A STUDY OF SPEAKER VERIFICATION PERFORMANCE WITH EXPRESSIVE SPEECH

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Motivation

Background:

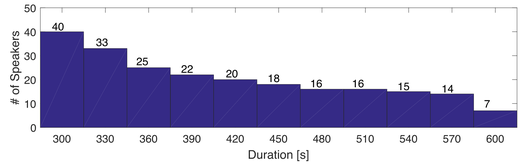
- Expressive speech introduces variations in acoustic features
  - Impacts performance of speaker verification systems
- Previous Work
  - Drop in performance when system trained with neutral speech and tested on expressive speech
- Limitations
  - Acted datasets
  - Limited number of speakers

Our Work:

- Analyze the effect of emotion on speaker verification performance
  - Naturalistic data from multiple speakers

MSP-PODCAST

- Emotional corpus being collected at UT-Dallas
  - We use subset – 40 speakers with >300s speech
- Multiple sentences from speakers appearing in various podcasts (2.75s – 11s)
- Annotated on Amazon Mechanical Turk
  - Primary Emotions : Angry, Neutral, Happy etc.
  - Arousal (1 –very calm vs 7 – very active)
  - Valence (1 – very negative vs 7 – very positive)
  - Dominance (1 – very weak vs 7 – very strong)



Number of speakers with at least x seconds of data

Methodology

Training Criterion:

- We use 150s of neutral speech, per speaker, for training the model

Criterion 1	Neu + 3 < x < 5	636
Criterion 2	Any + 3 < x < 5	188
Criterion 3	Neu + 2 < x < 6	194
Criterion 4	Any + 2 < x < 6	43

x ϵ {Arousal, Valence, Dominance}

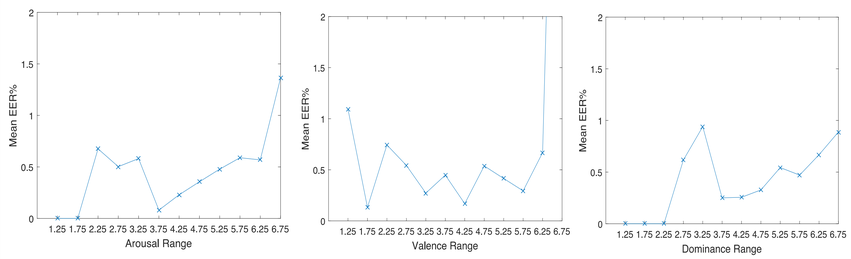
- i-Vector framework with probabilistic linear discriminant analysis (PLDA) back-end
- We extract a 13-dimensional MFCC with $\Delta + \Delta\,\Delta$ (39-D feature vector)
- We train a 256-mixture UBM using training data
- Dimension of i-Vector empirically set to 200

$$M = m + Tx$$

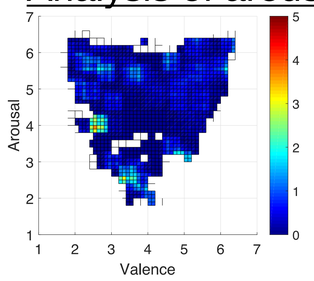
  - M – GMM super Vector
  - m – Mean vector constructed from UBM
  - T – Low- rank projection matrix
  - x – i-vector
- Dimension reduction with LDA
  - 200 → 39

Results

Individual emotions

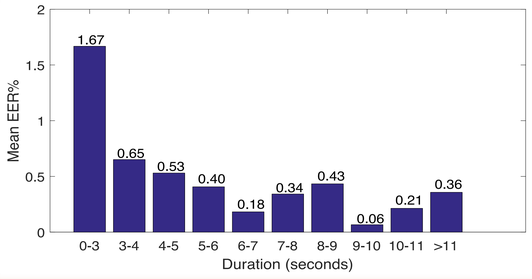


Analysis of arousal-valence space



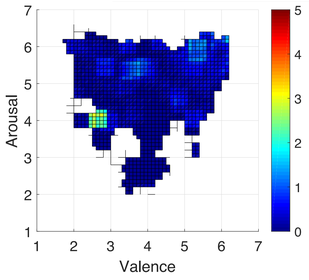
- Average of 0.5 x 0.5 window, shifted by 0.1
- EER low for neutral values of arousal, valence
- Higher EER as values deviate from neutral speech

Effect of duration of sentence



- Performance drop for short segments

After normalizing duration



- Create 5s training
  - Splitting long sentences
  - Concatenating turns with similar emotions
- Similar observations

Conclusions

- Speaker verification affected by expressive speech
- Higher errors on speaker verification when we deviate from neutral speech

Future Work

- We are annotating more data
- Study compensation techniques for emotional variability

80 speakers