



THROUGH-PLANE DIFFUSION MRI SUPER-RESOLUTION WITH AUTOENCODERS: VALIDATION ON OUTLIER REPLACEMENT SCHEME FOR PRE-TERM BABY BRAINS

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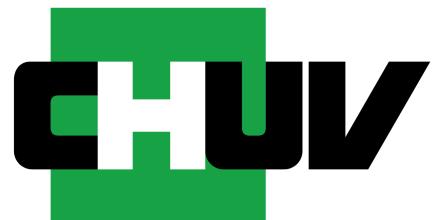
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Microstructure Imaging Meets Machine Learning Workshop

UCL, London

13.05.2022



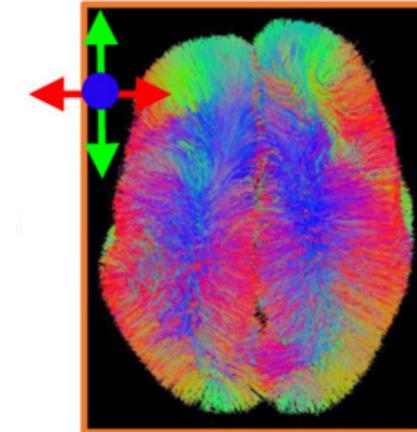
DIFFUSION MRI OF THE DEVELOPING BRAIN

■ BACKGROUND

- Diffusion MRI
- White matter



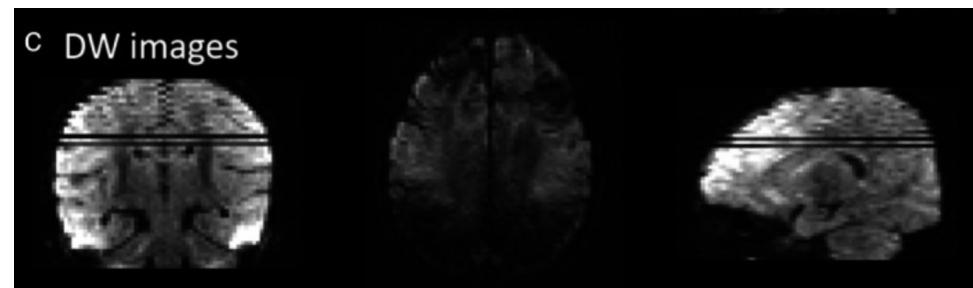
Americanpregnancy.org



Adapted from
Song et al.,
Frontiers in
Neuroscience
2017

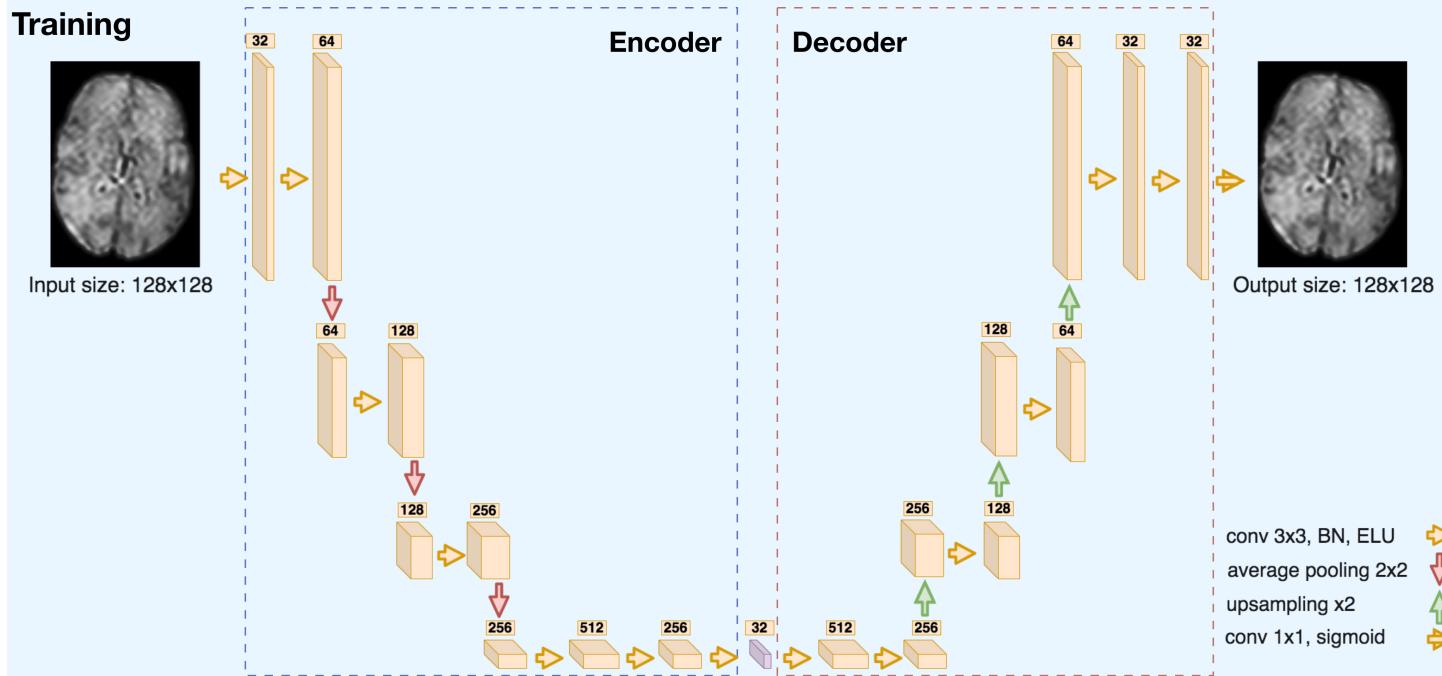
■ CHALLENGES

- Small brain structure
- Motion



Slice corruption due to motion. Adapted
from Dubois et al., J Man Reson Imaging
2021

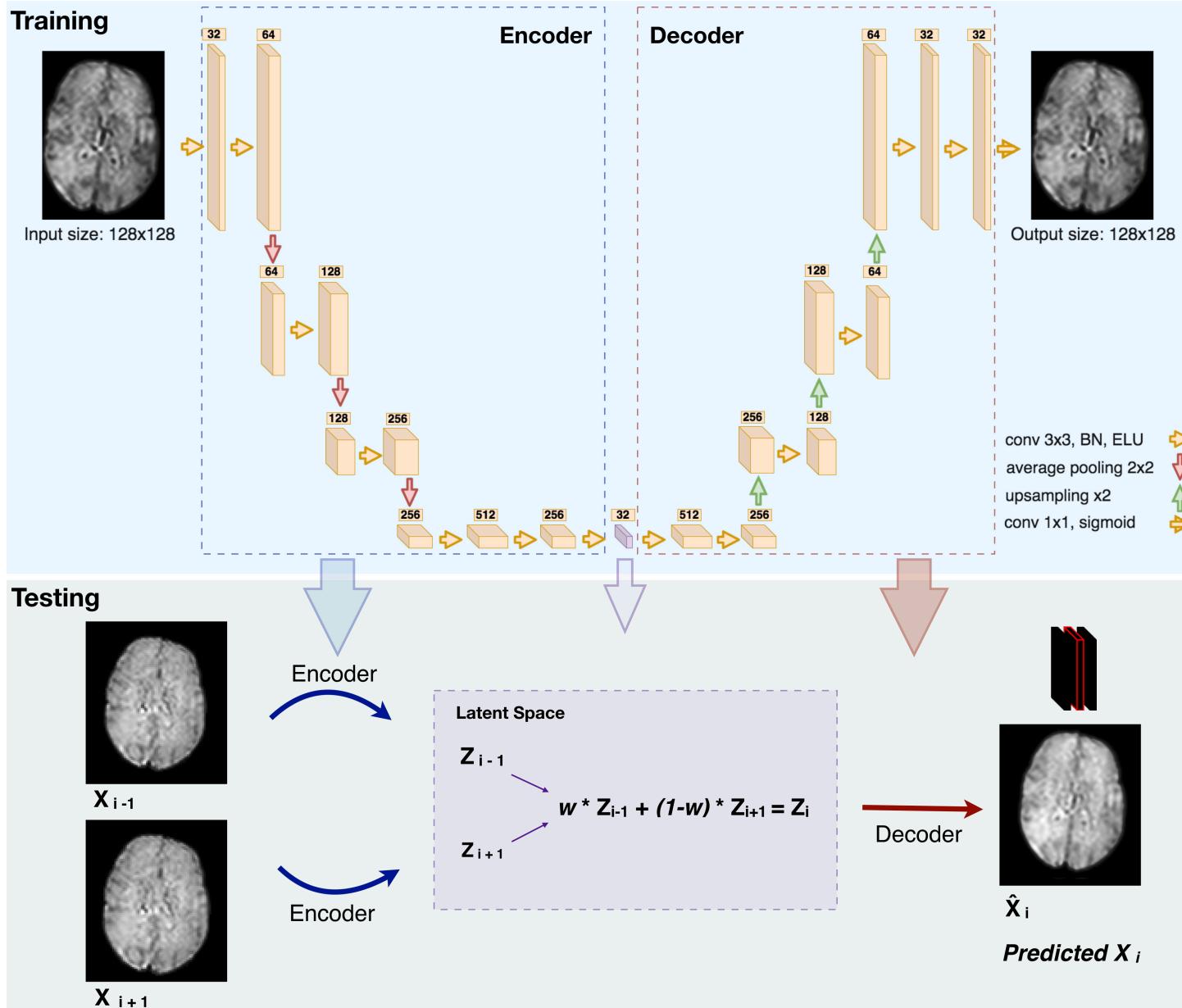
AUTOENCODER ARCHITECTURE



GOAL

- Using *latent space* representation, to infer corrupted slices using neighbouring clean ones

AUTOENCODER ARCHITECTURE & INFERENCE



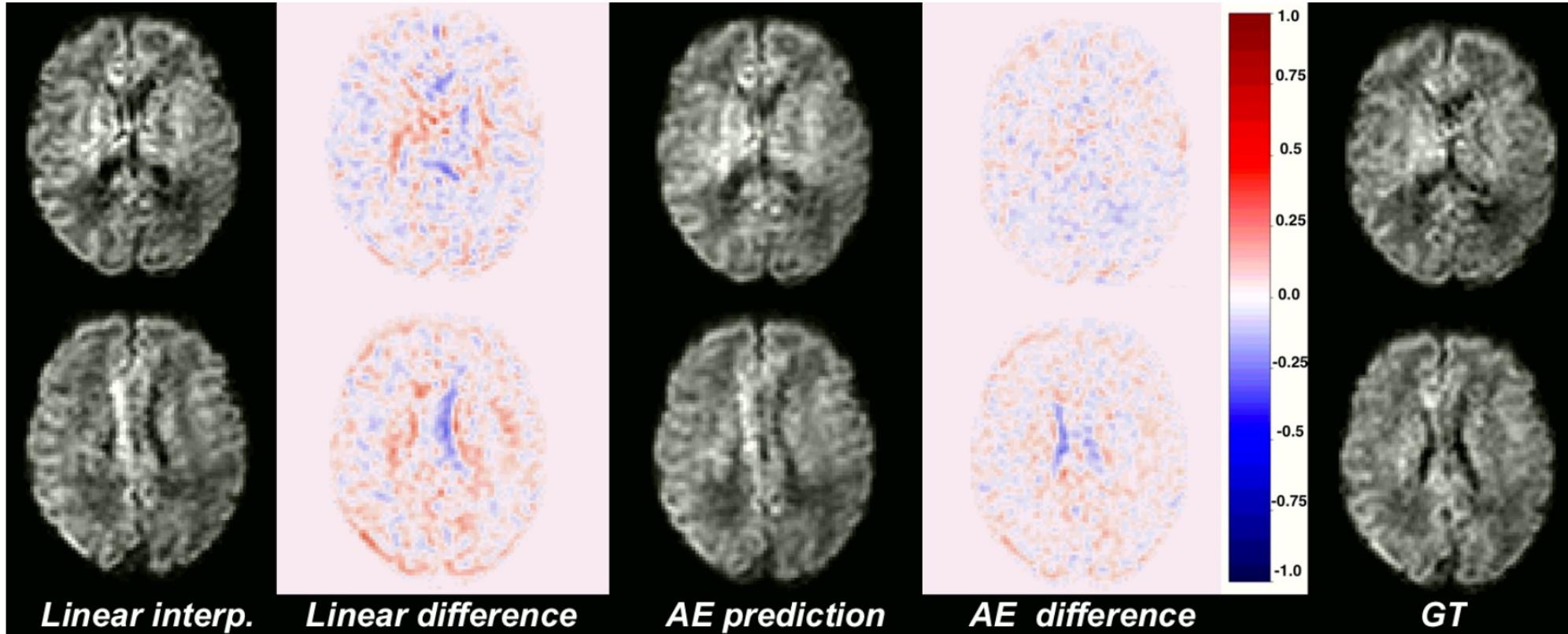
GOMA

- Using latent spaces of 29-37 representations, to infer corrupted slices using neighbouring clean ones
- 25,920 slices of $1.17 \times 1.17 \text{ mm}^2$
- Slice thickness: 1.5 mm
- $b = 1000 \text{ s/mm}^2$

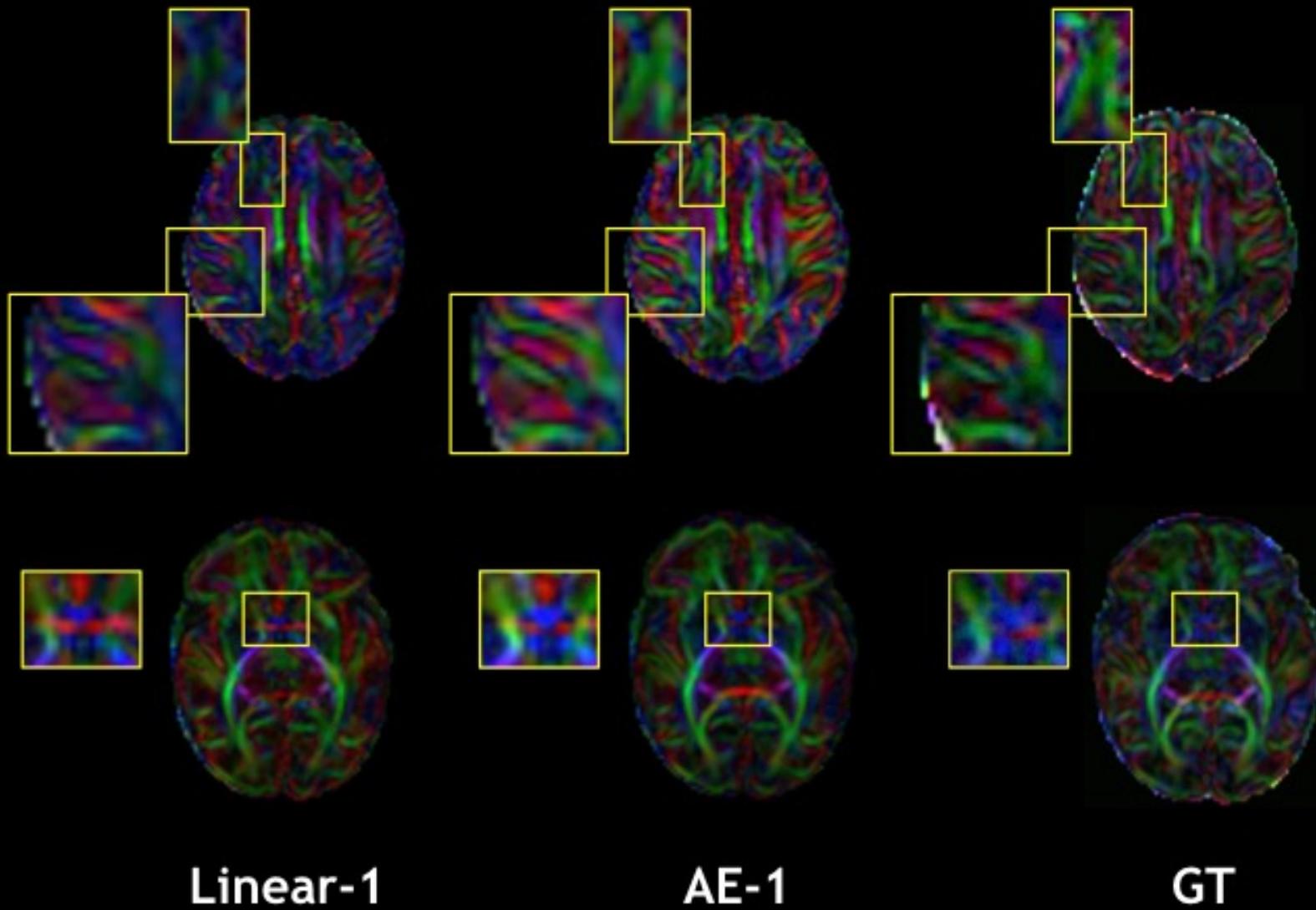


QUALITATIVE RESULTS: RAW SIGNAL

- B1000 error with respect to GT

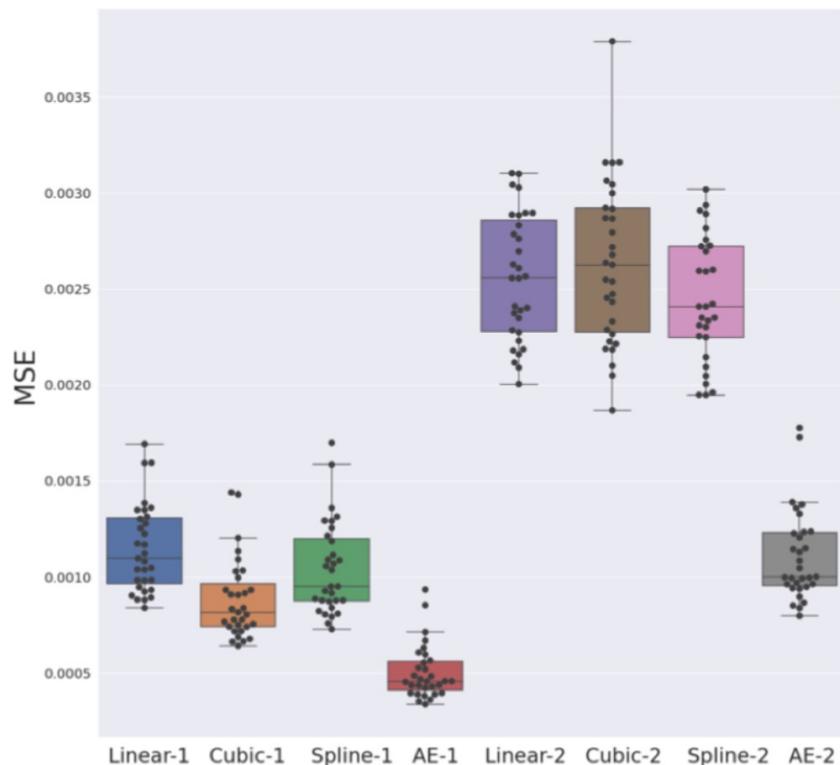


QUALITATIVE RESULTS: COLOR FA

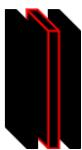
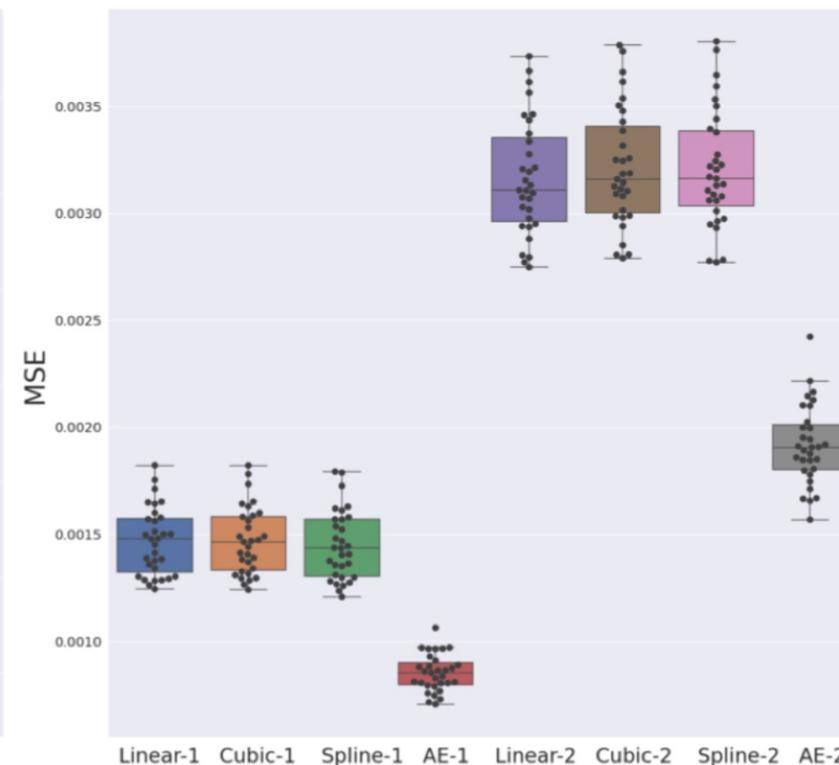


RAW SIGNAL MEAN SQUARED ERROR

b0



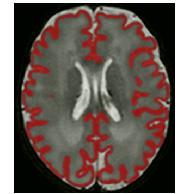
b1000



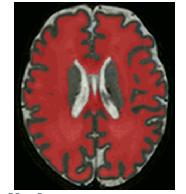
- Autoencoder outperforming interpolations
- Higher gap for 

DTI MAPS MEAN SQUARED ERROR

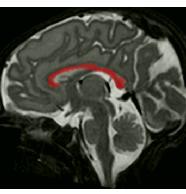
FA MD AD RD



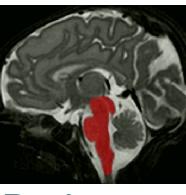
Cortical gray matter



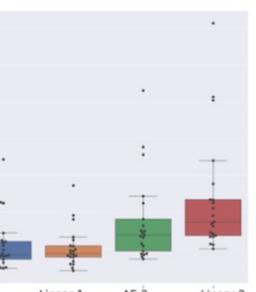
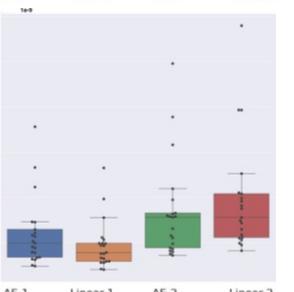
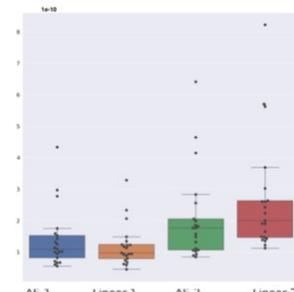
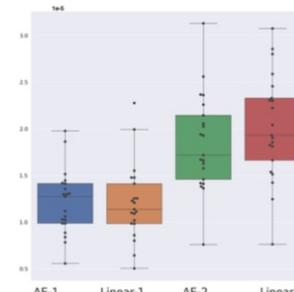
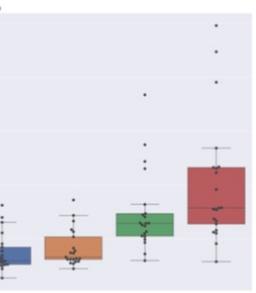
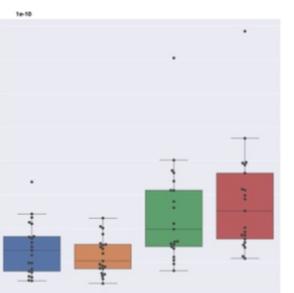
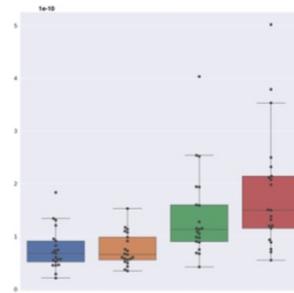
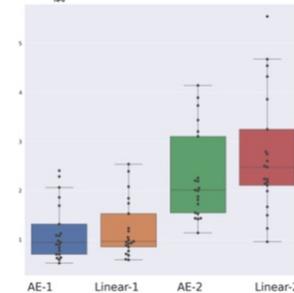
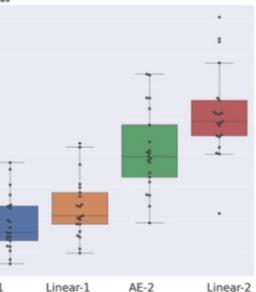
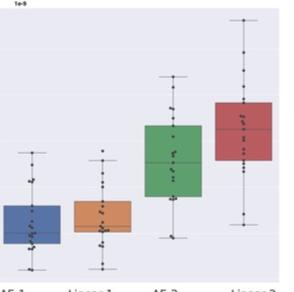
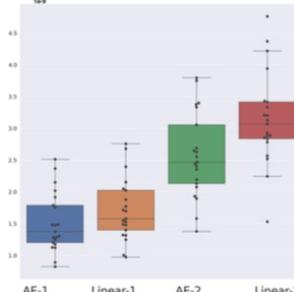
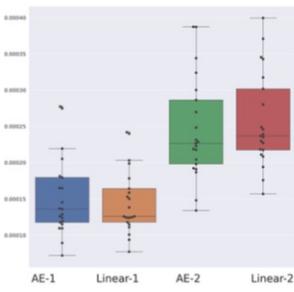
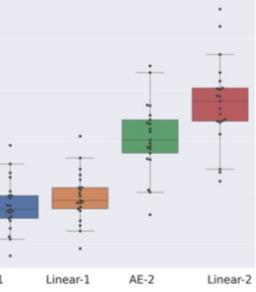
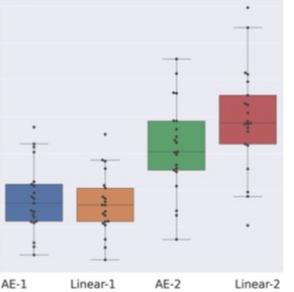
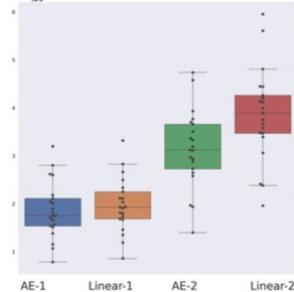
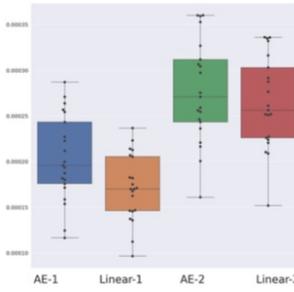
White matter



Corpus callosum



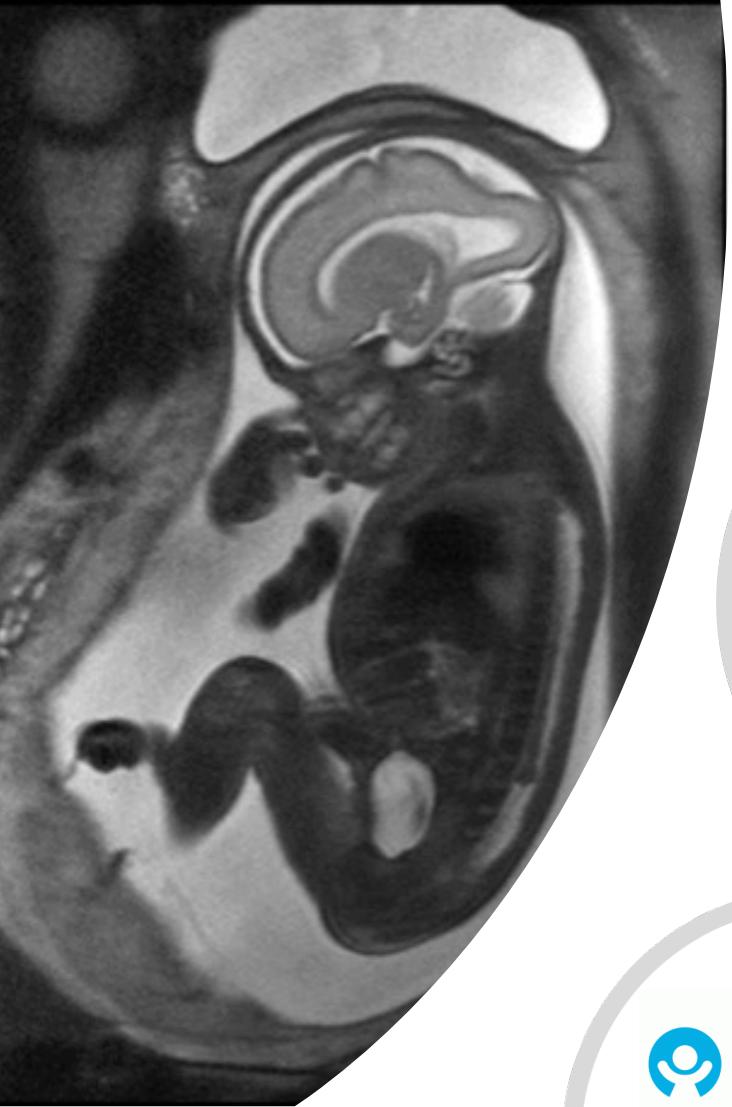
Brainstem



- No difference for
- Significant outperformance of autoencoders (MD, RD, AD) for



Kebiri et al., Frontiers in Neurology, 2022



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Thank you for your attention!

