Identifying Easy Indicators of Dementia

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Identifying Early Indicators of Dementia

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RATIONALE
- The increasing prevalence of dementia among the elderly population is a major societal challenge, leading to a growing demand of diagnostic services for defects in memory and cognitive performance.
- **Mild Cognitive Impairment (MCI)** is an intermediate state of cognitive functionality between the changes observed with aging (non-dementia) and those with dementia often due to Alzheimer disease (AD). The range of variation in scores of cognitive tests for MCI, often due to overlaps with that of healthy aging people, limiting the clinical use these tests in detecting early indicators of cognitive impairment.
- While recent work in analysing textual transcripts of spoken language has opened up new perspectives for classifying "speech", they are limited to binary classes of dementia under control vs AD-positive.
- We design a multi-class classifier (as control, MCI, Probable AD) to differentiate among the stages of AD on the clinical Pitt Corpus of the DementiaBank1 created during a longitudinal study conducted by the University of Pittsburgh School of Medicine on Alzheimer’s disease and related Dementia.

DEMENTIABANK
The DementiaBank dataset contains 242 Control, 43 MCI and 235 Probable AD interviews that were conducted in English and were based on the description of the Cookie-Theft picture [Figure 1] that is part of the Boston Diagnostic Aphasia Examination. During the interview, patients viewed the picture and were told to discuss everything they could see happening in the picture. The patients' verbal utterances were recorded and then transcribed in a format with the equivalent text.

DATA VISUALIZATION
- Simple word clouds or TF-IDF algorithms fail to reveal differences between the three classes.

PIPEDLINE
- Patient interviews
- Audio Data
- Textual transcripts
- Feature Engineering
- Train Models
- Evaluation

RESULTS

<table>
<thead>
<tr>
<th>Algorithm</th>
<th>Control</th>
<th>MCI</th>
<th>Probable AD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Precision</td>
<td>Recall</td>
<td>F1-Score</td>
</tr>
<tr>
<td>Logistic Regression</td>
<td>0.78</td>
<td>0.80</td>
<td>0.79</td>
</tr>
<tr>
<td>Doc2Vec</td>
<td>0.69</td>
<td>0.65</td>
<td>0.67</td>
</tr>
<tr>
<td>Neural Network</td>
<td>0.78</td>
<td>0.82</td>
<td>0.80</td>
</tr>
</tbody>
</table>

Table 1: Classification Results in a multi-class setting

DISCUSSION
- Our preliminary results show that despite the limitations of a small dataset, it is possible to detect early indicators of dementia i.e. Mild Cognitive Impairment from written descriptions of speech.

ACKNOWLEDGEMENT
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1 https://dementia.talkbank.org/access/English/Pitt.html