Introduction

Notes on Spoken Language Processing

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Speech

- Speech communication is the preferred mode for human social bonding and information exchange.
- *That* extends from human-human to human-machine interaction.
- Today's computers lack the ability to speak, listen, understand and learn. They use GUI which rely on mouse and keyboard.
- Even though not matured enough, speech technology is finding its way into computers.

Speech Technology

- speech recognition

- speech synthesis

- speech coding

- speech understanding

- speaker recognition or verification

Foundation

- signal processing

- stochastic models

- acoustics

- natural language processing

- pattern classification

- pattern recognition

Speech Recognition

■ A source-channel model for speech recognition

$$W \ \rightarrow \ x \ \rightarrow \ X \ \rightarrow \ \hat{W}$$

where

$$\begin{aligned} W &: \text{ text} \\ x &: \text{ wave} \\ X &: \text{ feature} \\ \hat{W} &: \text{ recognized text} \end{aligned}$$

■ From x to X is called feature extraction.

■ From X to $\hat{W}$ is called decoding.

Challenges in ASR

- no clear boundary between the words
- large speech variety (style, vocabulary size, etc.)
- noise corruption
- limited by computational resources

Speech Synthesis

- Basic system for speech synthesis

$$W \rightarrow A \rightarrow B \rightarrow C \rightarrow x$$

where

W : raw text

A : tagged text

B : phone sequence

C : prosody-tagged phone sequence

x : wave

Challenges in Synthesis

- text normalization
- text analysis, parse
- prosody analysis
- concatenation issues

Spoken Dialogue Systems

- A spoken dialogue system uses speech as interface to communicate with users to fulfill their requests.

- Needs speech understanding to interprete utterances in context and take appropriate actions.

- Implemented for reservation systems (hotel, airlines, etc.), tourist information centers, and so on.

A Robot

- R: *Tell me a task, and I will do it for $5 per hour.*

- H: *Sounds great. Can you paint?*

- R: *My painting is of the highest quality.*

- H: *OK. See that paint brush and bucket of paint? Take them out and paint the PORCH.*

- R: *Your request will be fulfilled.* (An hour later) *The task is completed. Please deposit $5.*

- H: *Good deal! Come back again!*

- R: *(While leaving) Oh, by the way, it wasn't a PORSCHE. It was a Honda.*