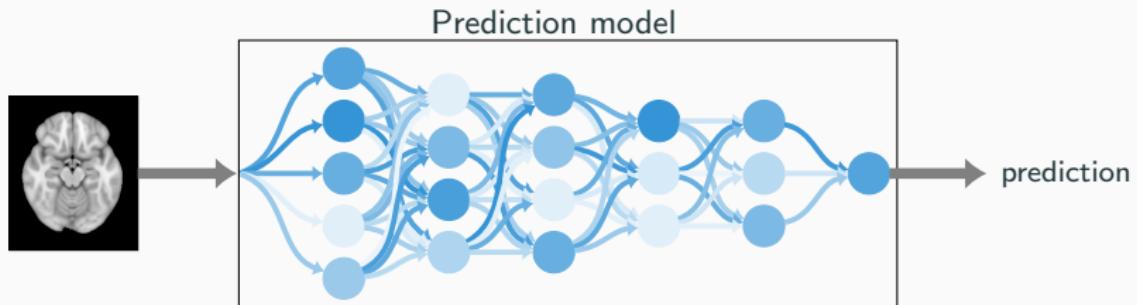
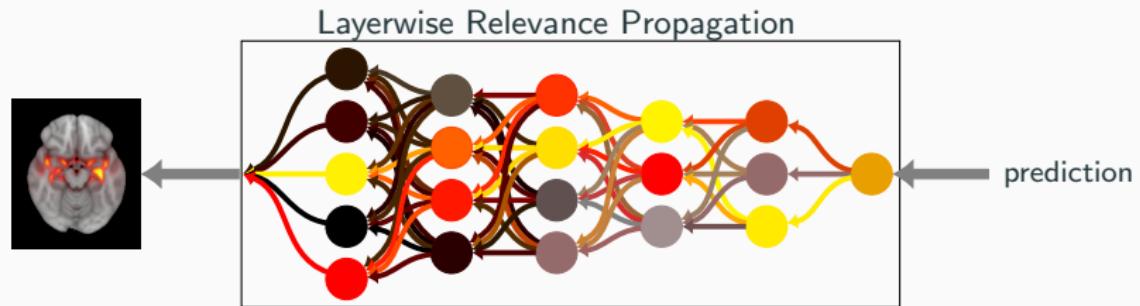


# Layerwise Relevance Propagation



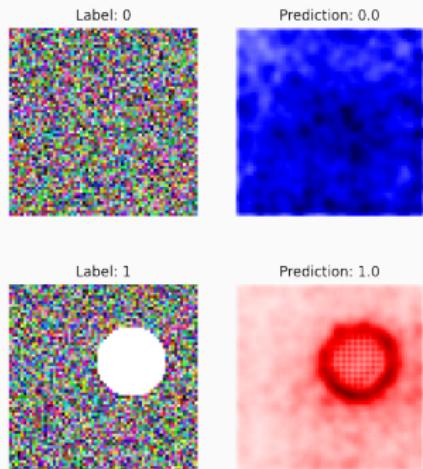
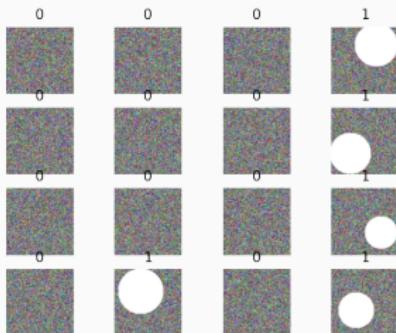
$$n_{i,j} = \sum_k n_{i-1,k} w_{k,j}$$

# Layerwise Relevance Propagation

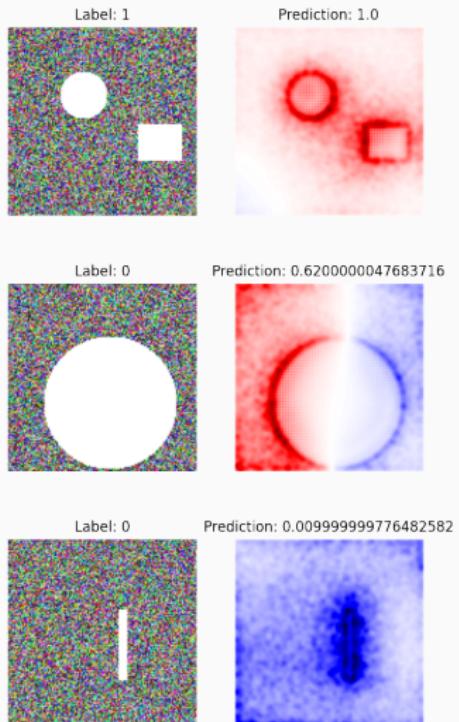
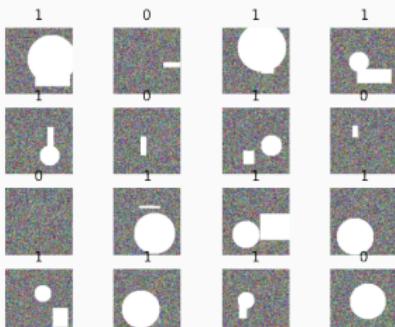


$$n_{i,j} = \sum_k n_{i-1,k} w_{k,j} \quad R_{i,j} = \sum_k \frac{\max(0, a_j w_{j,k})}{\sum_l \max(0, a_l w_{l,k})} R_{i+1,k}$$

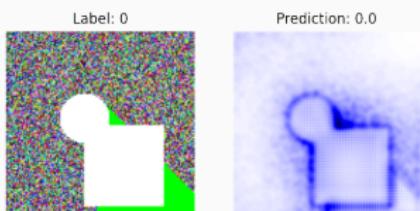
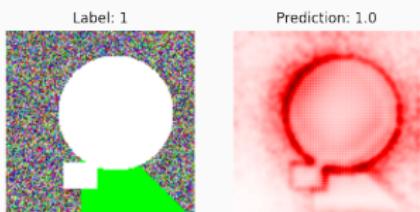
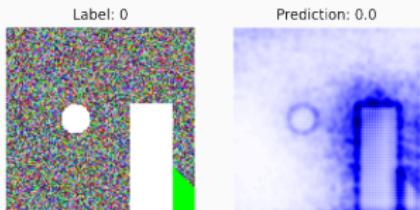
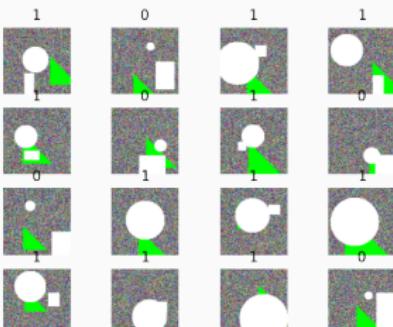
# Layerwise Relevance Propagation



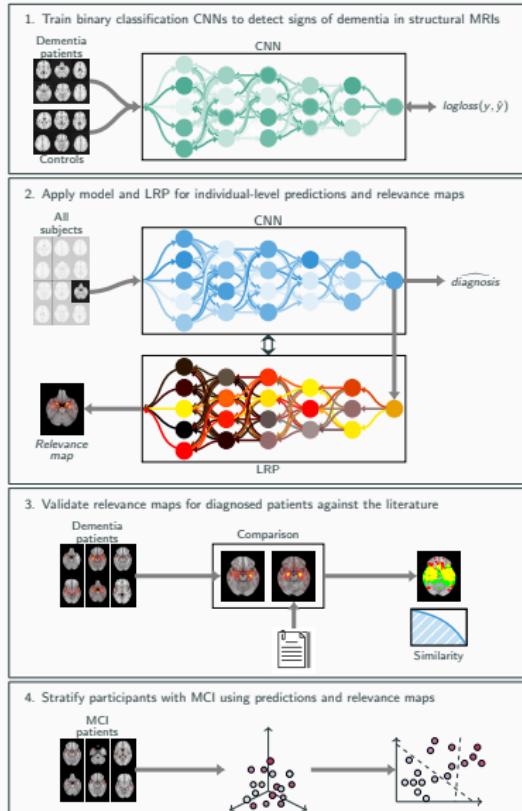
# Layerwise Relevance Propagation



# Layerwise Relevance Propagation

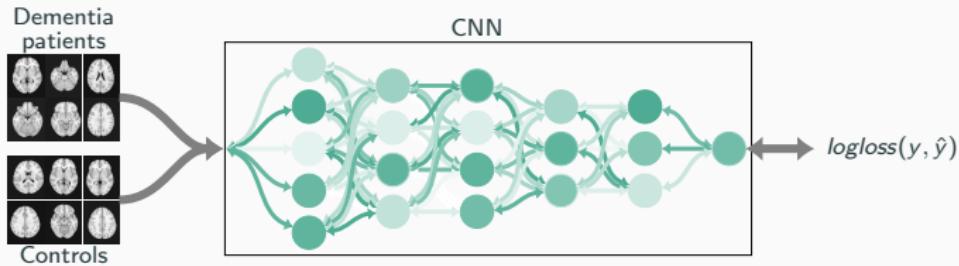


# Overview

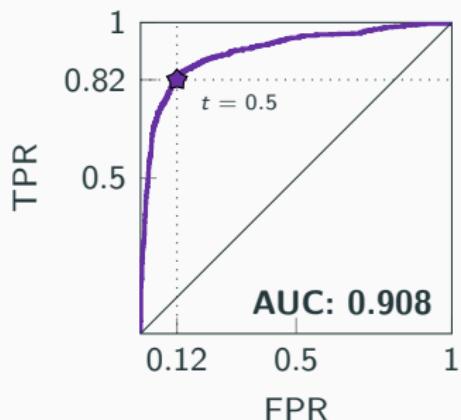
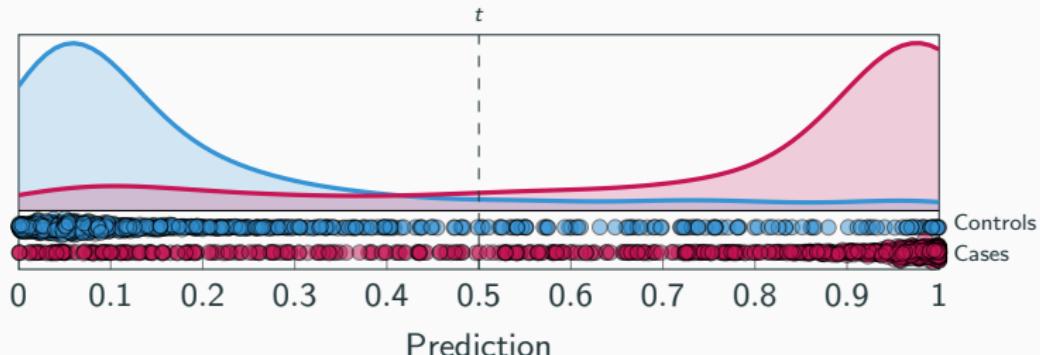


# Case-control predictions

1. Train binary classification CNNs to detect signs of dementia in structural MRIs



## Case-control predictions



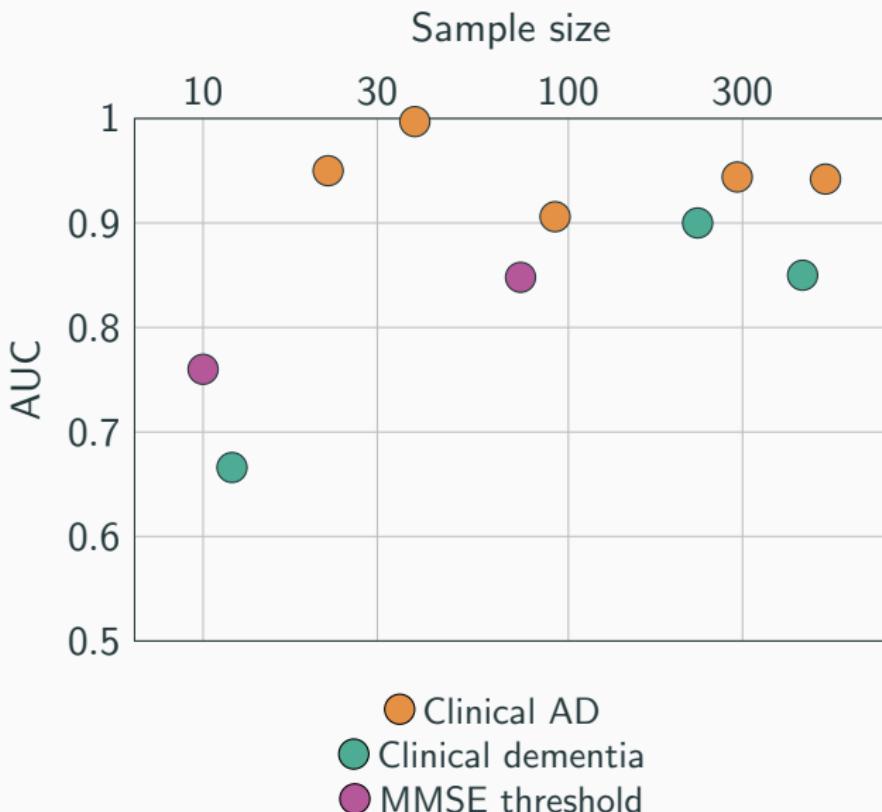
Predicted

	0	1
0	754	100
1	157	697

Observed

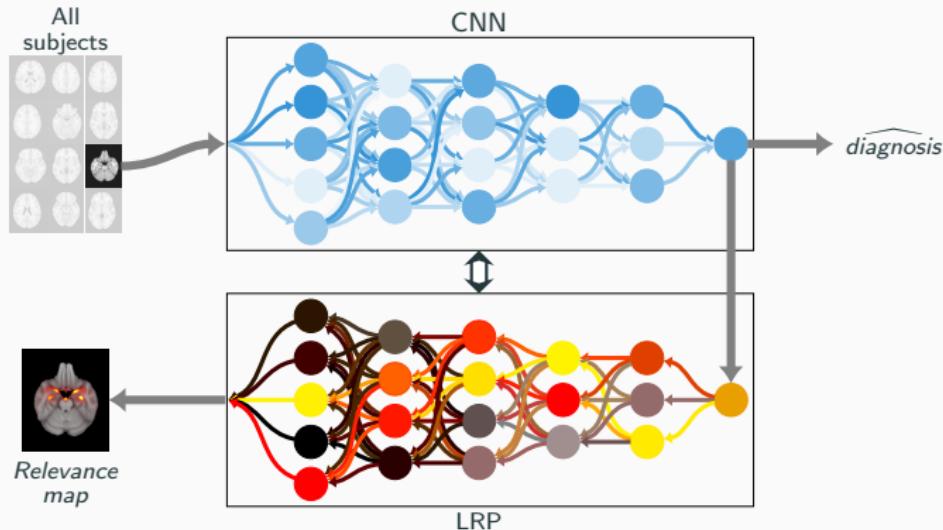
Accuracy: 84.95%

## Case-control predictions

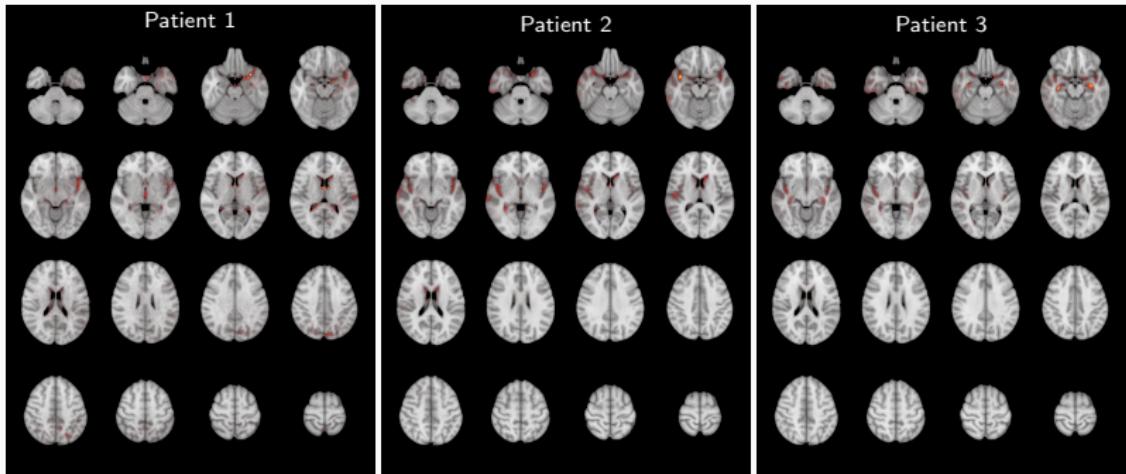


# Generating relevance maps

2. Apply model and LRP for individual-level predictions and relevance maps

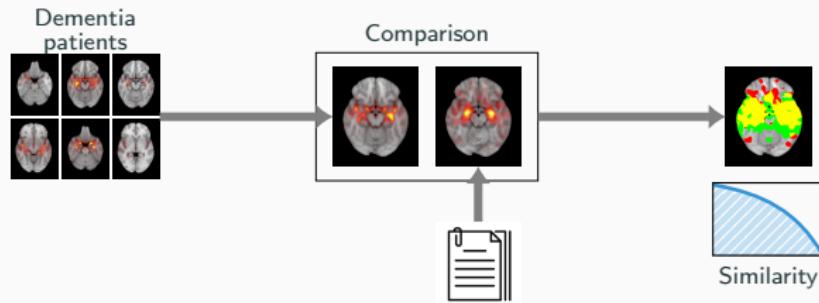


# Generating relevance maps

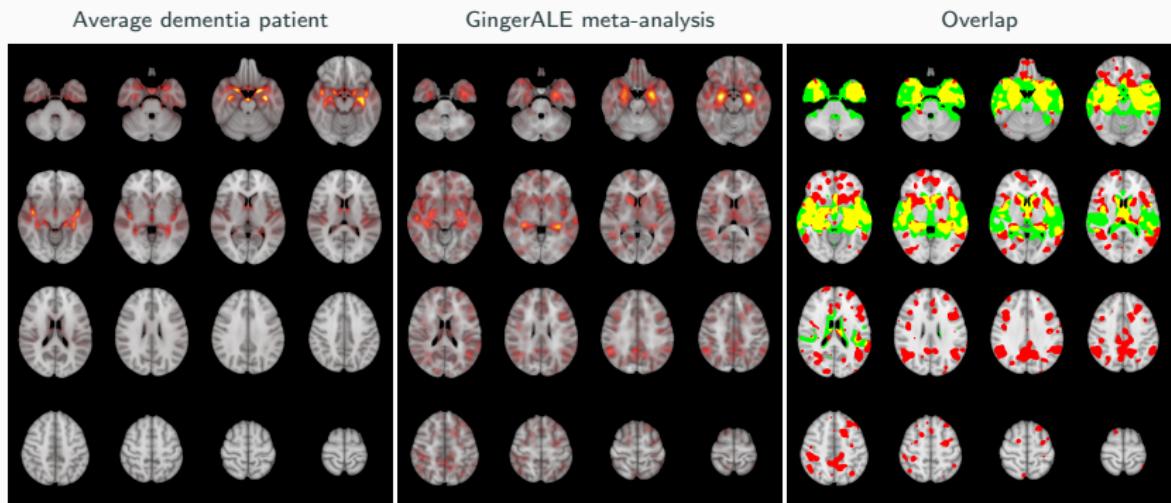


# Validating relevance maps in dementia patients

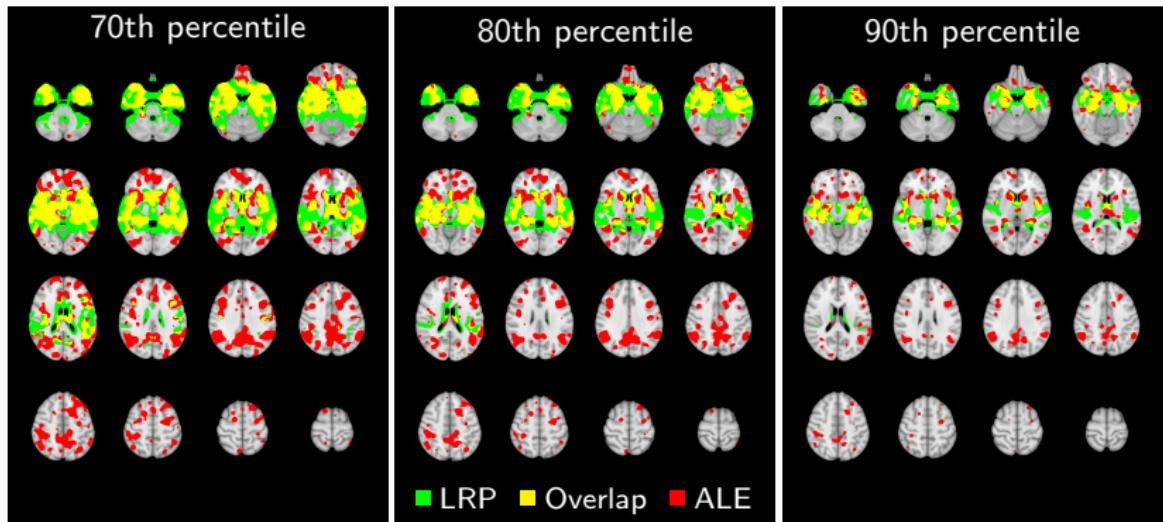
## 3. Validate relevance maps for diagnosed patients against the literature



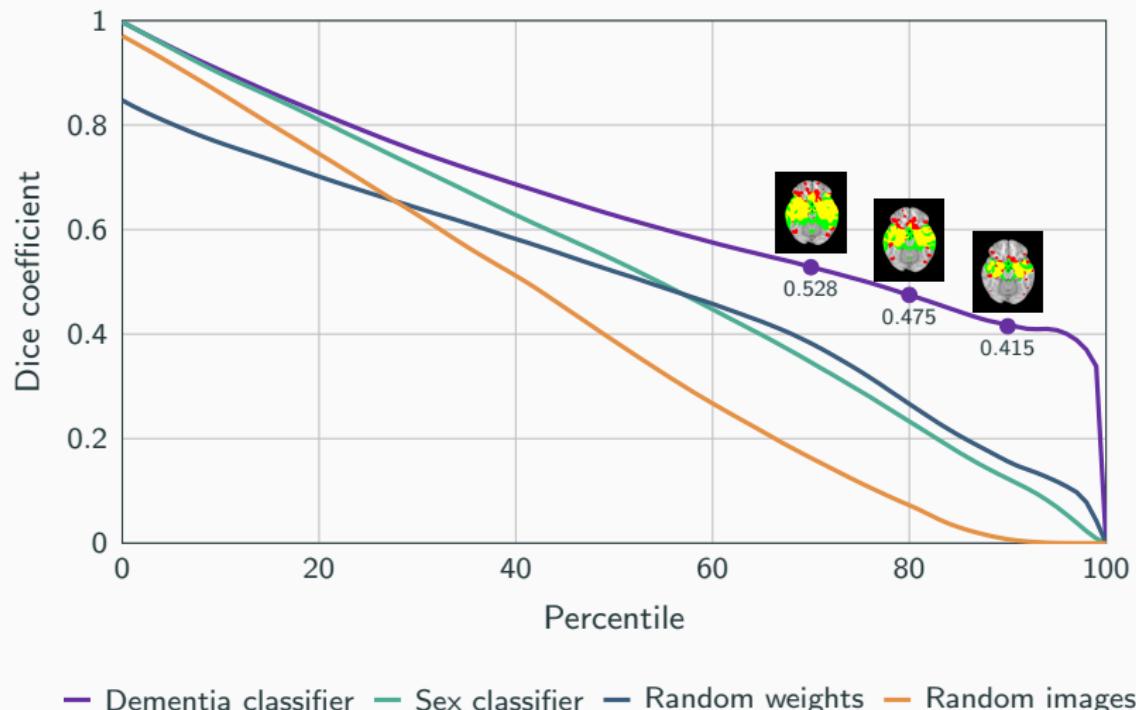
# Validating relevance maps in dementia patients



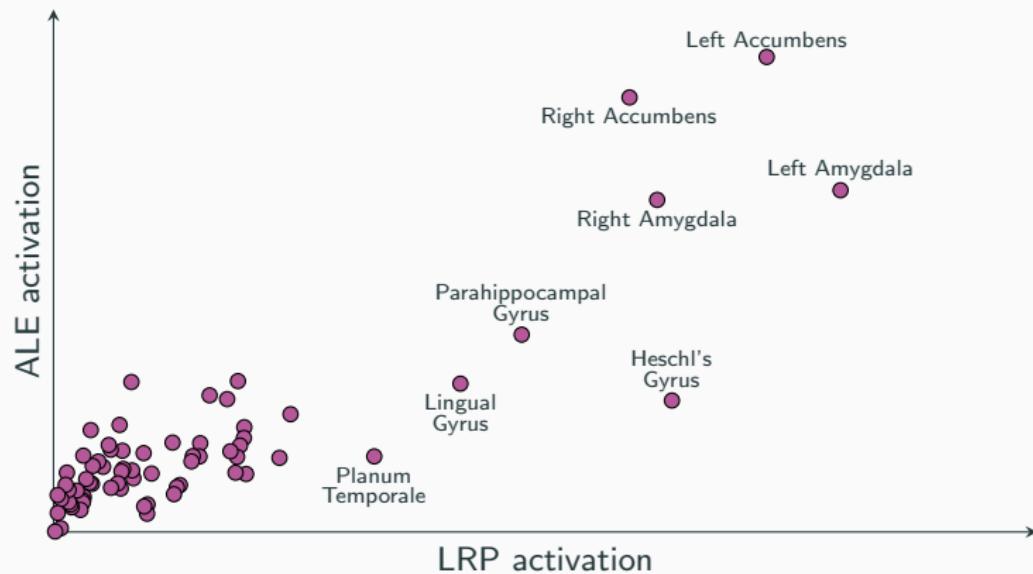
# Validating relevance maps in dementia patients



# Validating relevance maps in dementia patients

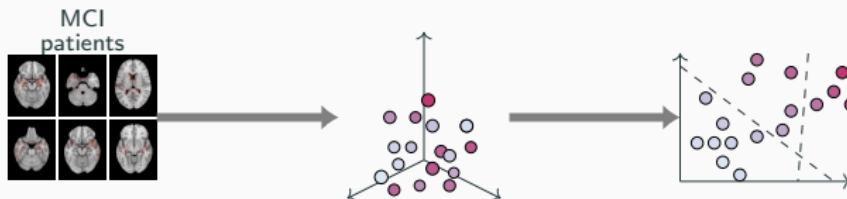


# Validating relevance maps in dementia patients

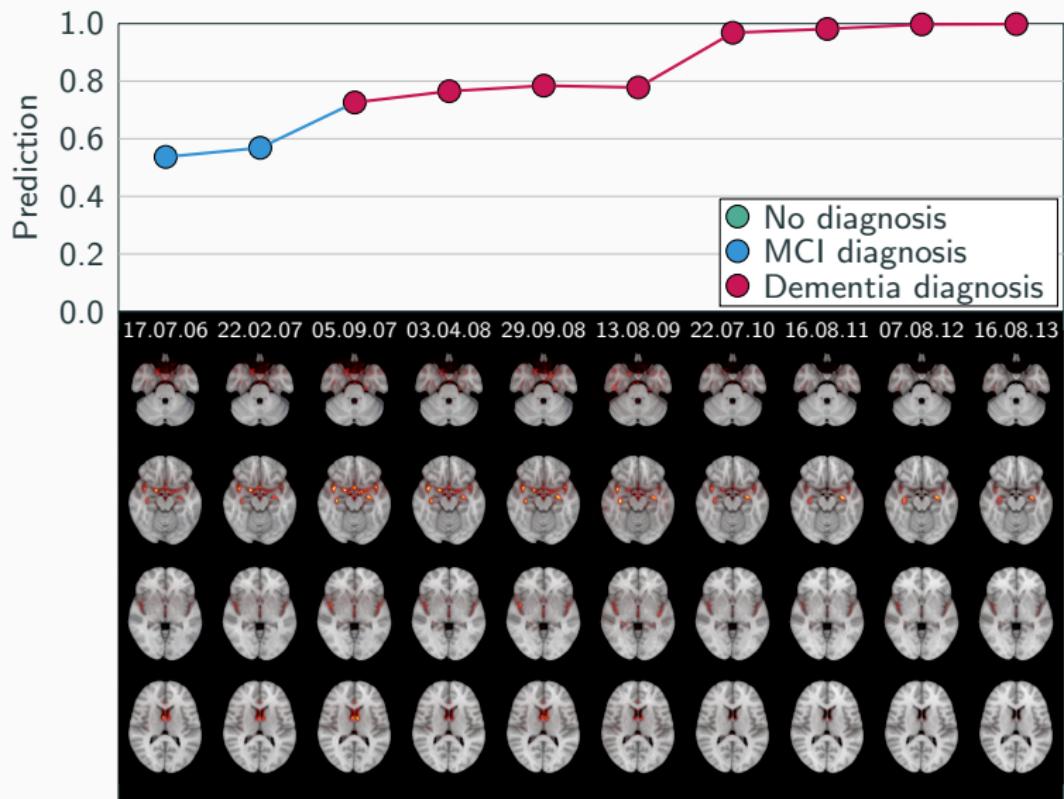


# Exploring relevance maps in MCI patients

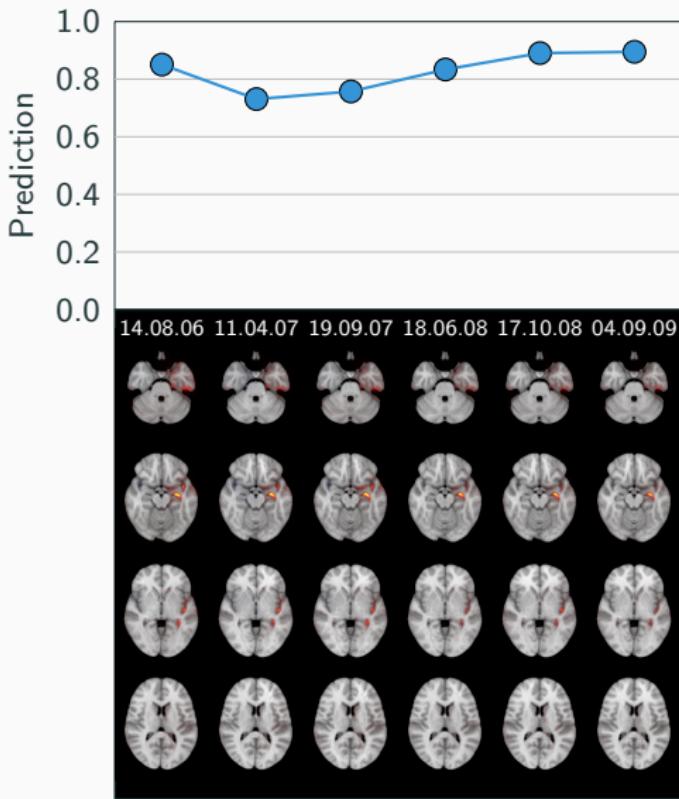
## 4. Stratify participants with MCI using predictions and relevance maps



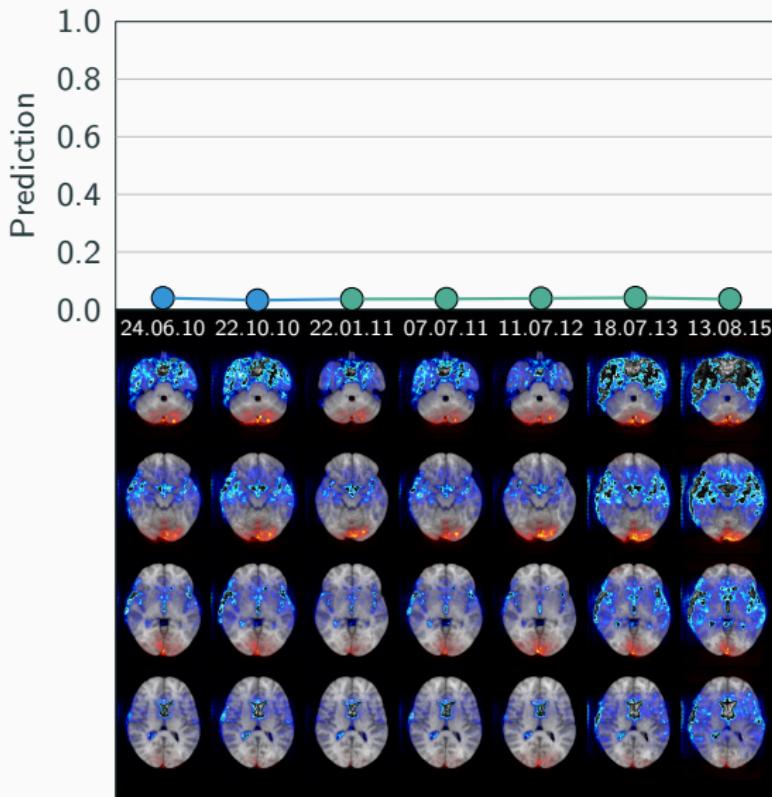
# Exploring relevance maps in MCI patients



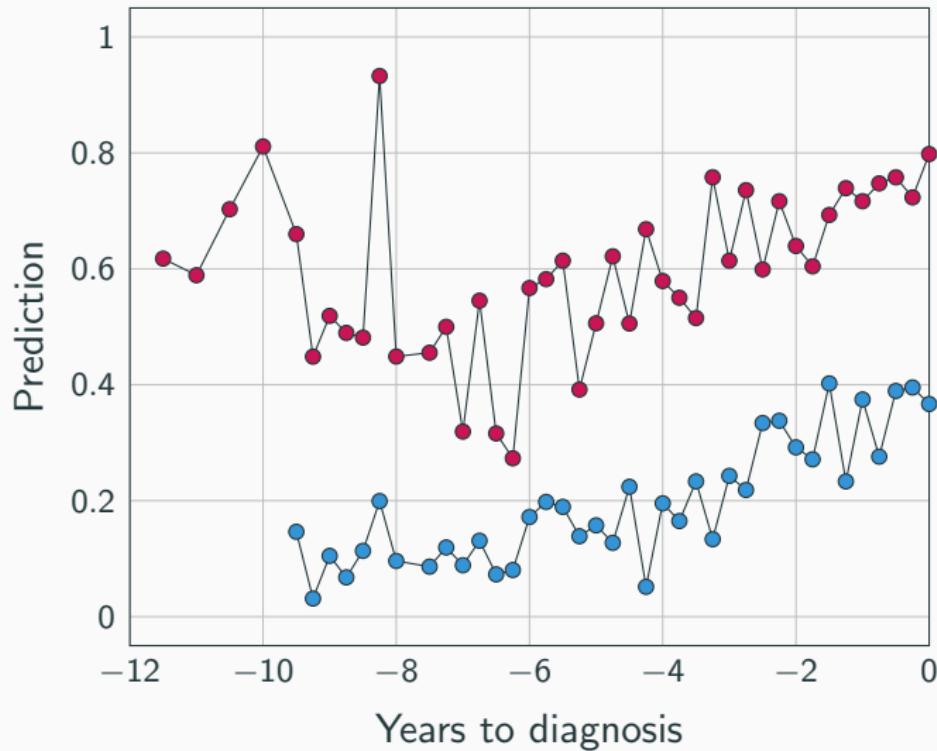
# Exploring relevance maps in MCI patients



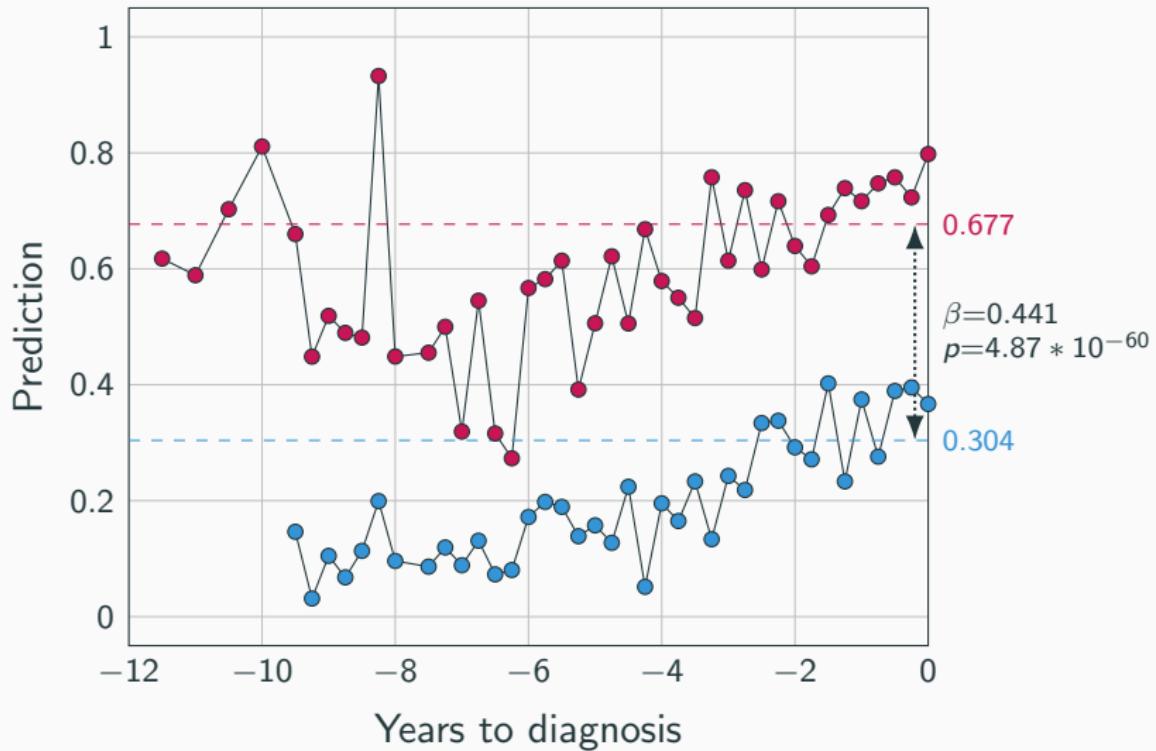
# Exploring relevance maps in MCI patients



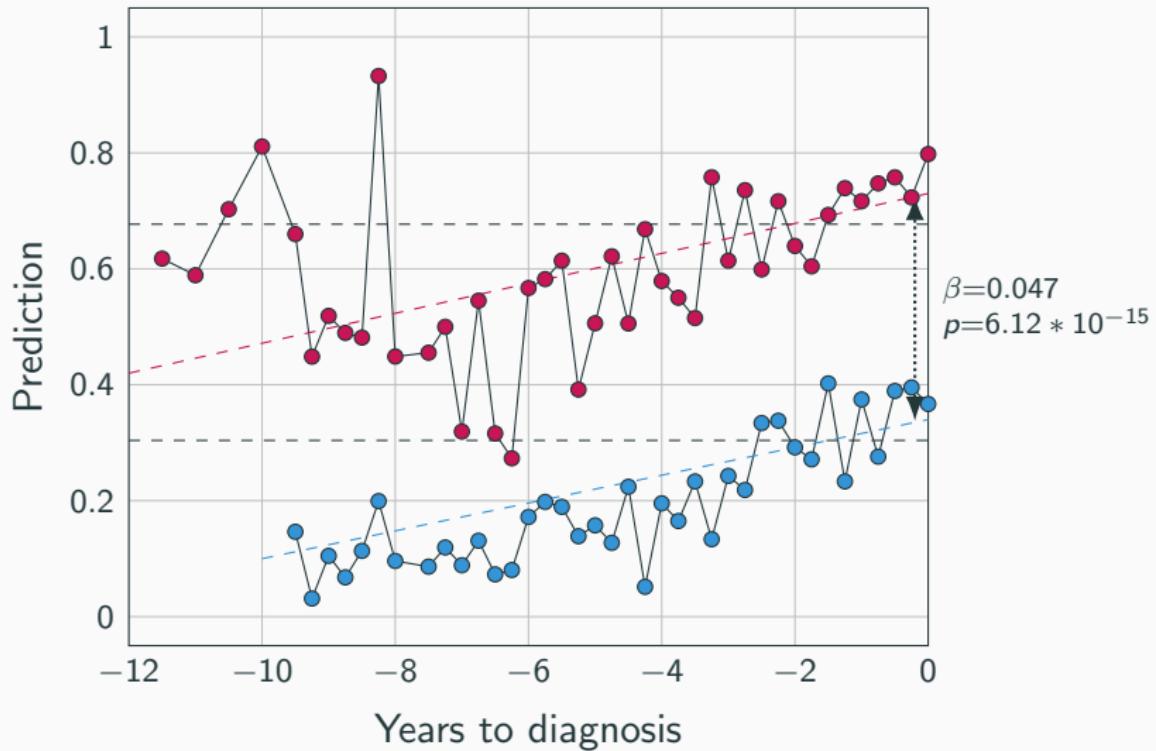
# Exploring relevance maps in MCI patients



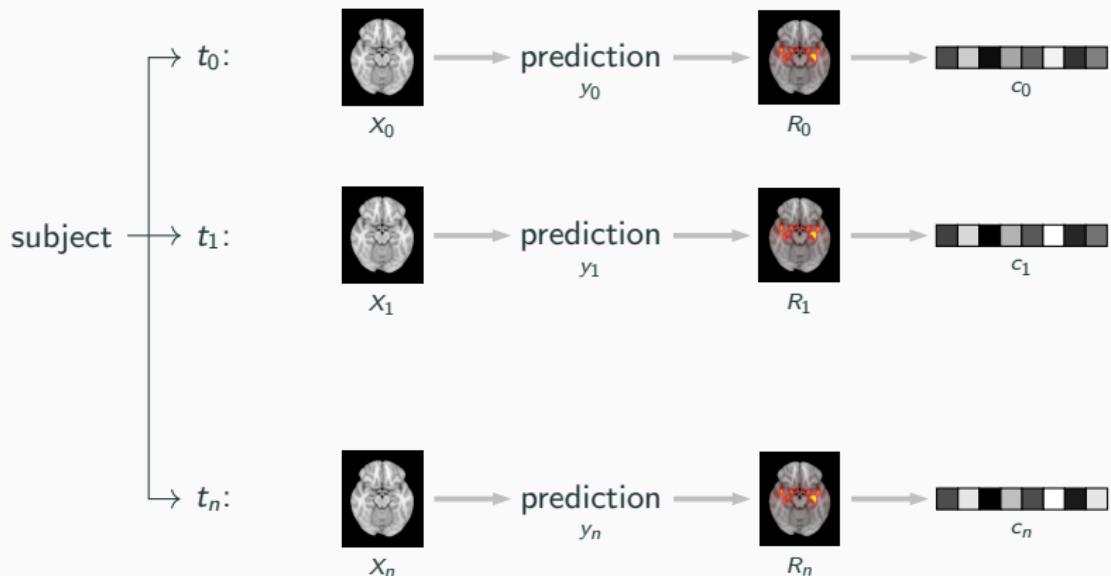
# Exploring relevance maps in MCI patients



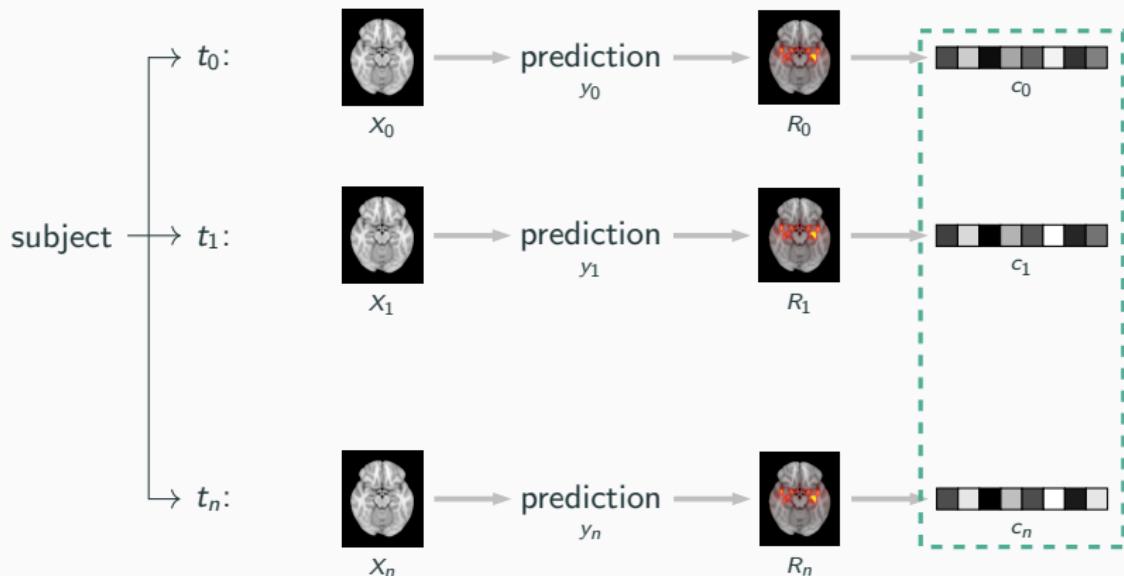
# Exploring relevance maps in MCI patients



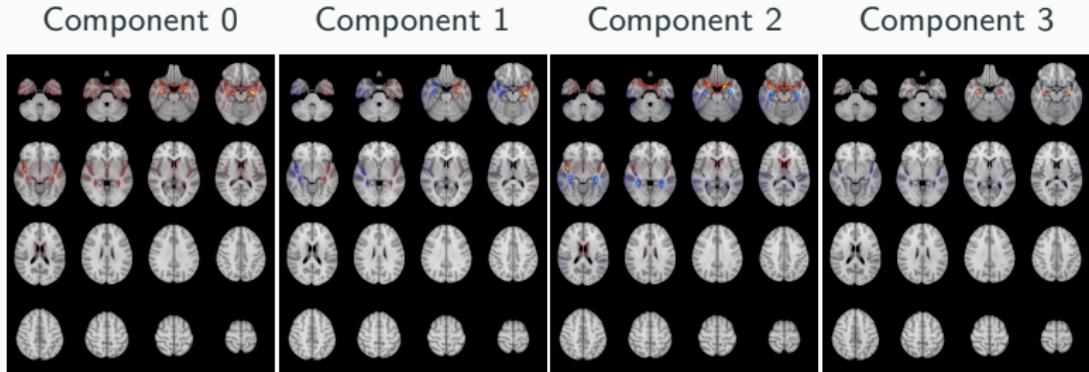
# Exploring relevance maps in MCI patients



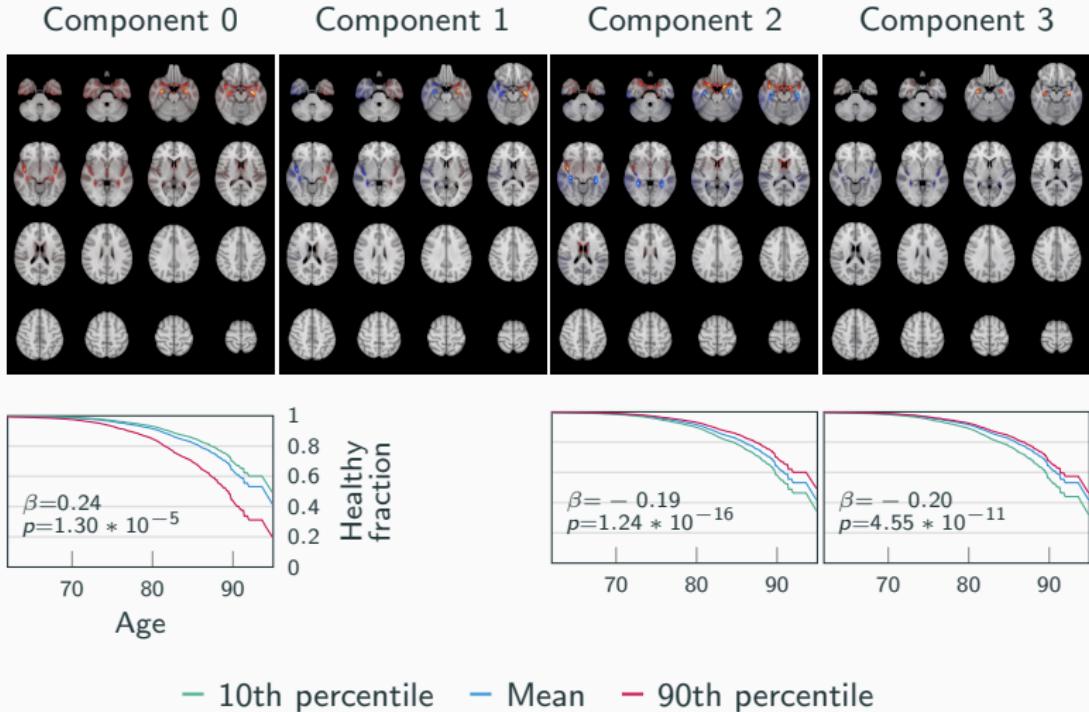
# Exploring relevance maps in MCI patients



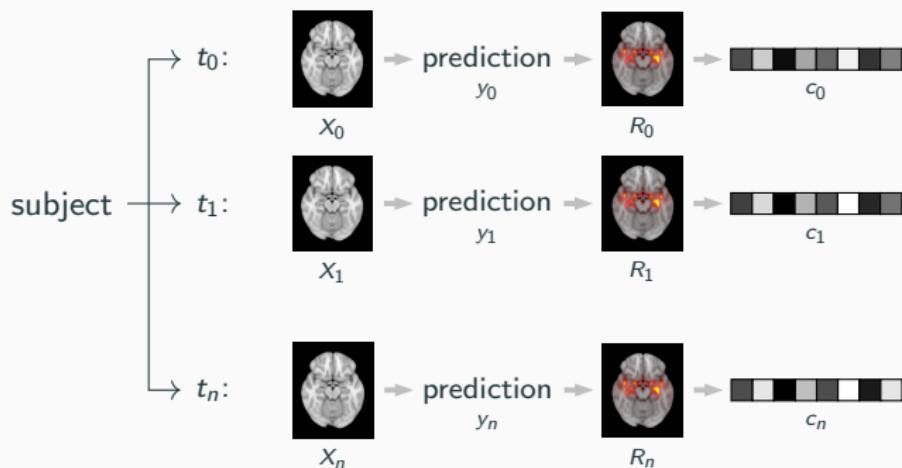
# Exploring relevance maps in MCI patients



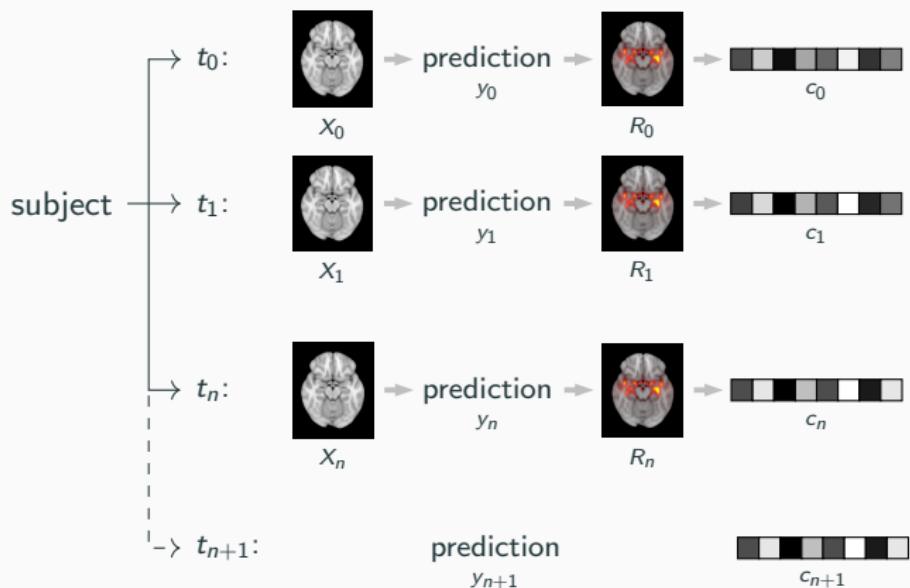
# Exploring relevance maps in MCI patients



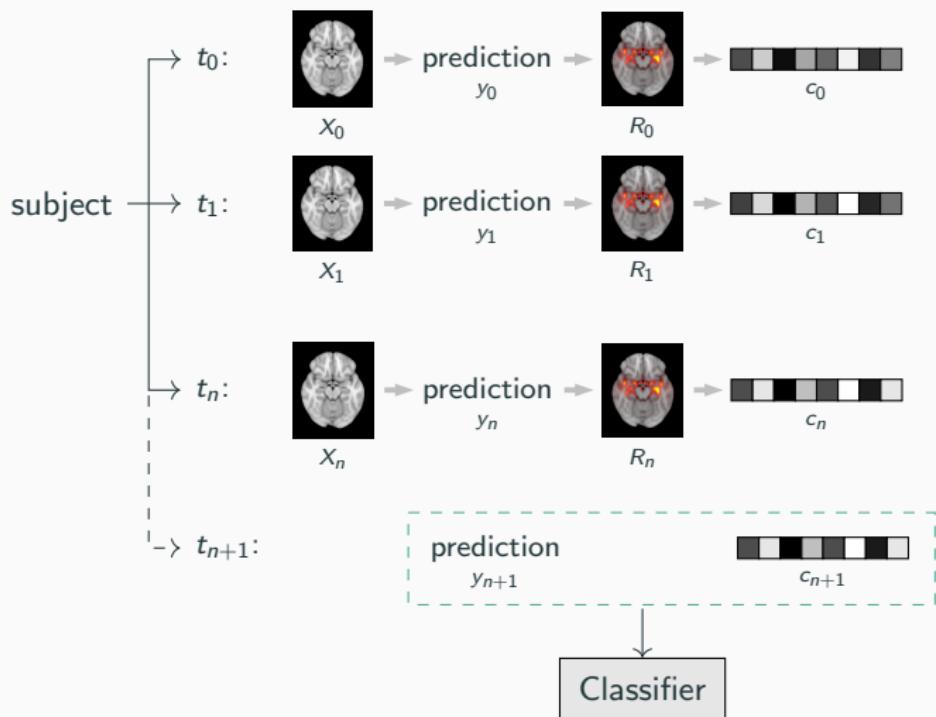
# Exploring relevance maps in MCI patients



# Exploring relevance maps in MCI patients



# Exploring relevance maps in MCI patients



# Exploring relevance maps in MCI patients

Covariates	AUC	Accuracy	PPV	Sensitivity	Specificity
$\text{progression}_{n+1} \sim \text{age} + \text{sex}$	$0.521 \pm 0.029$	$51.57 \pm 3.56$	$0.61 \pm 0.03$	$0.66 \pm 0.03$	$0.37 \pm 0.04$
$\text{progression}_{n+1} \sim \text{age} + \text{sex} + \hat{y}_n$	$0.833 \pm 0.077$	$75.23 \pm 7.03$	$0.82 \pm 0.10$	$0.72 \pm 0.11$	$0.79 \pm 0.09$
$\text{progression}_{n+1} \sim \text{age} + \text{sex} + \hat{y}_n * c_n$	$0.848 \pm 0.076$	$78.08 \pm 8.92$	$0.84 \pm 0.09$	$0.76 \pm 0.13$	$0.80 \pm 0.08$
$\text{progression}_{n+1} \sim \text{age} + \text{sex} + \hat{y}_{n+1} + c_{n+1}$	$0.849 \pm 0.074$	$76.97 \pm 9.46$	$0.82 \pm 0.10$	$0.78 \pm 0.15$	$0.76 \pm 0.08$

## Exploring relevance maps in MCI patients

*"There is an X% chance the patient will progress into dementia by date XX.YY.ZZZZ based on existing pathology in brain regions A, B and C, and an expected increase/decrease of pathology in regions D and E."*