Multimodal Classification of Alzheimer's Disease and Mild Cognitive Impairment
Zhang et al., NeuroImage January 2011

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OVERVIEW

• Context and rationale
• Methods
• Results
• Review
Context and rationale

Alzheimer’s Disease (AD)
Mild Cognitive Impairment (MCI)

http://www.nature.com/focus/neurodegen/content/images/nrn1433_f1.html
Context and rationale

Surrogate markers – MRI

Context and rationale

Surrogate markers – FDG PET

Context and rationale

Surrogate markers – CSF

http://brain.oxfordjournals.org/content/130/11/2837.full
Context and rationale

Standard methods

Classificator

Healthy  MCI  AD
Context and rationale

Objectives

Classificator

Healthy  MCI  AD

http://www.mybraintest.org/2011/06/
Methods

Patients

ADNI population

202 subjects

- 52 healthy controls
- 99 MCI
- 51 AD

202 subjects

52 healthy controls

99 MCI

51 AD
Methods

Measurements and processing

- Data processing: parcellation of MRI and PET in 93 regions of interest

- Classification healthy / AD and healthy / MCI:
  - Using only MRI or PET or CSF markers
  - Using them in combination

- Comparison in terms of accuracy / sensibility / specificity
Results

Zhang et al., NeuroImage 2011
# Results

<table>
<thead>
<tr>
<th>Methods</th>
<th>AD vs. HC</th>
<th>MCI vs. HC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ACC (%)</td>
<td>SEN (%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MRI</td>
<td>86.2</td>
<td>86</td>
</tr>
<tr>
<td></td>
<td>(82.9–89.0)</td>
<td>(82.7–88.7)</td>
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<tr>
<td>CSF</td>
<td>82.1</td>
<td>81.9</td>
</tr>
<tr>
<td></td>
<td>(80–84.9)</td>
<td>(80–84.7)</td>
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<tr>
<td>PET</td>
<td>86.5</td>
<td>86.3</td>
</tr>
<tr>
<td></td>
<td>(82.9–90.5)</td>
<td>(82.7–90.3)</td>
</tr>
<tr>
<td>Combined</td>
<td>93.2</td>
<td>93</td>
</tr>
<tr>
<td></td>
<td>(89.0–96.5)</td>
<td>(88.7–96.3)</td>
</tr>
<tr>
<td>Baseline</td>
<td>91.5</td>
<td>91.4</td>
</tr>
<tr>
<td></td>
<td>(88.5–96.5)</td>
<td>(88.3–96.3)</td>
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<tr>
<td></td>
<td>72.0</td>
<td>78.5</td>
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<tr>
<td></td>
<td>(68.4–74.7)</td>
<td>(75.6–80.6)</td>
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<td>71.4</td>
<td>78</td>
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<td></td>
<td>(68.2–73.3)</td>
<td>(75.6–79.4)</td>
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<td>71.6</td>
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<td>(67.4–74.7)</td>
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<td>76.4</td>
<td>81.8</td>
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<td>(73.5–79.7)</td>
<td>(79.4–84.4)</td>
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<tr>
<td></td>
<td>74.5</td>
<td>80.4</td>
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<tr>
<td></td>
<td>(71.9–78.2)</td>
<td>(78.3–83.3)</td>
</tr>
</tbody>
</table>

*AD = Alzheimer’s Disease, MCI = Mild Cognitive Impairment, HC = Healthy Control, ACC = classification ACCuracy, SEN = SENsitivity, SPE = SPEcificity.*

Zhang et al., NeuroImage 2011
Results

Zhang et al., NeuroImage 2011
Review

• Methodology
  ◦ Convincing approach on large samples
  ◦ Basic and improvable image processing
  ◦ Are results statistically significant?

• Results
  ◦ Slight benefit of data combination over raw data
  ◦ Poor specificity for healthy / MCI classification
  ◦ Is there a real clinical benefit?
Take home message

- MRI + PET + CSF classifies better than one modality alone
- Still needs further investigations
- Clinical benefit regarding early diagnosis of AD?
Bibliography

“Multimodal classification of Alzheimer’s disease and mild cognitive impairment” Daoqiang Zhang et al., NeuroImage January 2011