Detection of dementia from responses to atypical questions asked by embodied conversational agents
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Introduction

Overview

Suspected of dementia

No suspected of dementia

Aim
Early detection of dementia (Don’t need to go to hospital!)

Proposal
● During interaction with agents
● Tools that can be used repeatedly for daily use

Detection of dementia from responses to atypical questions

Typical question:
Based on neuropsychological tests
(e.g. MMSE: What’s the date today?)

Atypical question:
Not based on neuropsychological test

Neuropsychological tests
Frequently used screening for dementia
(e.g. MMSE [Folstein et al. 1975], MMSE-R [Wocchler 1997])

Experts are necessary for these tests
Need to go to hospital

Related work
[Roark et al. 2011], [Aramaki et al. 2016], [Tanaka et al. 2017]

Some previous studies show possibilities of detecting dementia from speech features and language features

Same interaction patterns and questions
These studies are not suitable for daily use

Method

Embodied conversational agents

Detail of participants

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Age mean (SD)</th>
<th>MMSE mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-dementia</td>
<td>12</td>
<td>74.3 (4.3)</td>
<td>27.5 (1.6)</td>
</tr>
<tr>
<td>Dementia</td>
<td>12</td>
<td>75.9 (7.6)</td>
<td>21.2 (5.1)</td>
</tr>
</tbody>
</table>

Diagnosis is based on DSM-IV-TR

Question set

Content
Q1: Please tell me about your family.
Q2: Please tell me something that you feel is stressful in your life.
Q3: What is your hobby?
Q4: What is your favorite song?
Q5: Please tell me about your past life.
Q6: Please tell me about your favorite song.
Q7: Tell me about your hobbies.
Q8: Who is Japan’s Prime Minister?
Q9: What is your favorite song?
Q10: Is your health good?
Q11: Are you left-handed or right-handed?
Q12: Do you sleep well?

These questions are based on consultations with neuropsychologists

System

Feature extraction
Speech features
Answer time, Gap, Power, Pause, F0

Language features
Speech rate, Tokens, Fillers, POS (noun, verb, adjective, adverb)

Analysis of "Gap" at each questions
No difference between the groups
Q5, Q6, Q7
About the past story unlike other questions
Q11, Q12, Q13
Closed-ended questions are not effective
Q13

Easy to answer with short sentences

Conclusion

Dementia can be detected even when using speech features and language features with atypical questions (AUC: 0.95, Unweighted accuracy: 0.92)

The result will change depending on question types

Possibility of measuring the degree of dementia from memory disorder

Future work

Analyze image features
E.g. facial expressions, eye movements

Confirm the relationship between memory disorder and degree of dementia

References