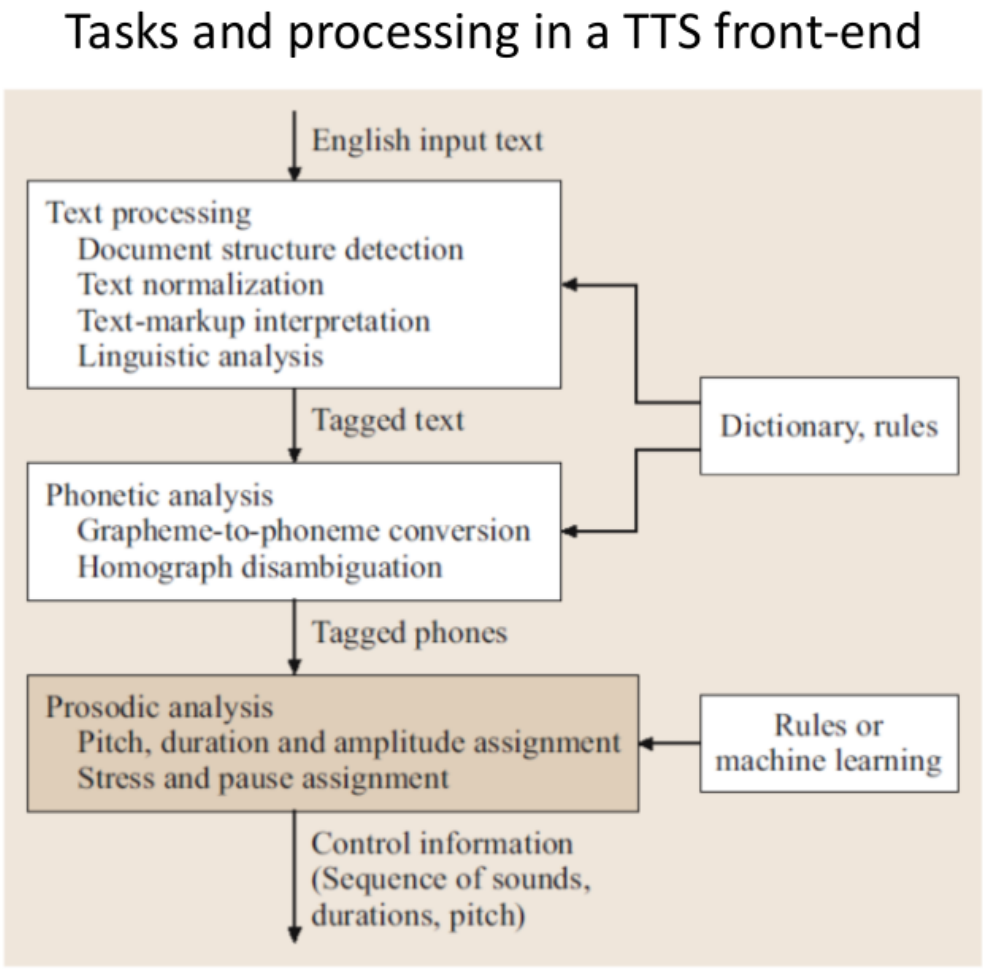
Uses of Speech Synthesis

- Dialog agents design
- Support speech impaired patients with communication aids `https://www.youtube.com/watch?v=UErbwiJH1dI` - Stephen Hawking's speech synthesizer.
- For people who cannot read (and also perhaps blind people?) - as a means to get information
- in Language tutoring (to teach how to pronounce correctly?)

Challenges for Speech Synthesis

- Breaking text down into sounds
- Mapping sound sequences to correct pronunciation (based on context)
- Getting the intonation, prosody etc right.
- Converting to a proper waveform that maps to human language words
- Not sounding too mechanical
- Some languages have straight forward pronunciation. Some languages do not.
- Some languages Tonal i.e., depending on tone, word meaning changes (e.g. Chinese)

Making of a speech synthesizer



[Schroeter, 2008, in Benesty et al., (Eds)]

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- text processing: identifying sentence and word boundaries, pronunciation, abbreviations, symbols (dollar sign) etc. Converting Mr. to Mister, numbers to word form, knowing what to discard (metadata in emails etc) etc.

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- waveform synthesis based on all the above steps

What resources do we need?

- text processing: lists of symbols, abbreviations etc, their word equivalents, sentence and word segmentation programs etc.
- phonetic analysis: pronunciation dictionaries
- prosodic analysis: pronunciation dictionaries + knowledge about pronunciation in context.
- waveform synthesis: usually needs hours and hours of recordings like in ASR (preferably from one person or two, which is not like ASR!), and some way to store the mapping between words/phrases and sounds.

There "where do I get so much data" question

https://research.googleblog.com/2015/09/crowdsourcing-text-to-speech-voice-for.html

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- Quality: ask several people and get a mean opinion score.
- Comparing 2 systems: play both and ask humans which one is better

A historical perspective after this background

- Voder, early speech synthesizer from Bell Labs (1939): `https://www.youtube.com/watch?v=0rAyrmm7vv0`
- Ordering a Pizza with a computer voice (1974): `https://www.youtube.com/watch?v=94d_h_t2QAA`
- More such stuff: See the History section in Wikipedia page: `https://en.wikipedia.org/wiki/Speech_synthesis`

Speech Synthesis in Real World

- Google, Microsoft, IBM - all major IT companies have a speech synthesizer software that others can also use in their own programs.
- Google Translate, Maps have one version of this for multiple languages. (Let us take a look at translate's SS)
- Siri's responses to you won't happen without some form of synthesis
- This is not exactly synthesis - but Waze allows you to record your own voice and uses that to give directions later.
- Synthesizing your own voice back to you?: `lyrebird.ai`, `goldenspeaker.las.iastate.edu`

Attendance Exercise

Work in groups of 2–4 people

- We briefly talked about an automated scoring system in text classification class (i.e., classifying English writing into beginners, intermediate, advanced learners) like in exams like GRE, TOEFL etc.
- Scenario: Test taker gets a question, they respond with, say, a 1 minute speech on that, and you get the speech file.
- If we were to do the same kind of classification system with with these files, what do we need?
- What resources do I need for such a classifier? What kind of features should I extract? Once I get all the "features", can I use same classification algorithms and evaluation metrics as for written responses?
- Hint: We already saw speech recognition is possible even with a audio file as input (swiftscribe.ai demo)