A SPEAKER ADAPTATION TECHNIQUE FOR GAUSSIAN PROCESS REGRESSION BASED SPEECH SYNTHESIS USING FEATURE SPACE TRANSFORM

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Abstract

– Propose model adaptation technique for statistical parametric speech synthesis based on Gaussian process regression (GPR)
– Incorporate acoustic-feature-space linear transform that converts acoustic features of source speakers in training data into those of a target speaker
– Objective and subjective evaluations show that the proposed approach outperformed HMM-based speaker adaptation technique

Background

– GPR-based speech synthesis outperforms HMM-based one and gives comparable with, or higher performance than DNN-based one
– Conventional study focused on speaker dependent model

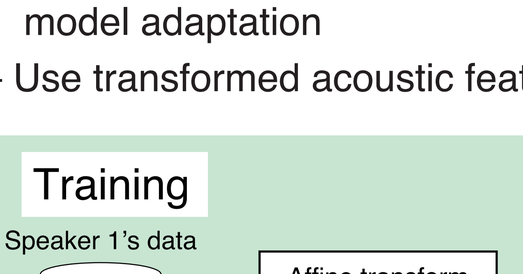
Purpose of this work

– Examine speaker adaptation technique for GPR-based synthesis

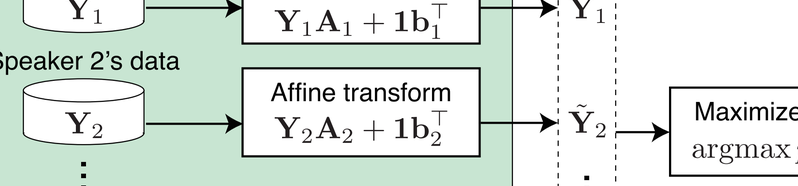
GPR-based speech synthesis

$$\mathbf{Y}_T|\mathbf{Y}_N \sim \mathcal{N}(\boldsymbol{\mu}, \boldsymbol{\Sigma})$$

$$\boldsymbol{\mu} = \mathbf{K}_{TN}(\mathbf{K}_N + \sigma^2\mathbf{I})^{-1}\mathbf{Y}_N$$



$$\boldsymbol{\Sigma} = \mathbf{K}_T + \sigma^2\mathbf{I} - \mathbf{K}_{TN}(\mathbf{K}_N + \sigma^2\mathbf{I})^{-1}\mathbf{K}_{NT}$$



$\mathbf{Y}_N$: Acoustic feature sequence of synthetic data
$\mathbf{Y}_T$: Output feature sequence of training data
$\mathbf{K}$: Gram matrix
σ^2: Noise power

– Kernel function is defined to represent the similarity of frames
– GPR can make use of raw speech data characteristics without parameterization using means and variances

Proposed method

– Employ affine transform to target speaker's feature space as the model adaptation
– Use transformed acoustic features as training data of GPR

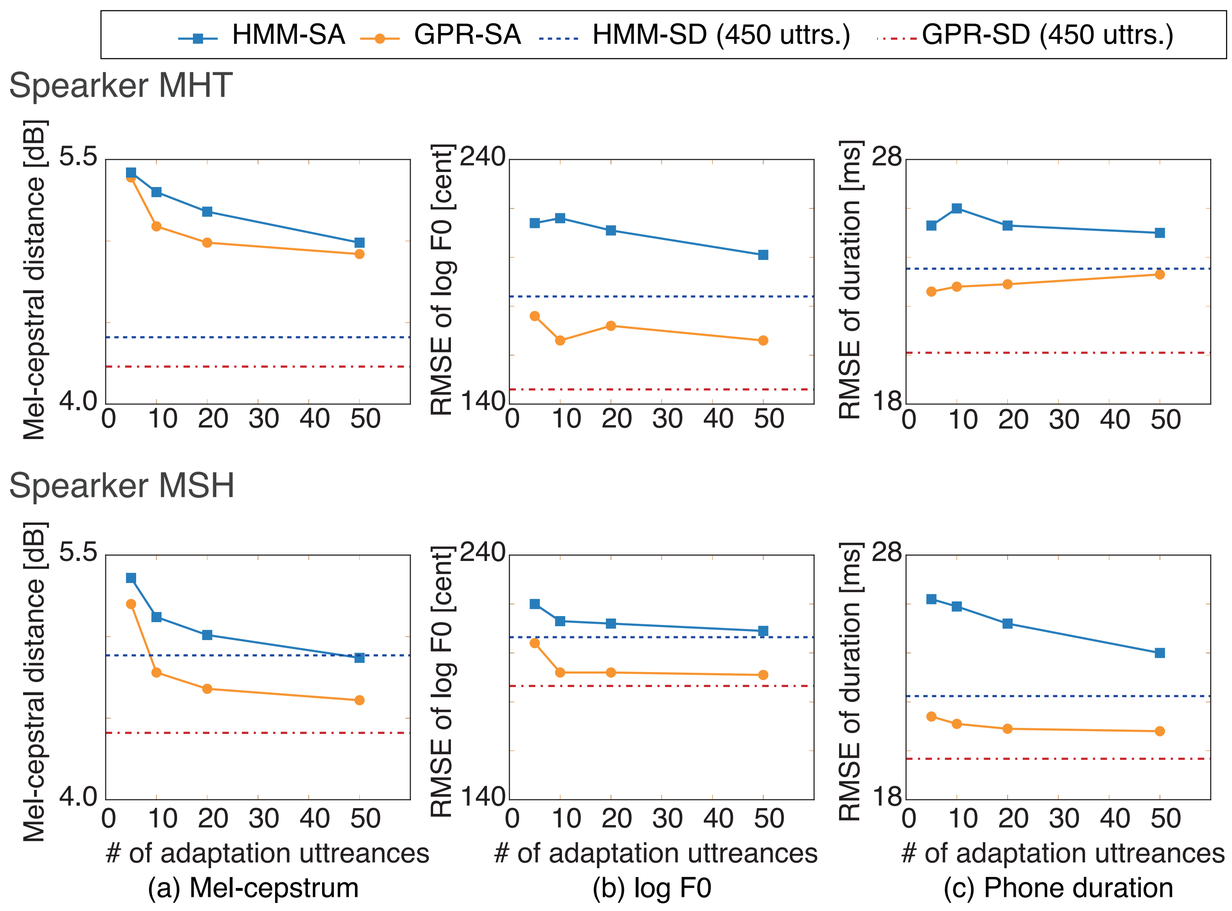
Experimental conditions

Database	ATR Japanese speech database set B
Training data	2 males (MHO, MMY), 450 utterances (approximately 40 min)
Adaptation data	2 males (MHT, MSH), 5, 10, 20, or 50 utterances (40sec. to 4min.)
Test data	53 utterances
Feature vector	0-39th mel-cepstrum, log F0, 5-band aperiodicity with their delta and delta-delta

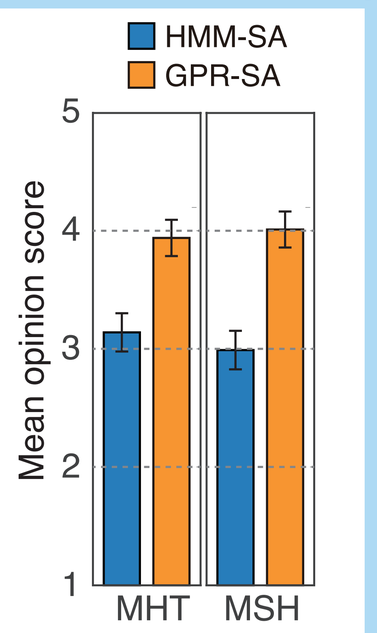
Methods

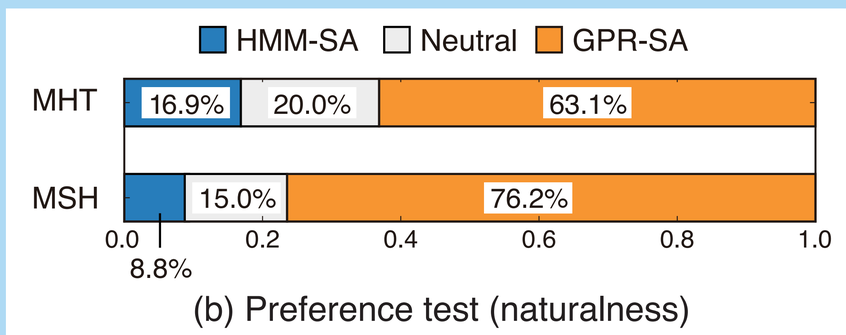
– **HMM-SA**: Adaptation using CSMAPLR+MAP
# of transforms was determined by state occupation count
– **GPR-SA**: Proposed method
Global tarnsform was used
– **HMM-SD**: Speaker dependent HMM trained by 450 utterances
– **GPR-SD**: Speaker dependent GPR trained by 450 utterances

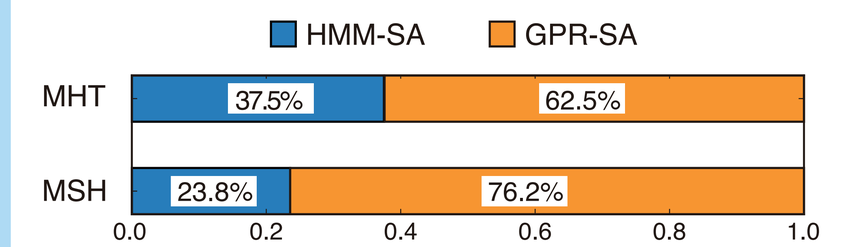
Results of objective evaluation



Results of subjective evaluation







Conclusion and future work

– Introduced feature-space transform matrices to target speaker's acoustic feature space
– Objective and subjective evaluation results showed that the proposed method outperformed the conventional HMM-based adaptation
– Future work will investigate the effect of the use of more speakers