EMOTION CLASSIFICATION USING SPEECH ACOUSTIC FEATURES AT VARIOUS TEMPORAL LENGTHS

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Expeditions in Computing

Introduction

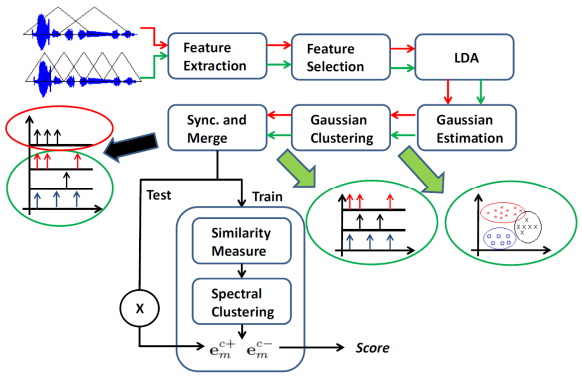
Human express their feelings through different forms of communication:

- Speech: explicit linguistic messages and implicit paralinguistic features.
- Gestures: hand motion, head orientation, etc.
- Writing: explicit messages, emoticons, etc.

Different emotional characteristics can be observed at different time scales [Busso et al. 2004].

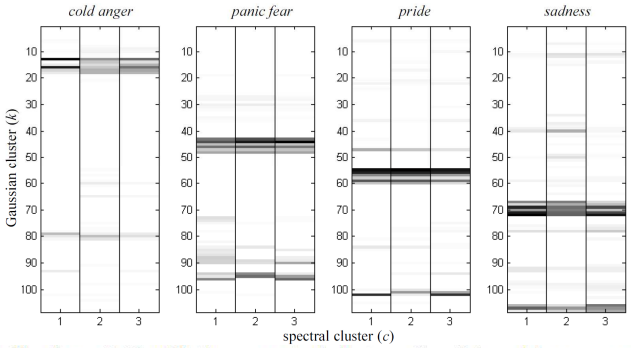
- At the phrasal level, average pitch and intensity are higher with the emotional state of *hot anger* than with other states [Sauter et al. 2010].
- At the phonemic level, spectral tilt and formant frequency amplitudes are significantly different for different emotional states [Lascarcyk et al. 2008].
- At a 30 ms analysis frame level, jitter and shimmer measurements are useful for the detection of *arousal* [Li et al. 2007].
- Moreover, other modalities use different analysis window lengths!

Proposed Method



Advantages:

- By using Gaussian clustering, it reduces the potential loss of information.
- By using the binary representation, the fusion of feature representation becomes an easy problem.



The visualization of $\mathbf{e}_m^{c+}$ with three spectral clusters $C = 3$ in cold anger, panic fear, pride, and sadness.

Database

The Geneva multi-modal emotion portrayals (GEMEP).

- 1,260 emotional utterances.
- 12,512 analysis frames with a 400 ms analysis window length.
- **12 emotional categories:** *amusement, anxiety, cold anger, despair, elation, hot anger, interest, panic, fear, pleasure, pride, relief, sadness.*
- **two affective dimensions:** *arousal, valence*.

Results

Experiment I: Classification without Fusion

Classification and detection results in unweighted average recall (UAR) using a Bayesian classifier (GMM) and the proposed method (BinF) at two temporal analysis lengths before fusion.

	Category		Arousal		Valence	
	UAR (%)	# mix.	UAR (%)	# mix.	UAR (%)	# mix.
GMM (400 ms)	36.7	96	76.7	16	76.0	16
BinF (400 ms)	**37.6**	72	**78.2**	12	**76.9**	12
GMM (phrase)	34.2	96	73.2	16	72.1	16
BinF (phrase)	**37.2**	36	**77.7**	12	**75.0**	12

Experiment II: Classification with Fusion

Classification and detection results in unweighted average recall (UAR) using the proposed method with fusion, and percentage points of improvement by fusion.

	Category	Arousal	Valence
UAR (%) (400 ms + phrase)	44.9	83.7	80.7
# mix.	108 (72+36)	24 (12+12)	24 (12+12)
Improvement (%)	7.3	5.5	3.8

Conclusions

An emotion classifier can improve its performance when speech is analyzed at the different timescales with fusion before a final classifier.

For a 12-way classifier, the unweighted accuracy is improved by 7.3 percentage points when compared to a system with a fixed analysis frame size.

For arousal and valence detectors, 5.5 and 3.8 percentage point improvements respectively are observed.