Detecting Dementia from Face in Human-Agent Interaction

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1. Motivation

• Early detection of dementia (or Mild Cognitive Impairment: MCI) by computer agents [Mirheidari et al., 2019]
• Multimodal features [Tanaka et al., 2017] and speech / language features [Ujiro et al., 2018]
• This study: focus on facial features

2. Methods

Participants

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Age (SD)</th>
<th>MMSE (SD)</th>
<th>Education (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>non-dementia</td>
<td>12</td>
<td>74.5 (4.3)</td>
<td>27.5 (1.8)</td>
<td>8.8 (2.6)</td>
</tr>
<tr>
<td>dementia</td>
<td>12</td>
<td>75.9 (7.3)</td>
<td>21.2 (5.1)</td>
<td>13.9 (3.8)</td>
</tr>
</tbody>
</table>

Data collection

Q1) What’s the date today?
Q2) Tell me something interesting about yourself
Q3) How did you come here today?

Facial expression modeling

• Lip activity (entropy-based)
  
  first lip activity (response time)

  pre- post- time

• OpenFace [Tadas et al., 2016]
  Facial action units (AU) intensity
  Eye-gaze estimation
  Head pose

  (mean and SD values)

• Dementia classification model
  L1 regularized logistic regression

3. Results

• Areas under ROC curves: 0.78 (Q1), 0.82 (Q2)
• Highly weighted features:
  [Q2] Post-AU17 (SD), Pre-AU14 (SD), Post-AU45 (SD), Post-AU10 (SD), Pre-AU04 (SD), Pre-AU12 (SD), Post-AU09
  [Q1] Post-AU09, …, response time

4. Conclusions and Future Works

• Dementia might be detected by facial expression
• Yet, the AUC was less than multimodal (0.93) [Tanaka et al., 2017]
• Compare to subjective face evaluation by psychiatrists

References