

# Exploring the brain with explainable artificial intelligence

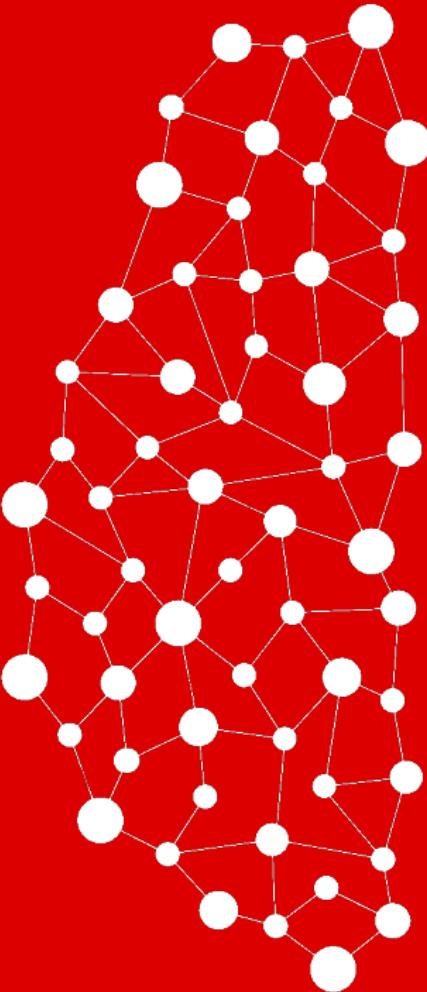
Finding patterns of abnormal brain aging  
in patients with neuropsychiatric  
disorders



Esten H. Leonardsen

Post-doc at the Department of Psychology,  
University of Oslo

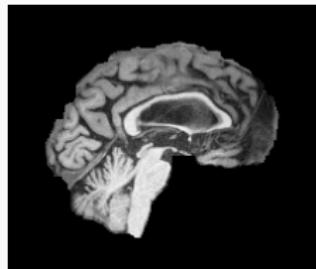
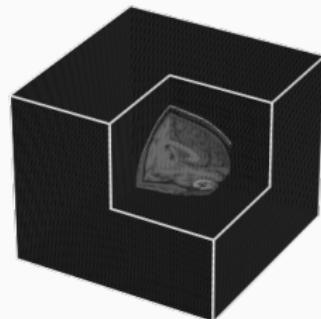
Chief Scientific Officer, baba.vision



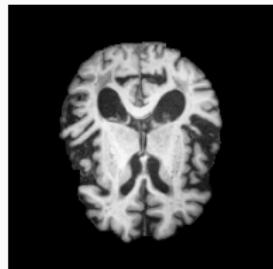
UNIVERSITY  
OF OSLO

# Brain age: Motivation

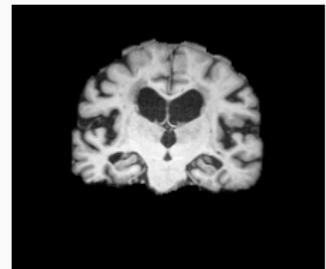
Structural Magnetic  
Resonance Imaging (MRI) scans



Side



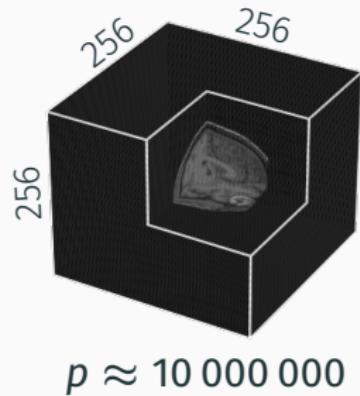
Above



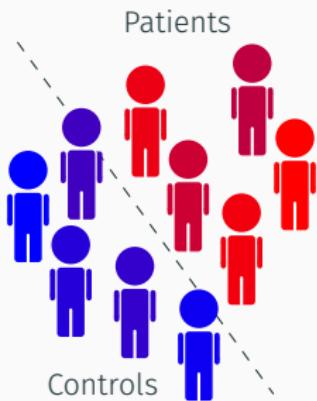
Front



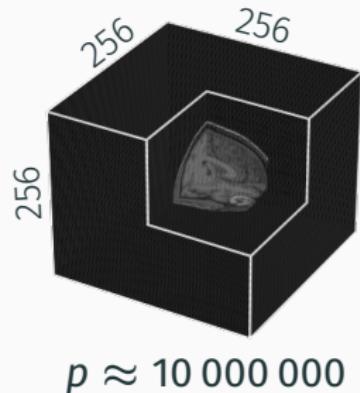
# Brain age: Motivation



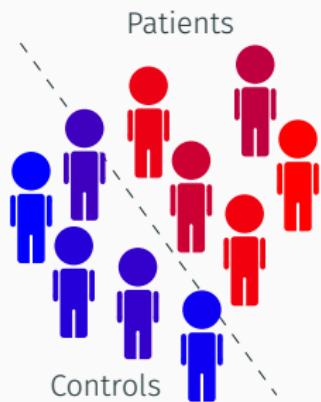
# Brain age: Motivation



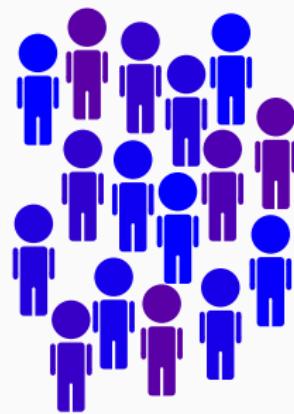
Clinical datasets  
( $n \approx 100$ )



# Brain age: Motivation



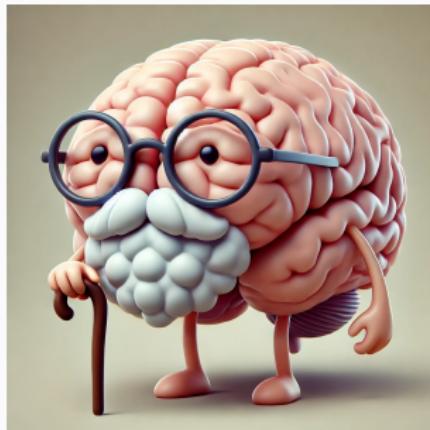
Clinical datasets  
 $(n \approx 100)$



Population datasets  
 $(n \approx 10\,000)$



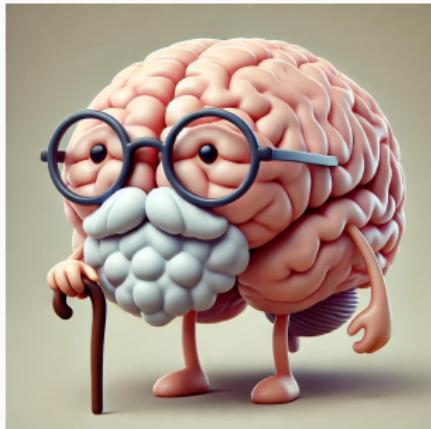
# Brain age: Motivation



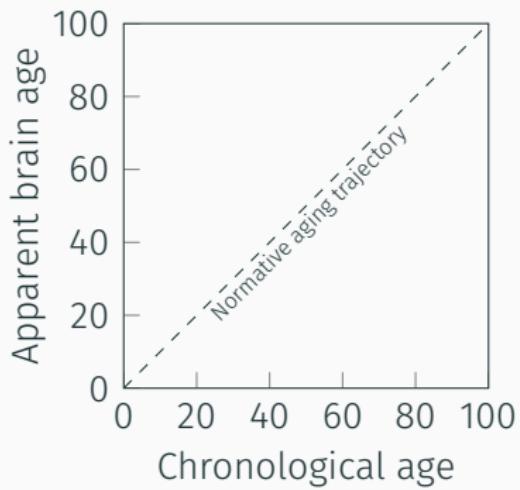
Generated by Dall-E 3



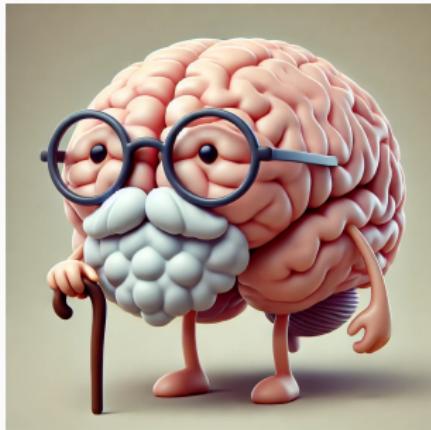
# Brain age: Motivation



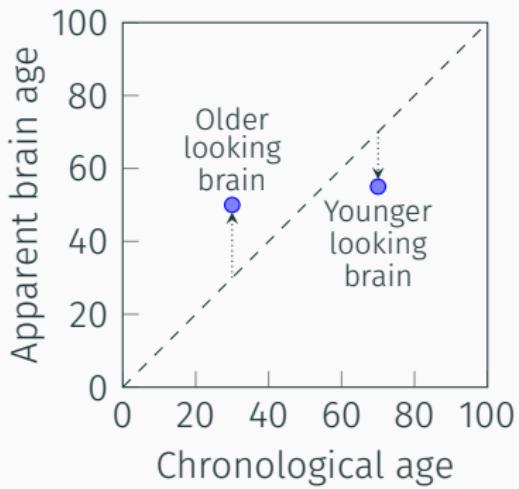
Generated by Dall-E 3



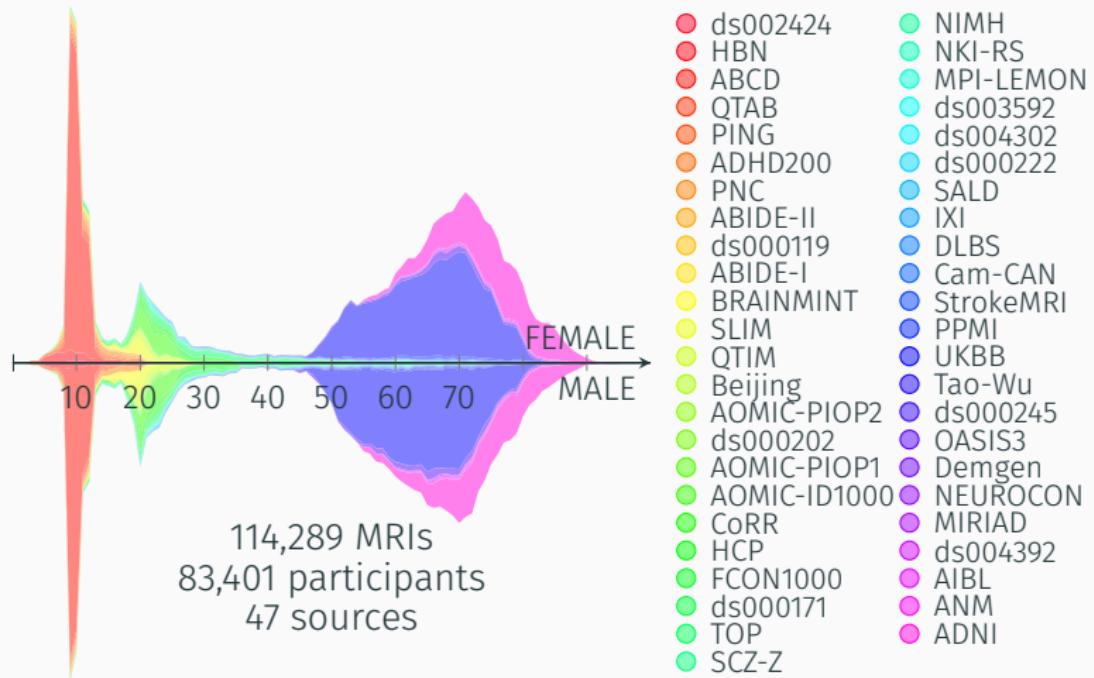
# Brain age: Motivation



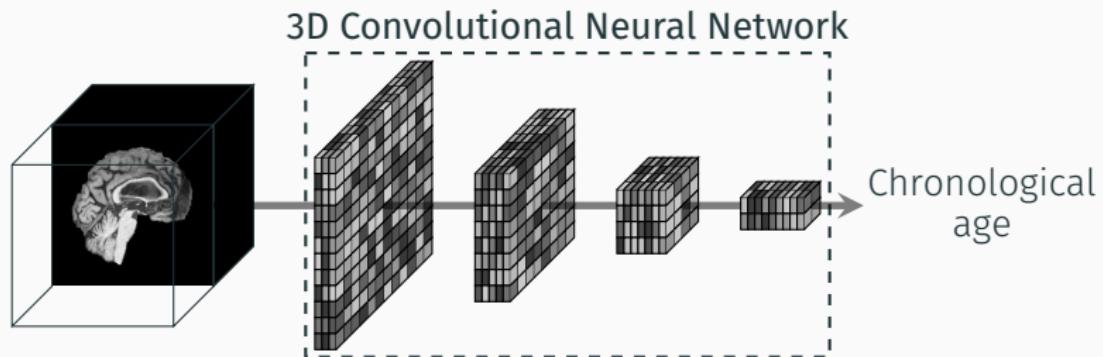
Generated by Dall-E 3



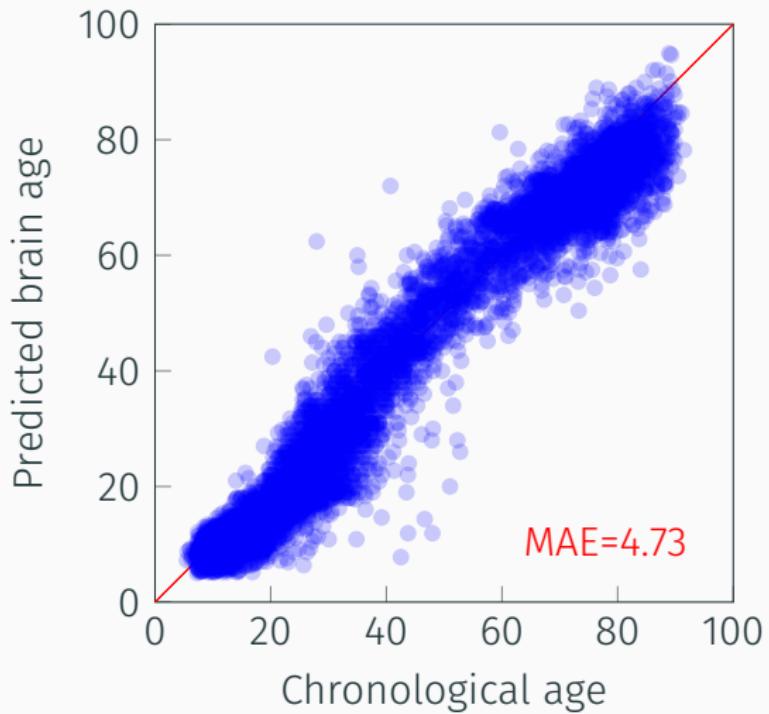
# Brain age modelling: Methods



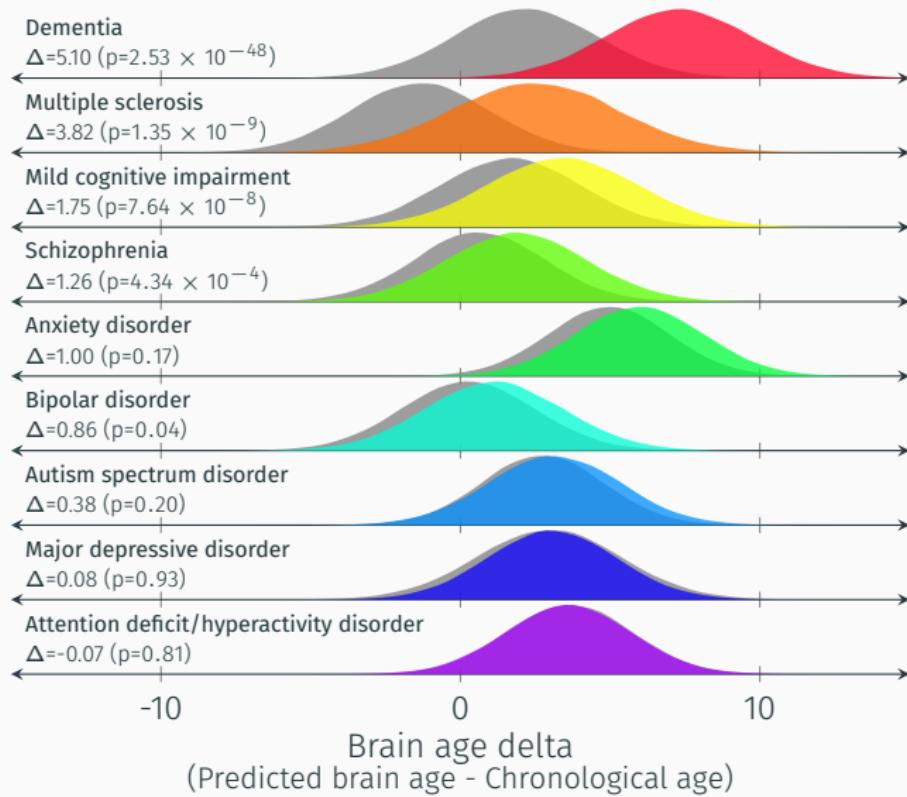
# Brain age modelling: Methods



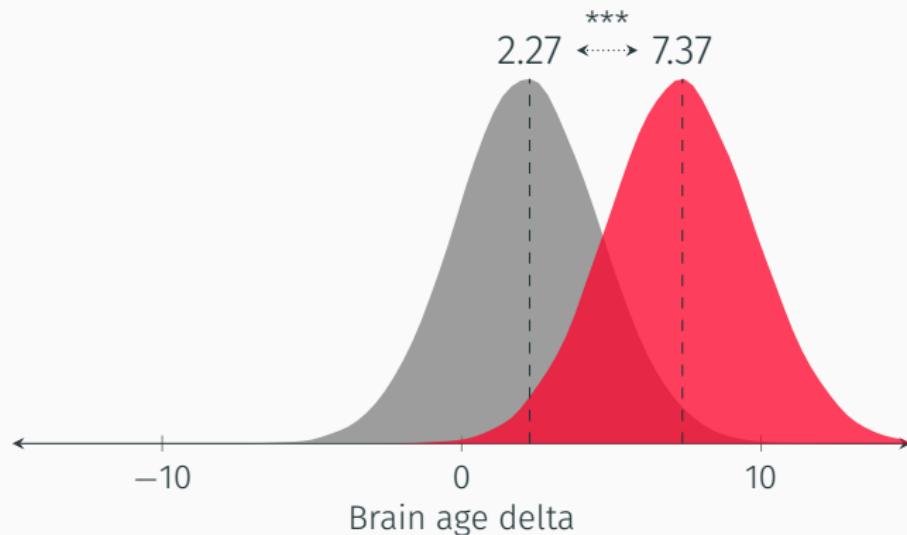
# Brain age modelling: Results



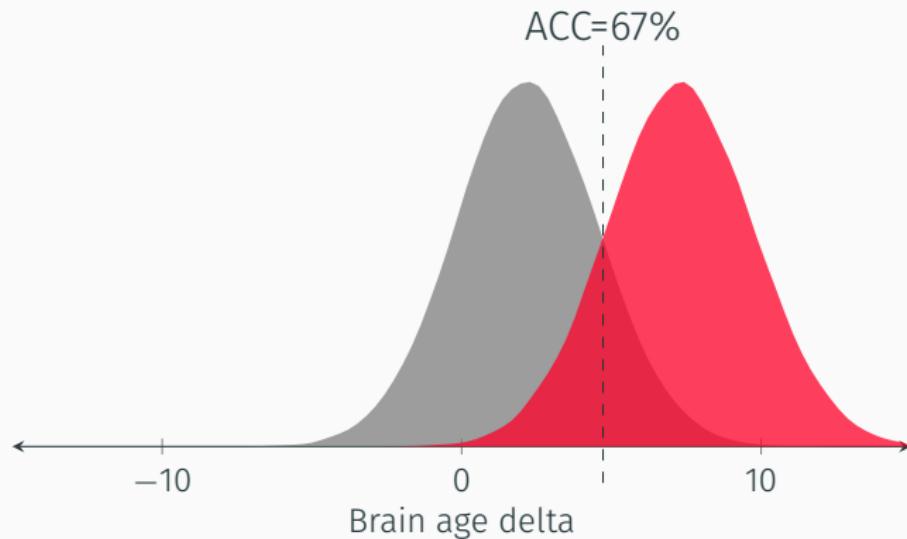
# Brain age modelling: Results



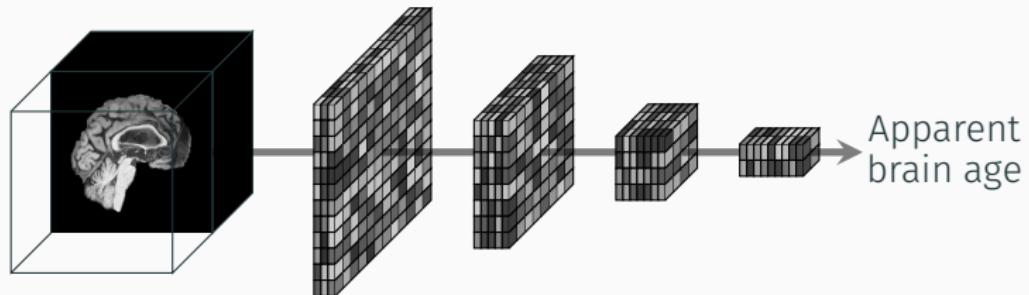
# Brain age modelling: Results



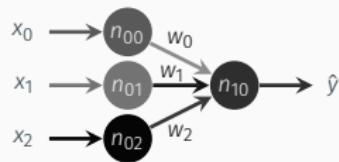
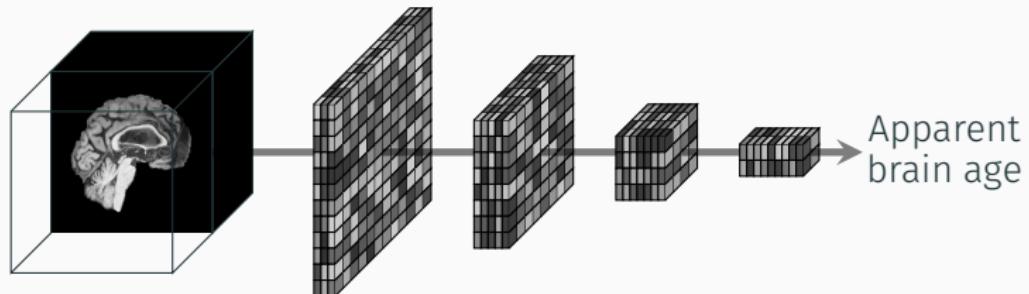
# Brain age modelling: Results



# Explainable artificial intelligence: Methods



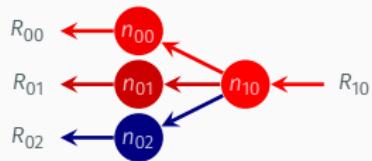
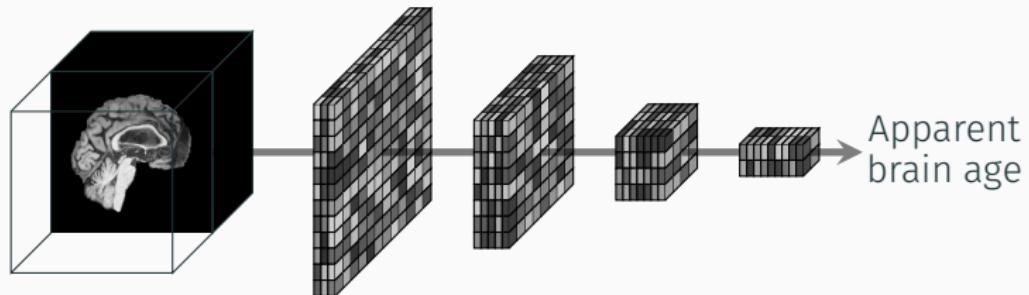
# Explainable artificial intelligence: Methods



$$\hat{y} = f \left( \sum_i^N w_i \cdot n_{0i} \right)$$

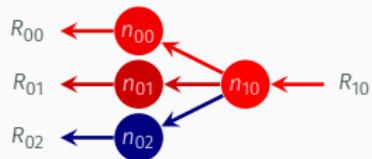
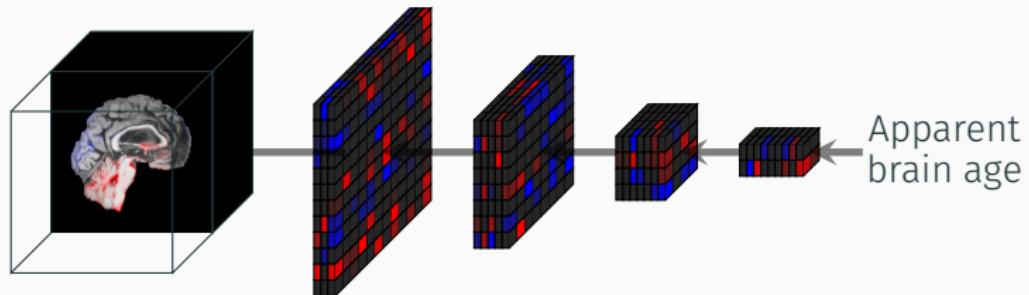


# Explainable artificial intelligence: Methods



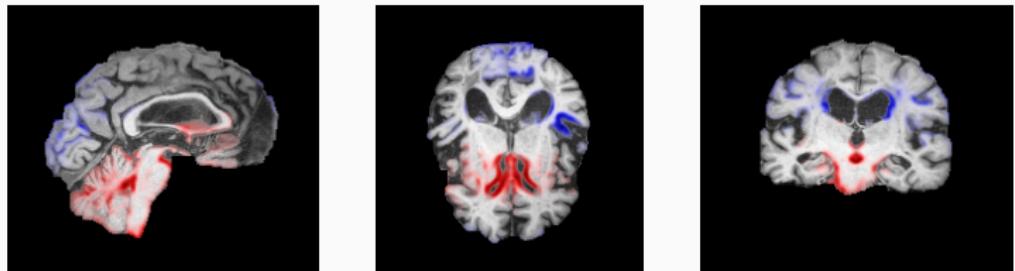
$$R_{0i} = \sum_j \frac{n_{0i} w_i}{\sum_k n_{0k} w_k} R_{1j}$$

# Explainable artificial intelligence: Methods



$$R_{0i} = \sum_j \frac{n_{0i} w_i}{\sum_k n_{0k} w_k} R_{1j}$$

# Explainable artificial intelligence: Methods

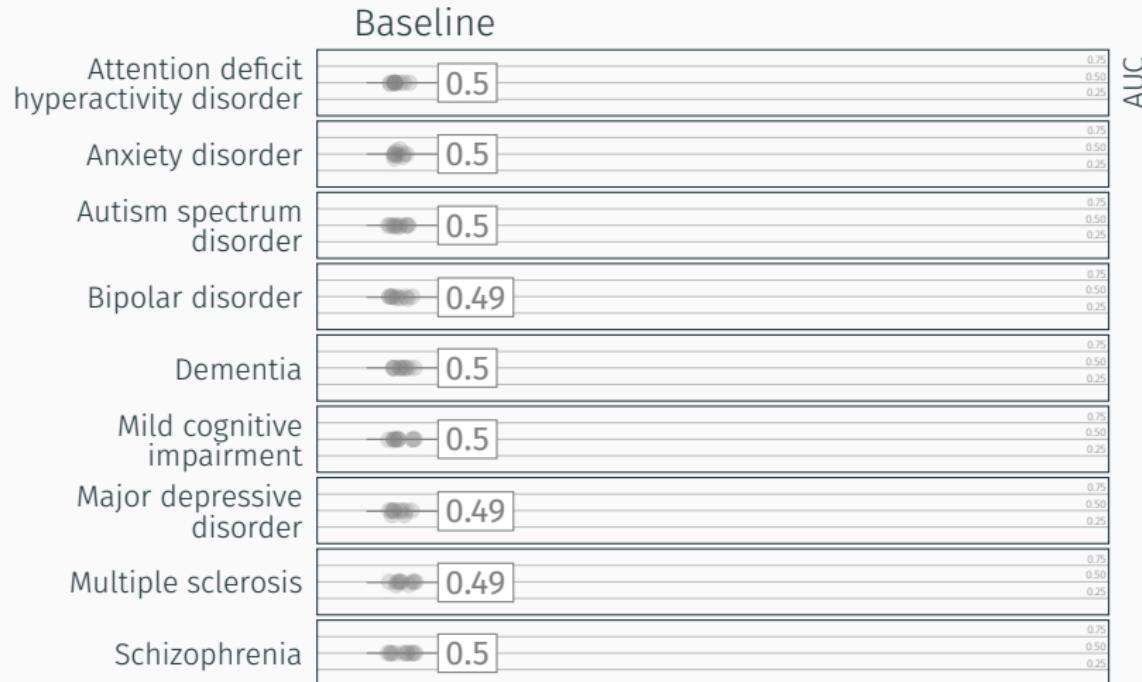


Younger  
appearing

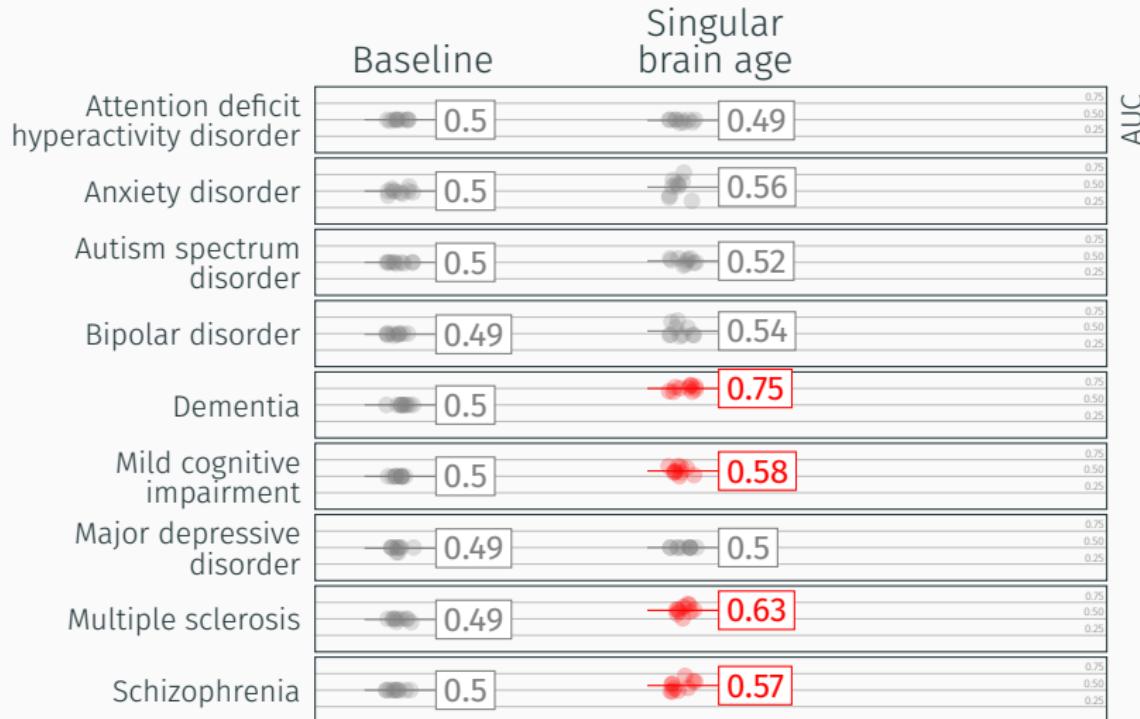
Older  
appearing



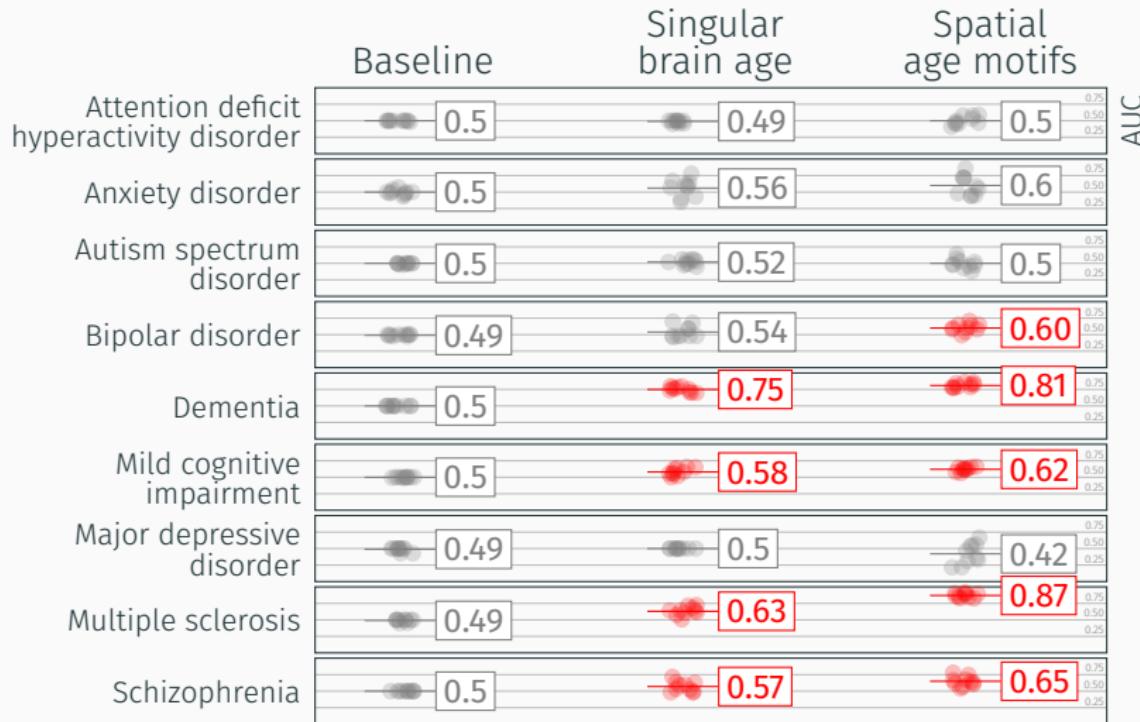
# Explainable artificial intelligence: Results



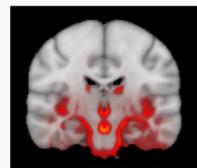
# Explainable artificial intelligence: Results



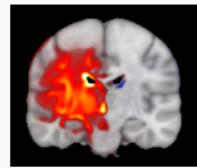
# Explainable artificial intelligence: Results



# Explainable artificial intelligence: Results



Dementia

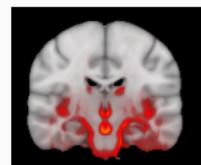


Multiple  
sclerosis



# Explainable artificial intelligence: Results

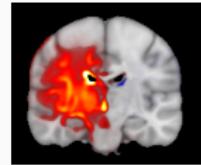
AUC



Dementia

Singular brain age	Spatial age motifs
-----------------------	-----------------------

0.75	0.81
------	------



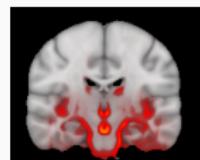
Multiple  
sclerosis

0.63	0.87
------	------



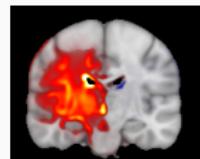
# Explainable artificial intelligence: Results

AUC



Dementia

Singular brain age	Spatial age motifs
0.75	0.81
<b>0.06</b>	

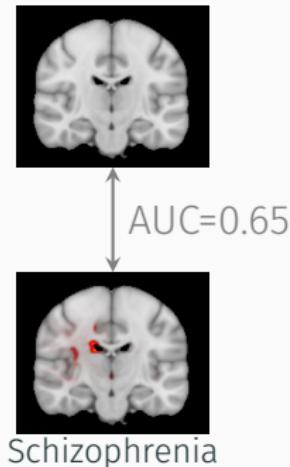
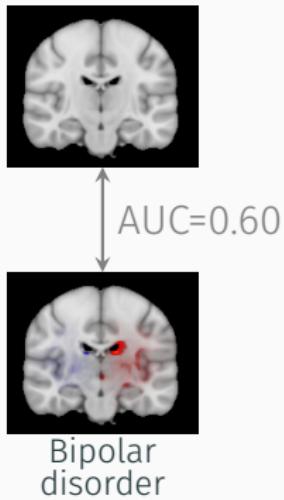


Multiple  
sclerosis

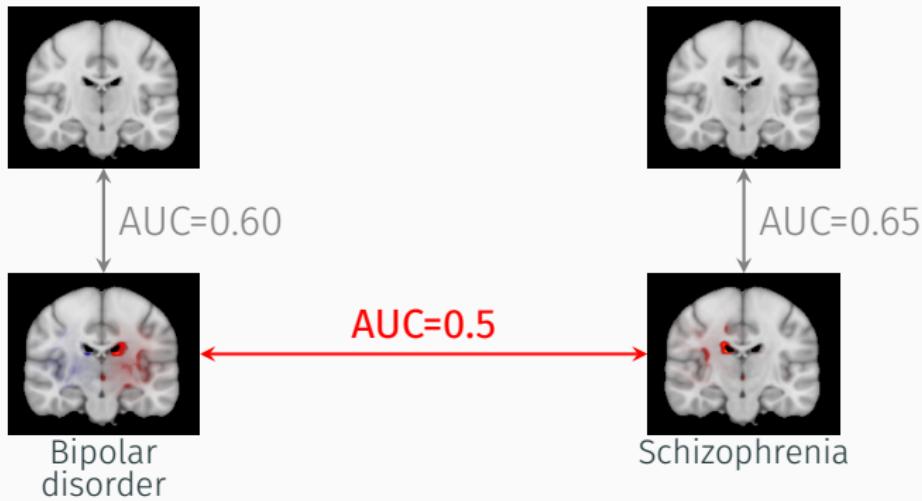
0.63 → 0.87  
**0.24**



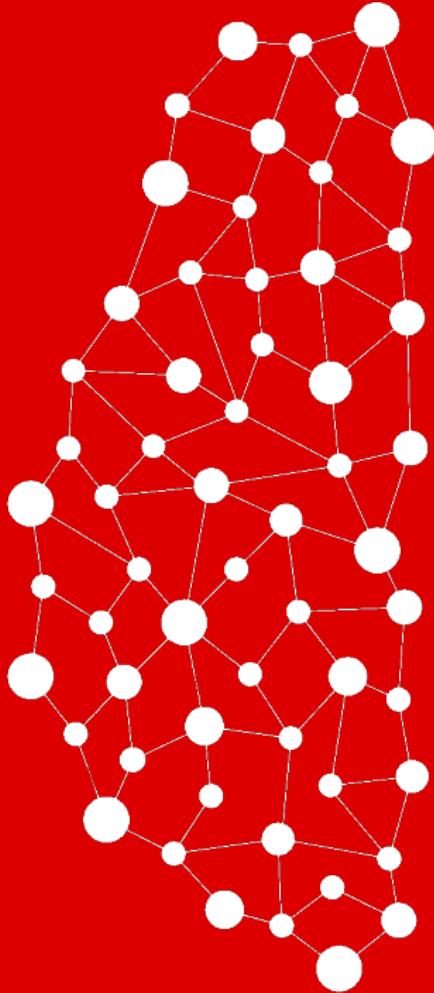
# Explainable artificial intelligence: Results



# Explainable artificial intelligence: Results



Thank you for your attention!  
estenhl@ui.no



UNIVERSITY  
OF OSLO