Speech Recognition Techniques for a Sign Language Recognition System

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Introduction

- automatic sign language recognition system
- necessary for communication between deaf and hearing people
- continuous sign language recognition, several speakers, vision-based approach, no special hardware
- large vocabulary speech recognition (LVSR) system to obtain a textual representation of the signed sentences
- evaluation of speech recognition techniques on publicly available sign language corpus

Automatic Sign Language Recognition (ASLR)

- similar to speech recognition: temporal sequences of images
- important features
  - hand-shapes, facial expressions, lip-patterns
  - orientation and movement of the
- goal: find the model which best expresses the observation sequence

System Overview

Visual Modeling (VM)

- related to the acoustic model in ASR
- HMM based, with separate GMMs, globally pooled diag. covariance matrix
- monophone whole-word models
- pronunciation handling

Language Modeling (LM)

- according to ASR: LM should have a greater weight than the VM
- trigram LM using the SRILM toolkit, with modified Kneser-Ney discounting with interpolation

Features

- appearance-based image features: for baseline system
  - thumbnails of video sequence frames (intensity images scaled to 32x32 pixels)
  - give a global description of all (manual and non-manual) features proposed in linguistic

Experimental Results

Features	Dim.	[%WER]
frame intensity (w/o pronunciations)	1024	54.0
frame intensity (w/ pronunciations)	1024	37.0
frame intensity (w/ pronunciations + tangent distance)	1024	33.7
PCA-frame	110	27.5
PCA-frame, hand-position	112	25.3
PCA-frame, hand-velocity	112	24.2
PCA-frame, hand-trajectory	112	23.6
model-combination	2x100	17.9

Example Results

Correct Examples

IX-1P FIND SOMETHING-ONE	
IX-1P FIND SOMETHING-ONE	
JOHN FISH WONT EAT BUT	(
JOHN FISH WONT EAT BUT	(
LOVE JOHN WHO	
LOVE JOHN WHO	
JOHN BUY YESTERDAY WHAT	
JOHN BUY YESTERDAY WHAT	

Incorrect Examples

MARY VEGETABLE KNOW IX	
MARY VEGETABLE KNOW IX	

RWTH-BOSTON-104 Database

Corpus Statistics

	Training	Tes
sentences	161	40
running words	710	178
frames	12422	3324
vocabulary	103	65
singletons	27	9