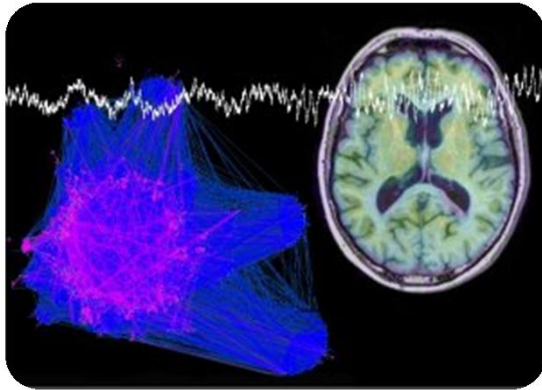


Business from technology

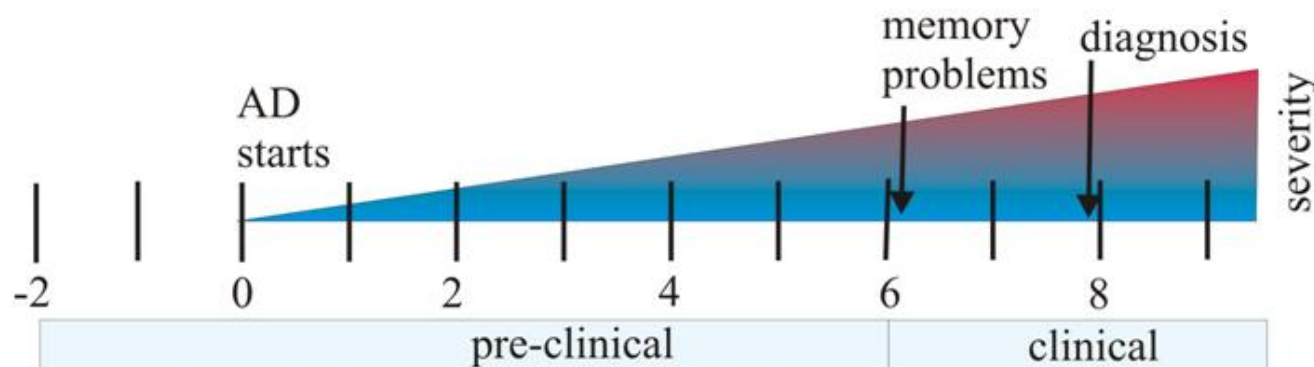


Predicting Alzheimer's Disease - PredictAD

Principal Scientist Jyrki Lötjönen
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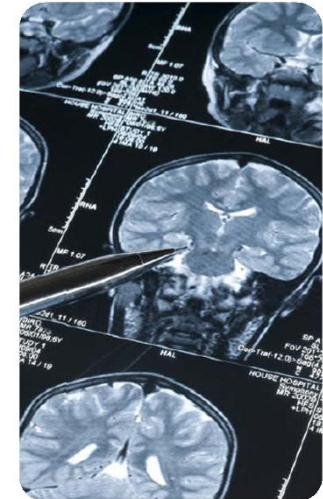
Motivation - Alzheimer's Disease

- Alzheimer's disease will be one of the main health issues of the next decades:
 - costs are 1 % of the gross-domestic product (GDP) of the whole world, and
 - 27 million people (2006) -> 114 million (2050).
- Delaying both the onset and progression only by modest one year would reduce the number of Alzheimer's cases by 10 %.
- Current medical problems:
 - no effective medication but new drugs and other treatments under development, and
 - **no objective and efficient early diagnostics.**



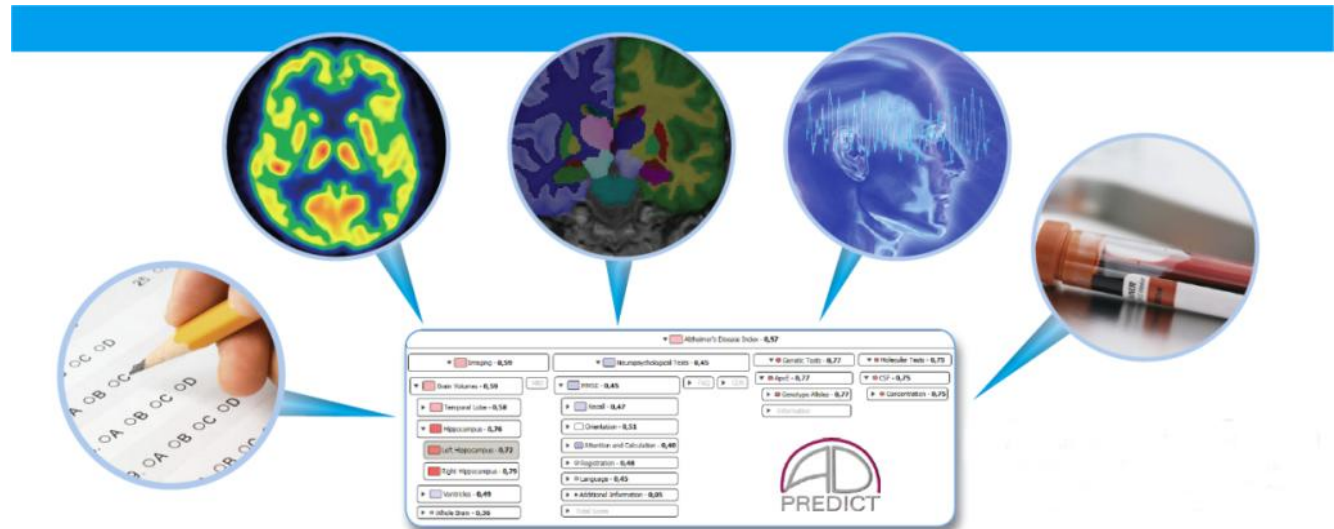
ICT-based solutions for diagnostics using big data?

- In healthcare domain, **huge amounts of data** are acquired from patients: various databases contain **hidden information** about variability of humans that could be utilized in diagnostics and follow-up of disease progression.
- There is a **great need** for objective diagnostics and follow-up of treatment efficacy but ...
 - human body is a highly complex system, i.e., we need better **understanding of diseases** and **better biomarkers** for early diagnostics,
 - **data quantification** is difficult, e.g., automated image segmentation tools are rare in clinical practice,
 - changing the clinical world by ICT- based solutions require that the **clinical needs** are really understood and met, and
 - there are no solutions for **integrating heterogeneous data** (holistic view) although 85 % of clinicians would like to have.



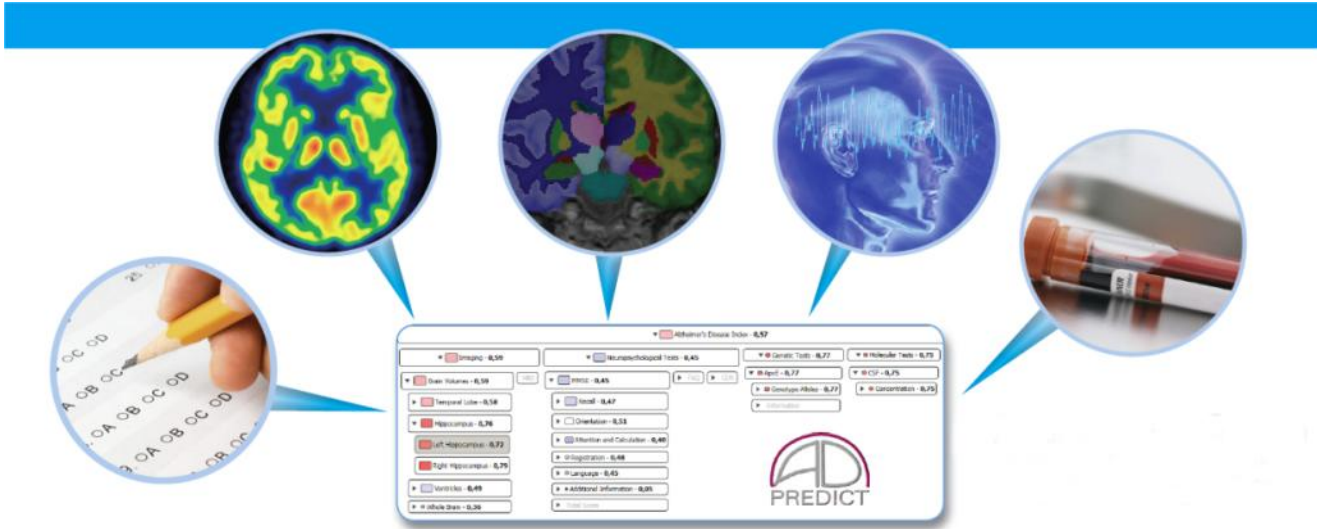
PredictAD – Objective diagnostics

- **PredictAD** (www.predictad.eu, 6/2008-11/2011, 4 M€) developed **objective methods for the diagnostics of Alzheimer’s disease**:
 - tools for extracting biomarkers from the blood, electrophysiology and imaging (MRI & PET),
 - a tool for integrating the biomarker information and forming a holistic view of the patient.



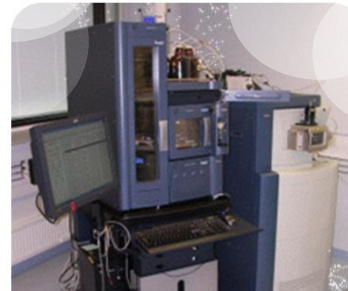
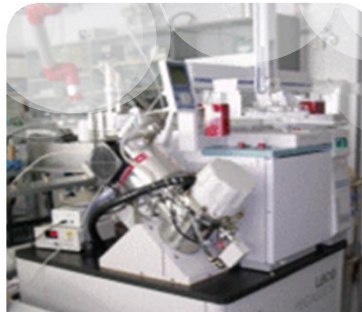
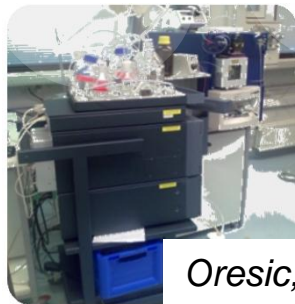
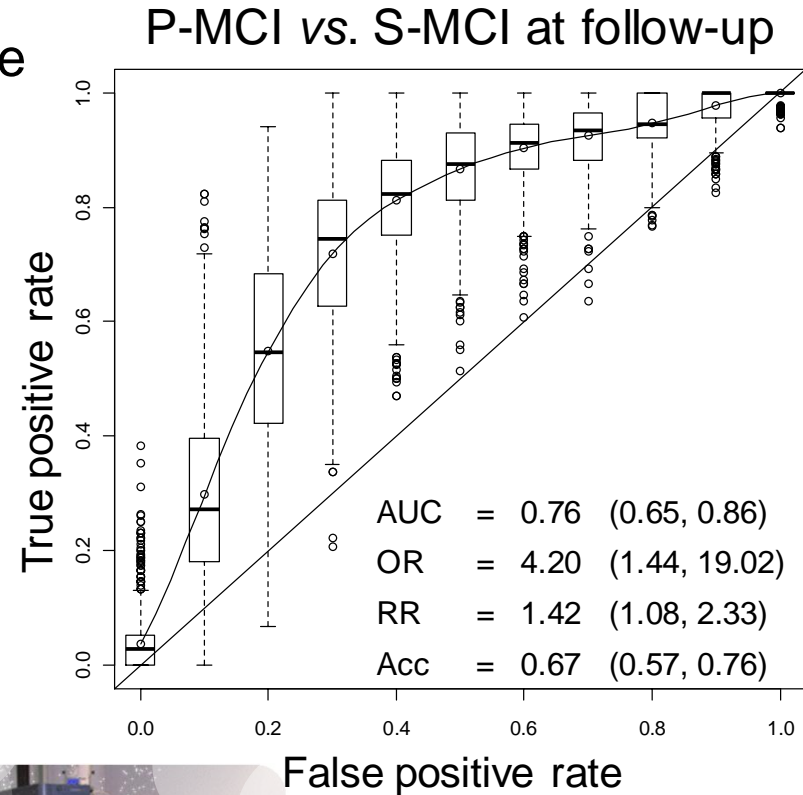
European Commission
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Biomarkers from blood and imaging



Biomarkers from blood samples

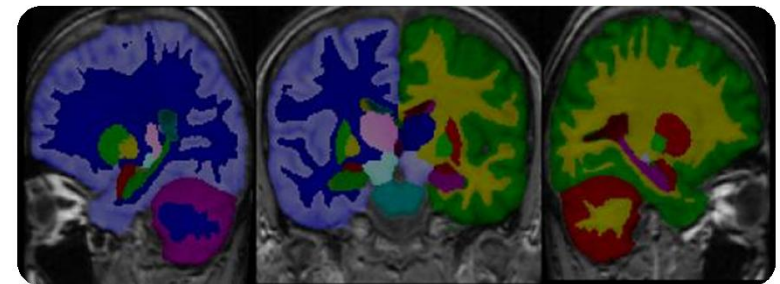
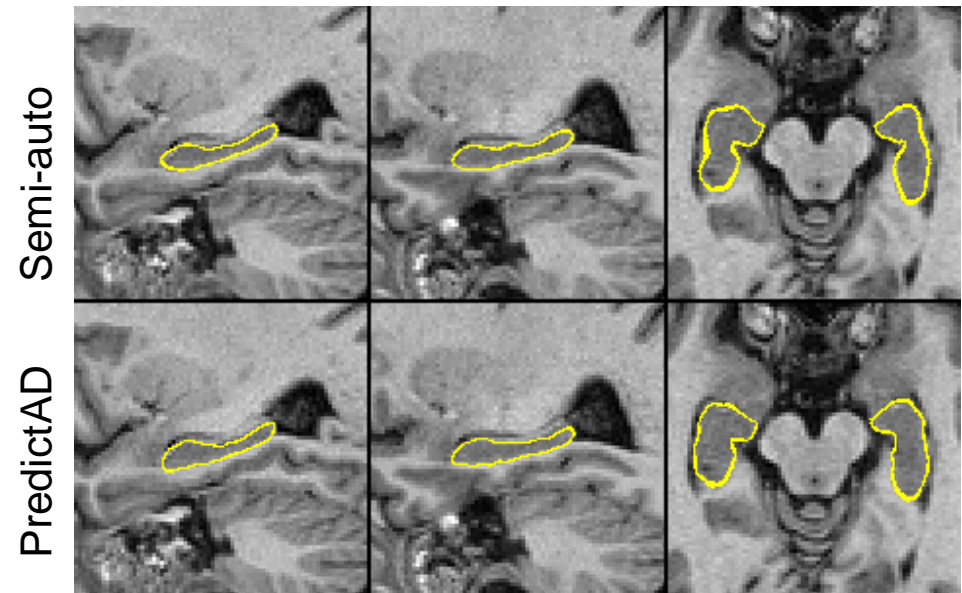
- extraction of cerebrospinal fluid is an invasive and relatively expensive procedure: **blood samples would be an excellent source**
- novel findings from blood samples:
 - analysis of 268 samples in total
 - good performance in predicting persons converting to Alzheimer's disease
 - implicates hypoxia, oxidative stress and membrane lipid remodelling in progression to AD



Oresic, *Translational Psychiatry*, 2011 & Patent pending

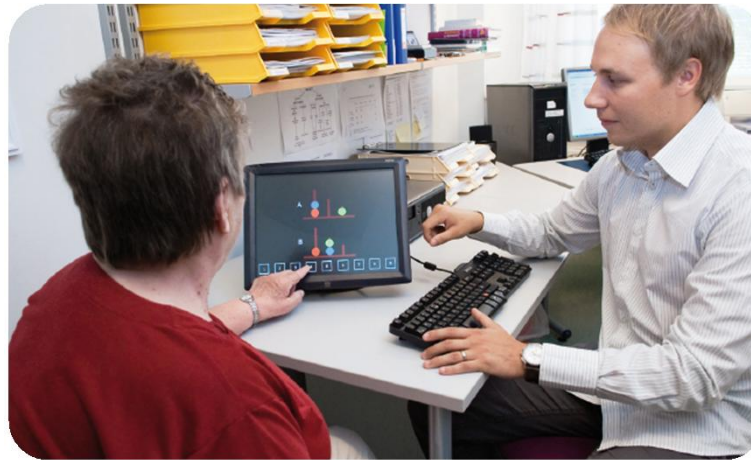
Biomarkers from imaging

- PredictAD developed a new solution to **image segmentation of magnetic resonance images (MRI)**:
 - accuracy comparable to manual segmentation,
 - computation only 2 minutes, and
 - licensed technology.
- **Other solutions for MRI** using tensor-based morphometry, manifold learning, and atrophy measurements.
- **Other solutions for PET imaging** using FDG- and Amyloid-tracers.



Lötjönen: NeuroImage, 2010 & 2011
Koikkalainen: NeuroImage, 2011

Decision support system



Requirements for decision support system

A **clinical decision support system** should

be quantitative

offers an index about the status of a patient or severity of disease or fit to a certain disease by comparing with data from a high number of other persons,

be simple

is not a black-box to users but easy to understand,

integrate

exploits knowledge from heterogeneous data,

be individualised

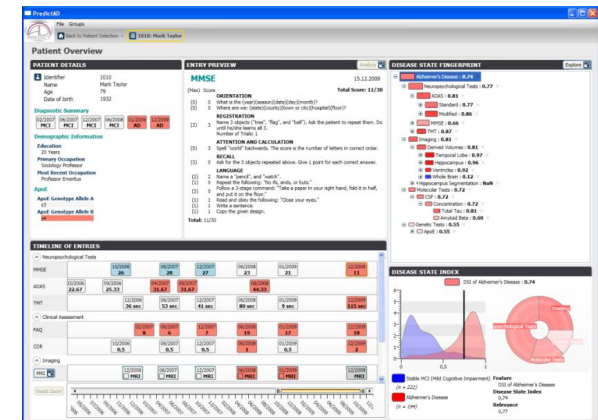
allows personalisation (personalised healthcare),

meet realities

works with incomplete data,

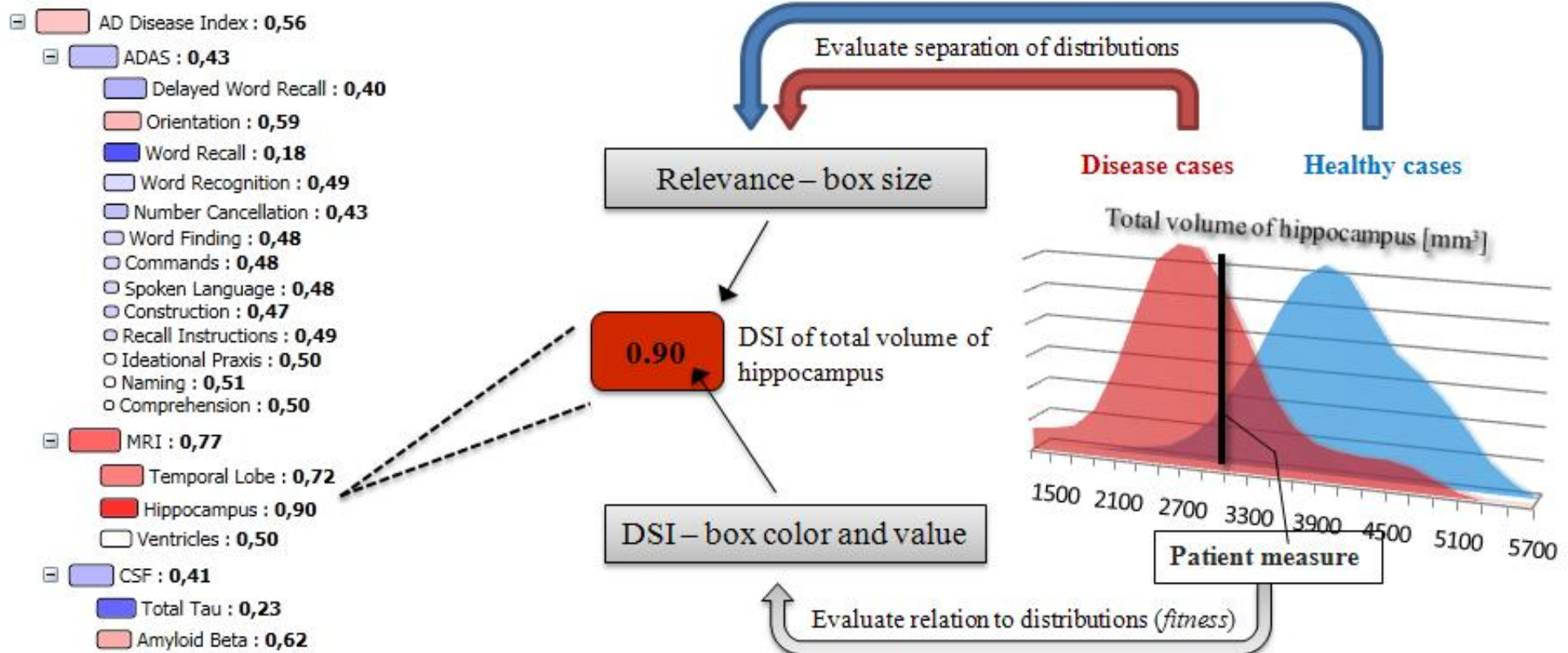
meet needs

has been developed with clinicians.



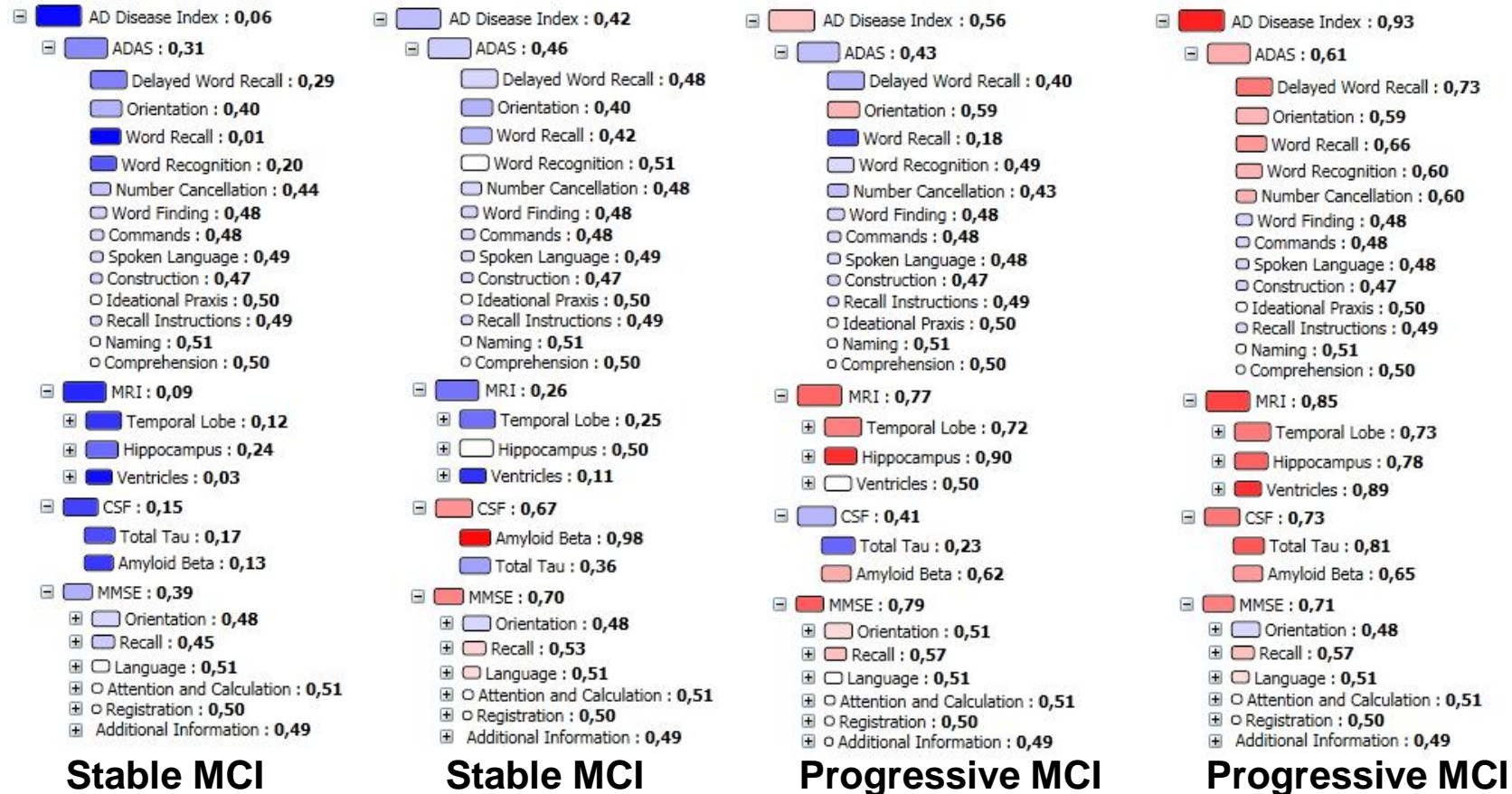
Disease state index and disease state fingerprint techniques

Decision support system developed builds a disease specific profile (list of biomarkers with relevance) and shows the fit of patient to this disease (fitness).



Four cases with memory problems

All four cases had the status ‘MCI’ (mild cognitive impairment) on the baseline but two converted to Alzheimer’s Disease later.



We have shown that the tool improves

both the **prediction accuracy** and the **confidence about the diagnosis!**

Summary

- Methods based on **mining large databases** will offer novel solutions to hospitals.
- We have developed a unique solution for **evidence-based diagnostics**.
- The approach developed is **generic**.
- **Early interventions** are needed emphasizing the importance of **early diagnostics**.



Information

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