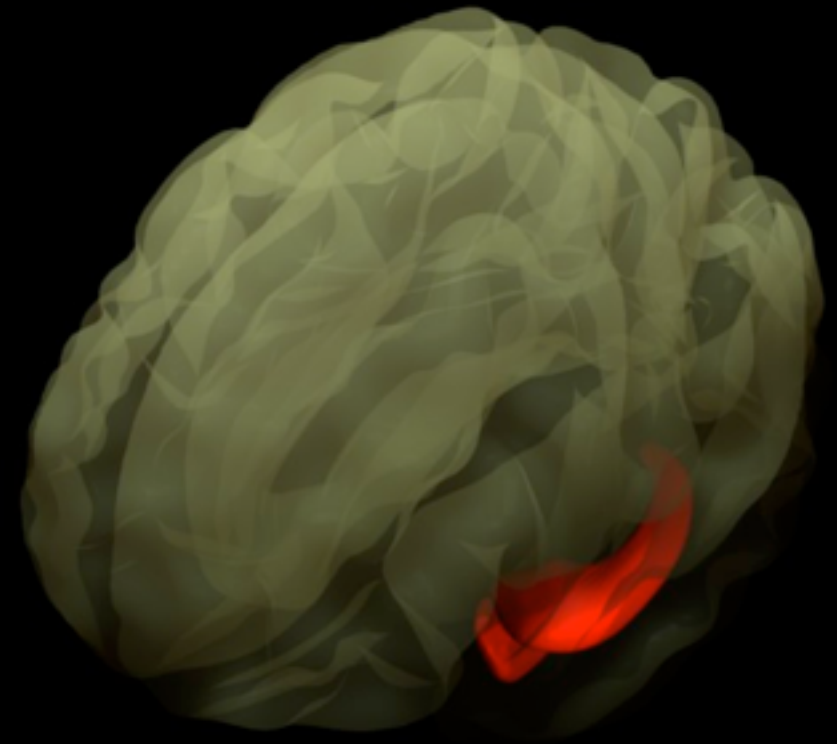


# Structural MRI profiling in TLE



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## Temporal lobe epilepsy (TLE)

- associated with mesiotemporal sclerosis (MTS)
  - MRI hippocampal atrophy (HA) reliable marker of MTS (Cascino 1991)
  - lateralizes focus in ~70% of patients
  - better chances of seizure-free surgical outcome in HA patients
- 
- hippocampal assessment has influenced clinical evaluation in TLE for decades
  - patients dichotomized into those with HA and NV

# Is it appropriate to reduce TLE to the hippocampus?

## Challenge 1

- variable hippocampal damage across patients and subfields (Blumcke 2013)

## Challenge 2

- changes in adjacent amygdala and EC in significant proportions of patients (Bernasconi 2003)

## Challenge 3

- lateralization in cases without HA often requires invasive studies

## Challenge 4

- outcome prediction patients inaccurate (30-50% show seizure recurrence)

# biomarkers

Novel prognostic biomarkers are needed

refine clinical subpopulations of TLE

- ▶ *aim 1*: extend spectrum of TLE-HA vs TLE-NV

improve patient-specific assessment

- ▶ *aim 2*: lateralize focus and predict outcome

## Methods: participants

134 consecutive unilateral TLE patients referred to MNH from 1996-2006

64 LTLE / 70 RTLE

72 HA/62 NV

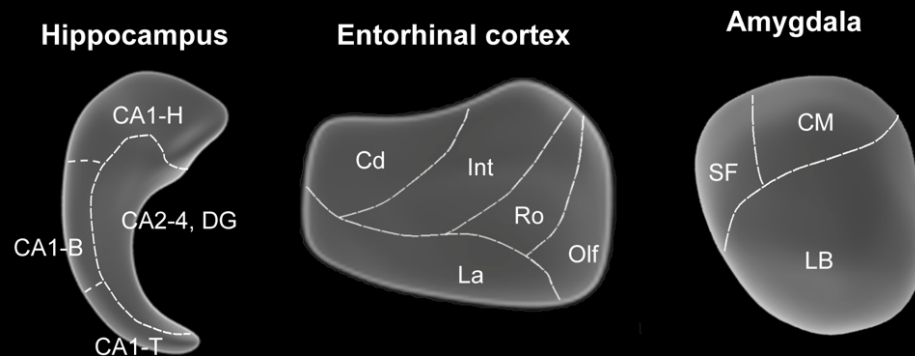
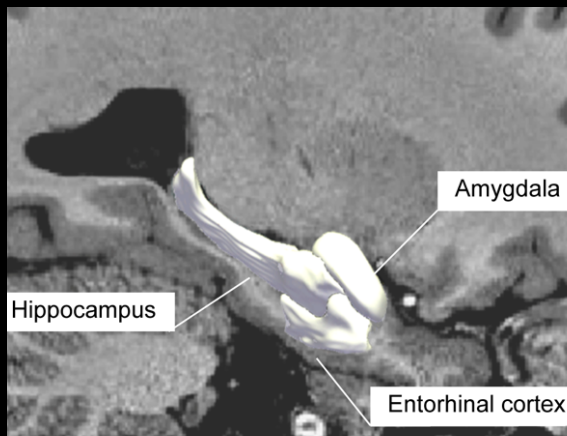
92 patients operated: 65% Engel I at  $4.4 \pm 3.1$  years of follow up ( $>1$  year)

70 specimens available: 60% HS+gliosis, 40% isolated gliosis

scanned at 1.5 Tesla MRI with 1mm isotropic voxels

Manual volumetry of hippocampus, entorhinal cortex, amygdala in all patients

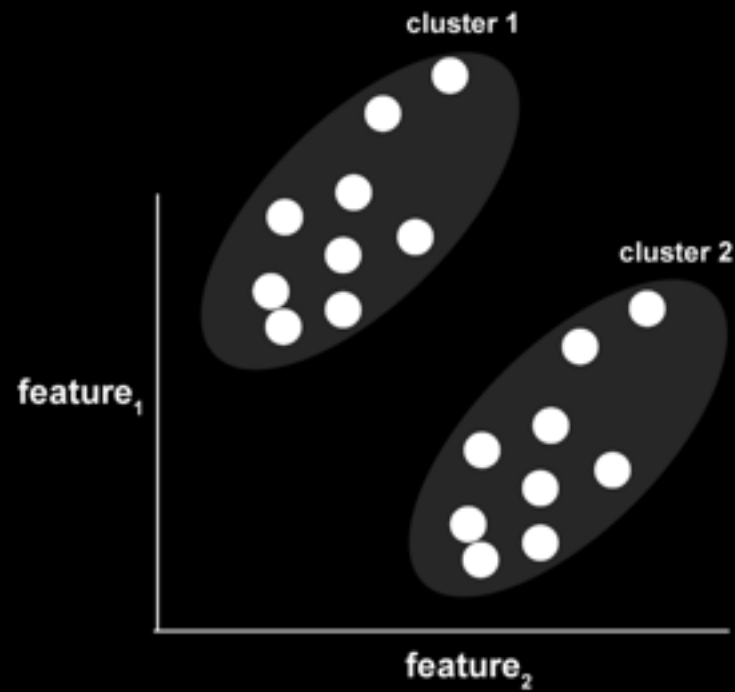
## mesiotemporal surface-shape mapping



*Kim et al. 2008 MICCAI, Bernhardt et al. 2013 Neurology*

Each patient is represented as a feature vector of 24 subfield volumes

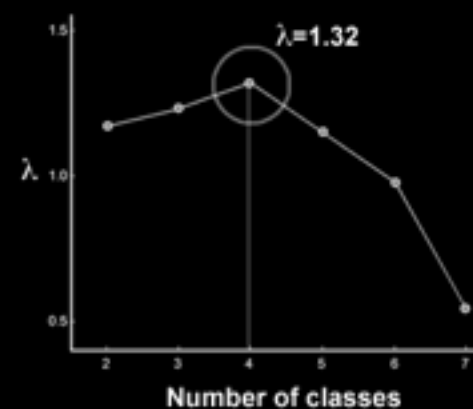
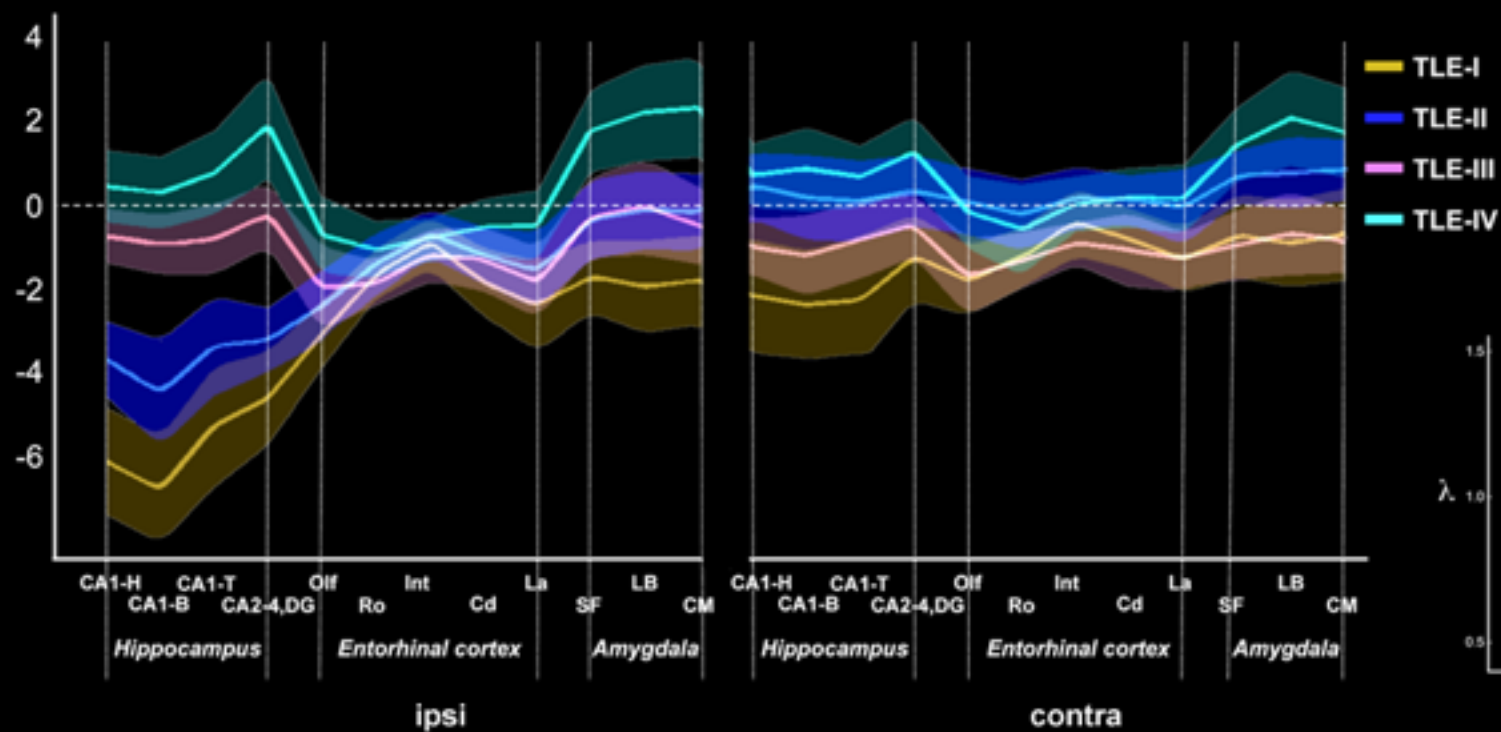
## Aim 1: extend patient spectrum



k-means = grouping of patients with similar feature profiles

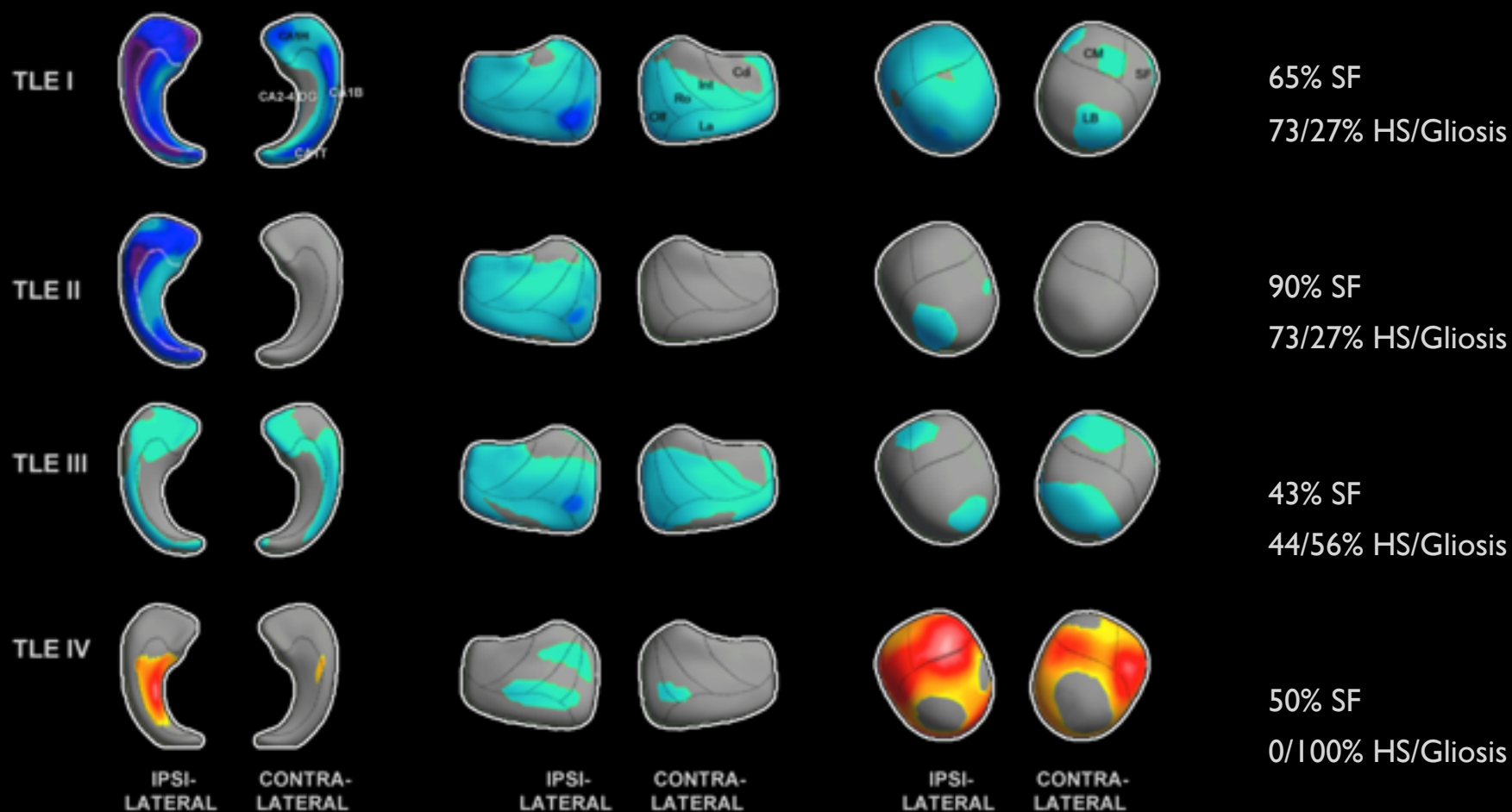
# Patient spectrum partitioning

## Feature profiles



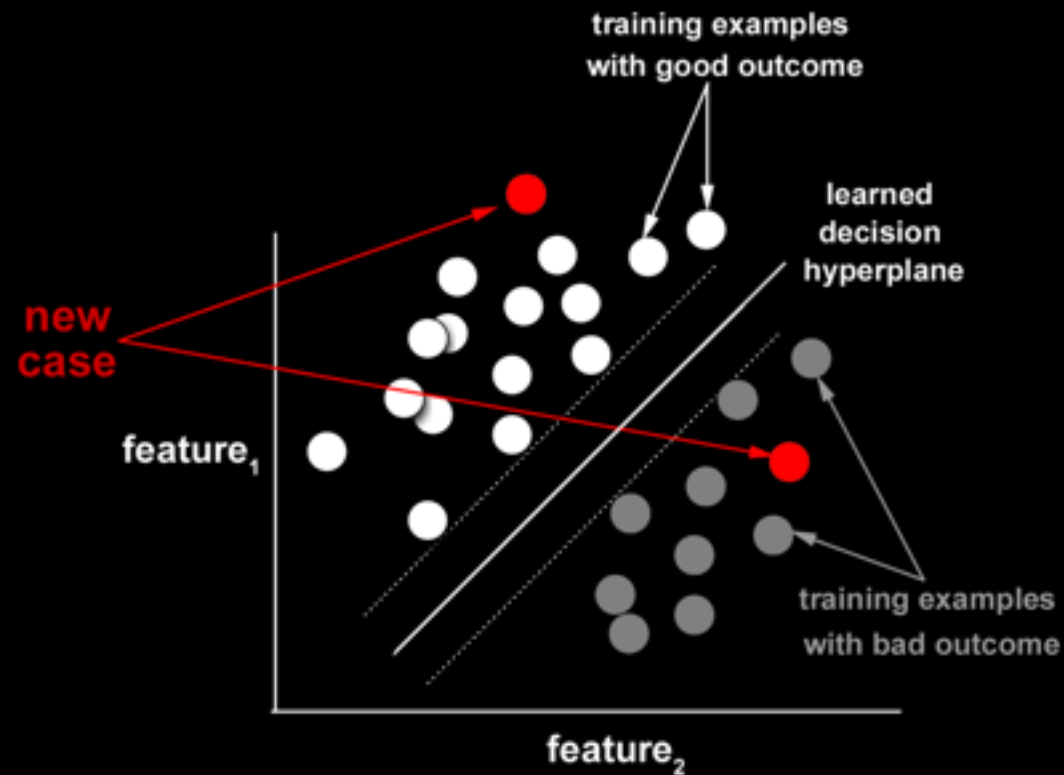


## Patient spectrum partitioning



compared to 46 healthy controls, FDR<0.05 corrected

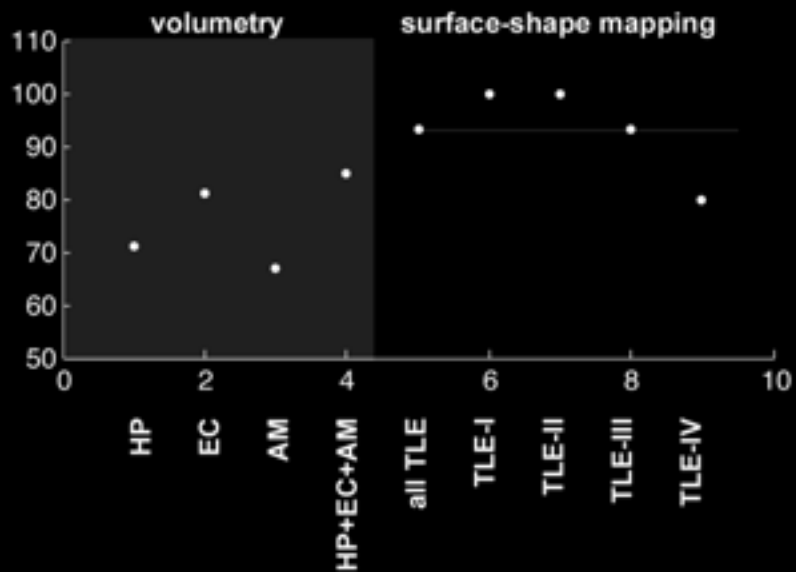
## Aim 2: diagnostics in individual case



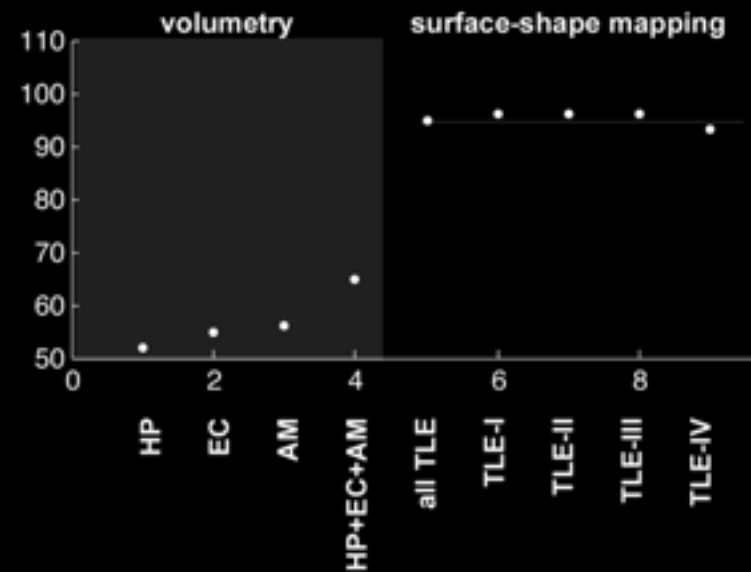
linear discriminant analysis = prediction of outcome based on similarity to training examples

# Outcome prediction and focus lateralization

## Focus lateralization (93%)



## Outcome prediction (95%)



## conclusions

MRI profiling provides nuanced characterization of TLE spectrum

- ▶ gradation of hippocampal-amygdala changes (atrophy >> hypertrophy)
- ▶ consistent anterior entorhinal subfield atrophy

high clinical validity

- ▶ 95% accurate prediction of outcome (conventional volumetry: 52%)
- ▶ 93% accurate lateralization (conventional volumetry: 71%)

promising non-invasive biomarkers for drug-resistant TLE

merci!

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