Compensation of speech codec in speaker recognition

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Speaker recognition

- Speaker recognition tasks: speaker verification, speaker identification.
- Usage: electronic commerce, electronic banking transactions, forensic investigations.
- Problem: session variability. Codecs contribute to session variability.

Feature generation

MFCC got from signal: $x_1, \ldots, x_n$. Overlapping fragments (e.g. of length 20 ms, shift 10 ms). Each fragment maps to feature vector.

Feature generation

GMM supervector *M* [4].

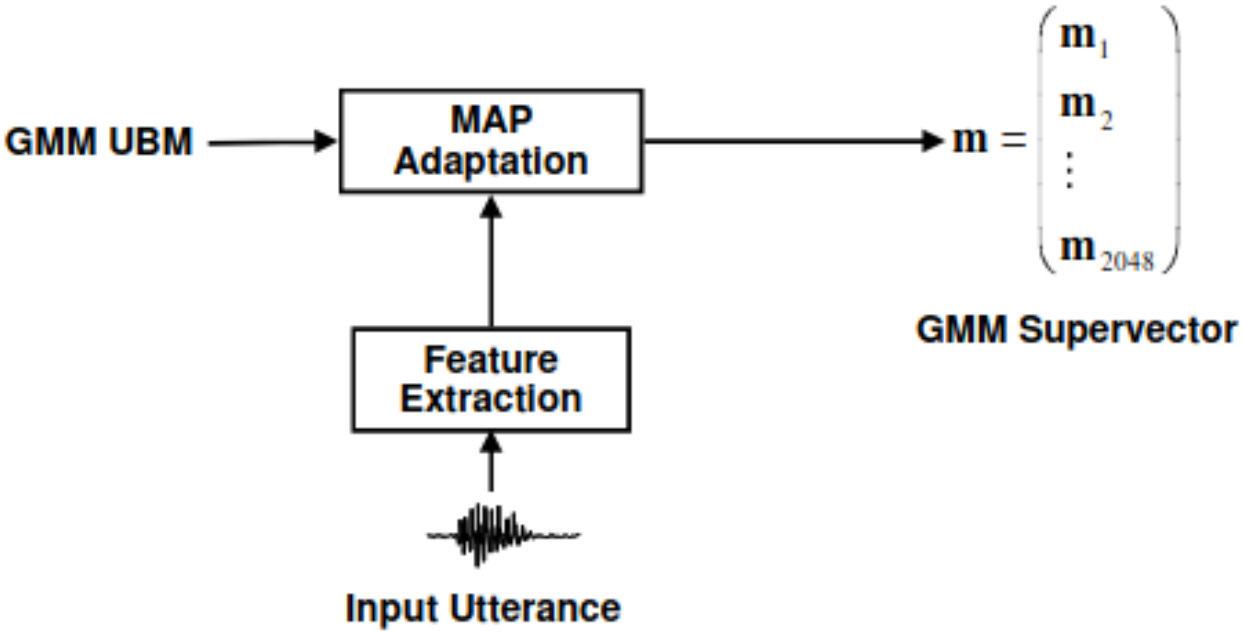


Fig. 1. GMM supervector concept

Joint factor analysis

- Classical approach. Speaker utterance is represented by a supervector

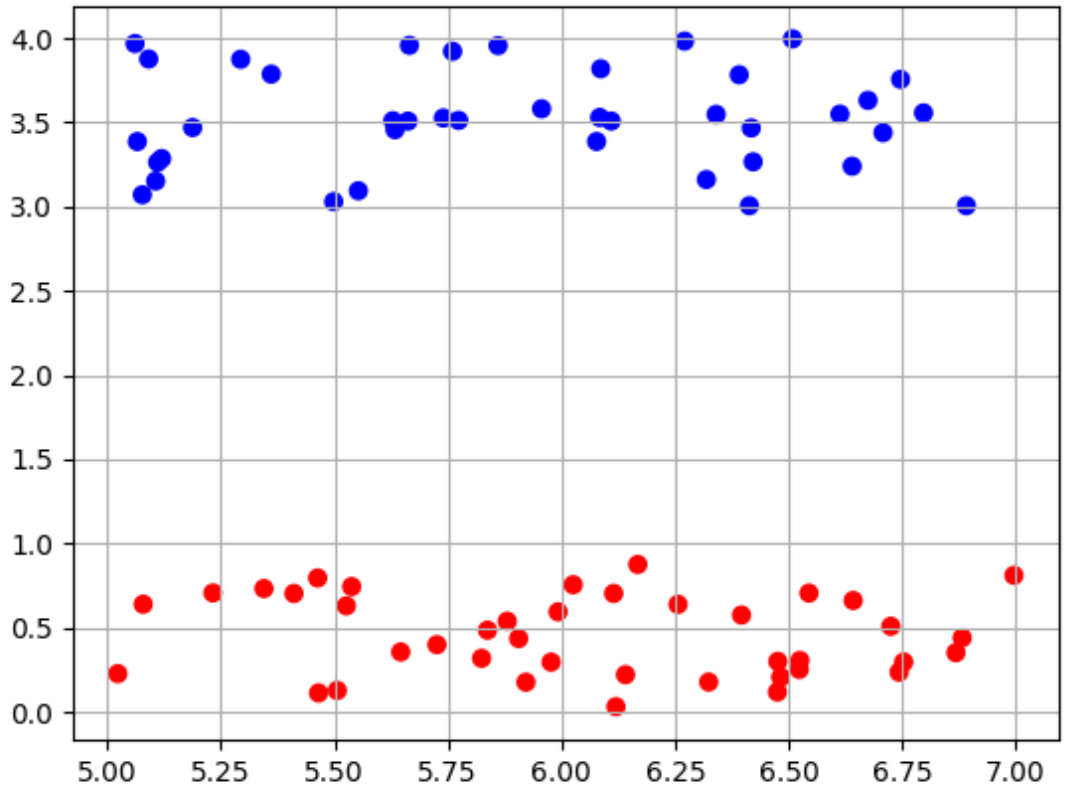
$$M = m + Ux + Vy.$$

  V defines speaker subspace, U defines session subspace.
- Drawback: channel factors contain information about the speaker.
- Total variability space:

$$M = m + Tw.$$

Session variability compensation

- NAP — Nuissance Attribute Projection.
- WCCN — Within Class Covariance Normalization.
- LDA — Linear Discriminant Analysis: find features that discriminate speakers best.



Codecs

- Codecs by sampling frequency: NB — narrow bandwidth (sampling frequency 8kHz), WB — broad bandwidth (sampling frequency 16 kHz).
- Codecs by bit rate: low or high bit rate.
- Codecs with higher bit rate affect speaker recognition less.
- NB codecs — worse recognition effectiveness.
- Some frequency bands more discriminative than others [3].

Experiments

- Data transmitted through a digital telephone network.
- First experiment: MOS quality measurement for different codecs. t
- Second experiment: influence of speech codec on speaker identification. 4 speakers, 7 codecs. High bit-rate codecs provide better speech quality and preserve better speaker discriminative capacity.
- Third experiment: NIST dataset, use of S-LDA variability compensation. Codecs G.722, GSM 6.20. S-LDA method improves speaker recognition.

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