**Quadratic discriminant classifier (QDC)**

Emotional detection (neutral vs. emotional)

Goal: modeling the shape of the energy and F0 contours

Discriminant Analysis

- Emotion detection (neutral vs. emotional)
- Quadratic discriminant classifier (QDC)
- SVM achieves similar performance
- We evaluate lexicon-independent models
- Neutral speech with different lexical content
- Benchmark classifiers (QDC)
  - Trained with statistics from F0 and energy
  - Subset from IS challenge 2010
  - Forward feature selection
    - 20 for (F0) or (E)
    - 40 for (F0+E)

**FDA corpus [Liscombe et al., 2003]:**

- Sentences' durations are linearly warped
- Speaker-independent cross-validation
- Development, training, testing sets
- Emotional classes grouped into 1 class
- Trained with under sampling (100 times)

<table>
<thead>
<tr>
<th>Feature Set</th>
<th>FDA (F0)</th>
<th>FDA (E)</th>
<th>FDA (F0+E)</th>
<th>Ben. (F0)</th>
<th>Ben. (E)</th>
<th>Ben. (F0+E)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neutral</td>
<td>71.3 (3.6)</td>
<td>75.6</td>
<td>64.1 0.691</td>
<td>69.0 (9.7)</td>
<td>65.9 (7.3)</td>
<td>62.8 (8.1)</td>
</tr>
<tr>
<td>Emotional</td>
<td>75.9 (4.6)</td>
<td>80.0</td>
<td>69.2 0.742</td>
<td>65.9 (7.3)</td>
<td>67.3</td>
<td>66.6 0.566</td>
</tr>
<tr>
<td>Neutral &amp; Emotional</td>
<td>80.4 (4.8)</td>
<td>88.3</td>
<td>70.3 0.572</td>
<td>62.8 (8.1)</td>
<td>95.9</td>
<td>27.2 0.390</td>
</tr>
</tbody>
</table>

**EMO-DB corpus [Liscombe et al., 2010]:**

- FDA neutral models trained with WSJ1
- Time based segmentation (1 sec)
- Neutral and emotional classes based on averaged activation-valence scores
- Two-fold cross-validation (5 train, 5 test)

<table>
<thead>
<tr>
<th>Feature Set</th>
<th>FDA (F0)</th>
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<th>FDA (F0+E)</th>
<th>Ben. (F0)</th>
<th>Ben. (E)</th>
<th>Ben. (F0+E)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neutral</td>
<td>63.6 0.663</td>
<td>63.6</td>
<td>63.6 0.656</td>
<td>58.4</td>
<td>54.9</td>
<td>54.8 0.548</td>
</tr>
<tr>
<td>Emotional</td>
<td>57.6 0.507</td>
<td>57.6</td>
<td>59.0 0.529</td>
<td>57.4</td>
<td>56.3</td>
<td>56.3 0.563</td>
</tr>
</tbody>
</table>

**Results & Conclusions**

- **EMO-DB:**
  - IPCA projections increase performance up to 17.6%
  - The IPCA classifiers are more consistent (lower std)

- **SEMAINE**
  - Classifiers with IPCA projections are 6.9% better than benchmark
  - Performance is not affected by shorter segments (results on paper)
  - Global statistics do not capture all emotional cues

**Future Directions:**

- Evaluation of the approach with prosodic & spectral features
- Detect localized emotional information in dialogues

**References**

- Erik Jonsson School of Engineering & Computer Science University of Texas at Dallas Richardison, Texas 75083, U.S.A.

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