Detecting Dementia from Face in Human-Agent Interaction

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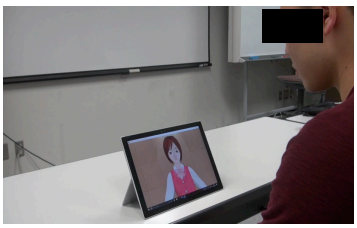
1. Motivation

- 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

	N	Age	MMSE	Education
non-dementia	12	74.5 (4.3)	27.5 (1.8)	8.8 (2.6)
dementia	12	75.9 (7.3)	21.2 (5.1)	13.9 (3.8)

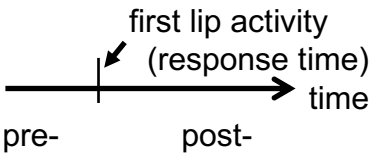
Diagnosis based on DSM-IV-TR
MMSE: Mini-mental state examination (max: 30)

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)



- Dementia classification model
  L1 regularized logistic regression

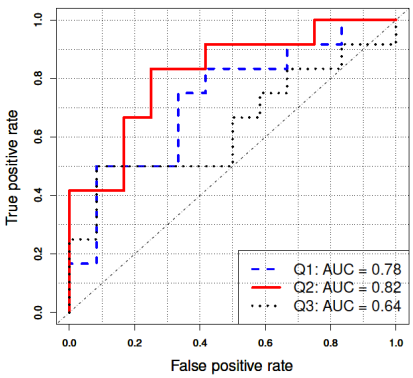
- OpenFace [Tadas et al., 2016]
  Facial action units (AU) intensity
  Eye-gaze estimation
  Head pose

(mean and SD values)

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

[Mirheidari et al., 2019] B. Mirheidari,D. Blackburn, T.Walker, M. Reuber, and H. Christensen. Dementia detection using automatic analysis of conversations. Computer Speech and Language 53 (2019), 65–79.
[Tanaka et al., 2017] H. Tanaka, H. Adachi, N. Ukita, M. Ikeda, H. Kazui, T. Kudo, and S. Nakamura. Detecting Dementia Through Interactive Computer Avatars. IEEE Journal of Translational Engineering in Health and Medicine 5 (2017), 1–11.
[Ujiro et al., 2018] Tsuyoki Ujiro, Hiroki Tanaka, Hiroyoshi Adachi, Hiroaki Kazui, Manabu Ikeda, Takashi Kudo, and Satoshi Nakamura. Detection of Dementia from Responses to Atypical Questions Asked by Embodied Conversational Agents. In Proc Interspeech (2018), 1691–1695.