Anatomical Predictions using Subject-Specific Medical Data

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MIDL
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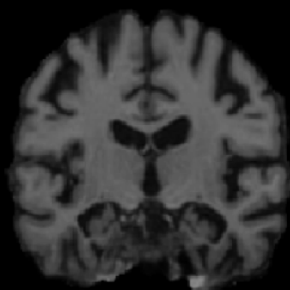
Baseline | 0.8 year | 1.7 years | 2.3 years | 3 years | 4 years | 5.3 years

Model

INPUTS

Baseline scan, $\boldsymbol{x}_0$

Attributes, $\boldsymbol{a}_0$

Follow-up scan, $\boldsymbol{x}_t$
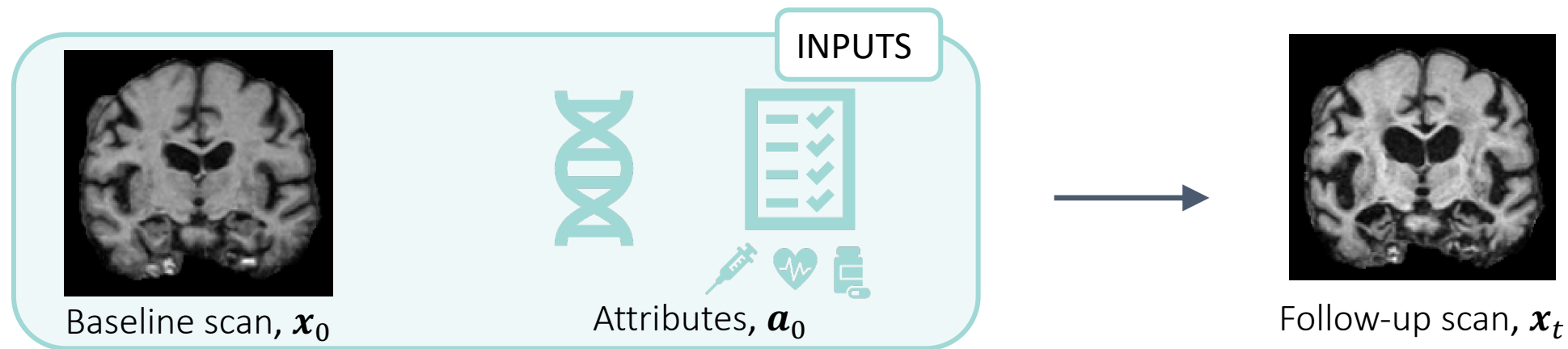
Evolution is captured by deformation field, $\boldsymbol{\phi}_v$:

Baseline scan, $\boldsymbol{x}_0$

Deformation field, $\boldsymbol{\phi}_v$

Follow-up scan, $\boldsymbol{x}_t$
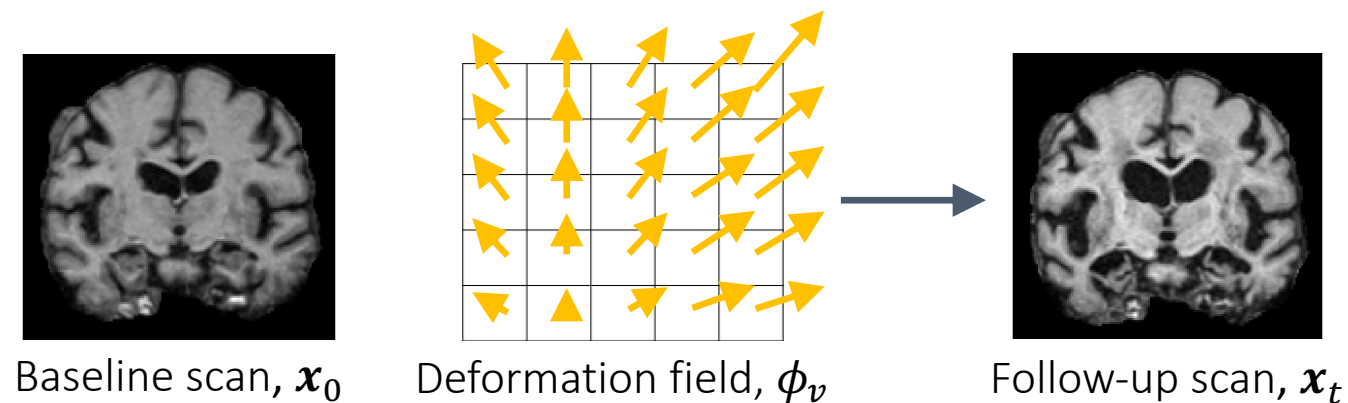
$$\boldsymbol{x}_0 \circ \boldsymbol{\phi}_v + \epsilon = \boldsymbol{x}_t$$

Model

- Use convolutional neural network to predict ϕ_v

$$\phi_v = g_\theta(\boldsymbol{x}_0, \boldsymbol{a}_0, t)$$

Baseline scan

Attributes

Architecture

$g_\theta(\boldsymbol{x}_0, \boldsymbol{a}_0, t)$

Attributes

$\boldsymbol{a_0}$

Baseline Scan ($\boldsymbol{x_0}$)

Concatenate

U-Net

Velocity field

$v_{\boldsymbol{x_0} \rightarrow \boldsymbol{x_1}}$

Integration Layer

$\int_0^t$

Deformation field

$\phi_{\boldsymbol{x_0} \rightarrow \boldsymbol{x_t}}$

Spatial Transform

Follow-up Scan ($\boldsymbol{x_t}$)

$(\boldsymbol{x}_0 \circ \phi_{\boldsymbol{x_0} \rightarrow \boldsymbol{x_t}})$
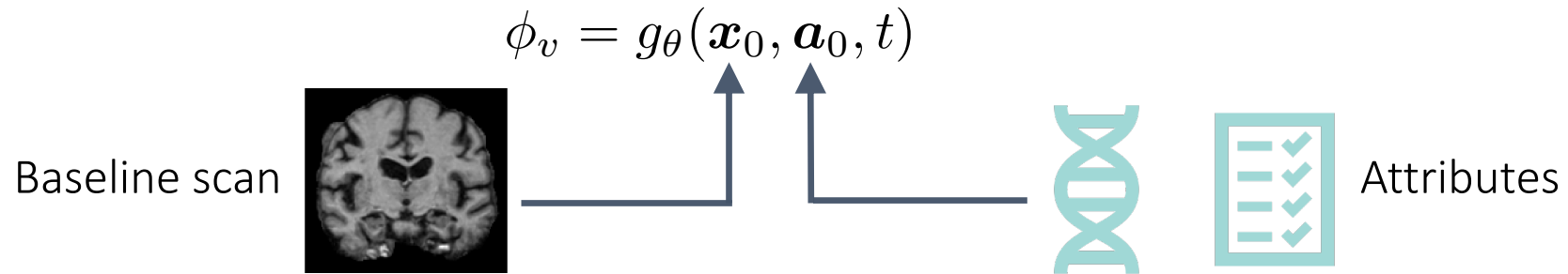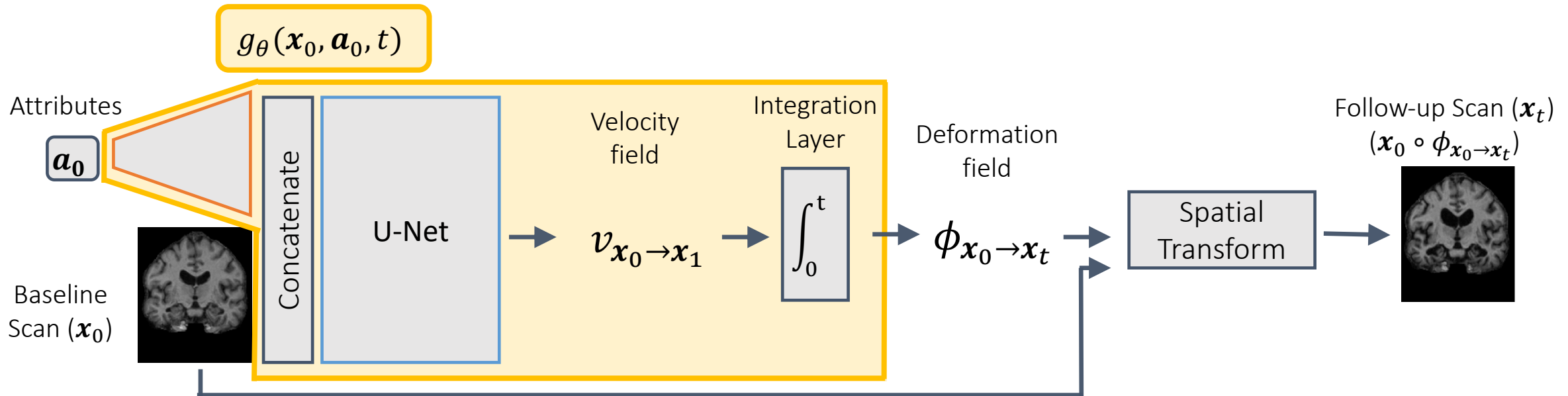
Experiments: More external data helps

- Experiments using the ADNI dataset
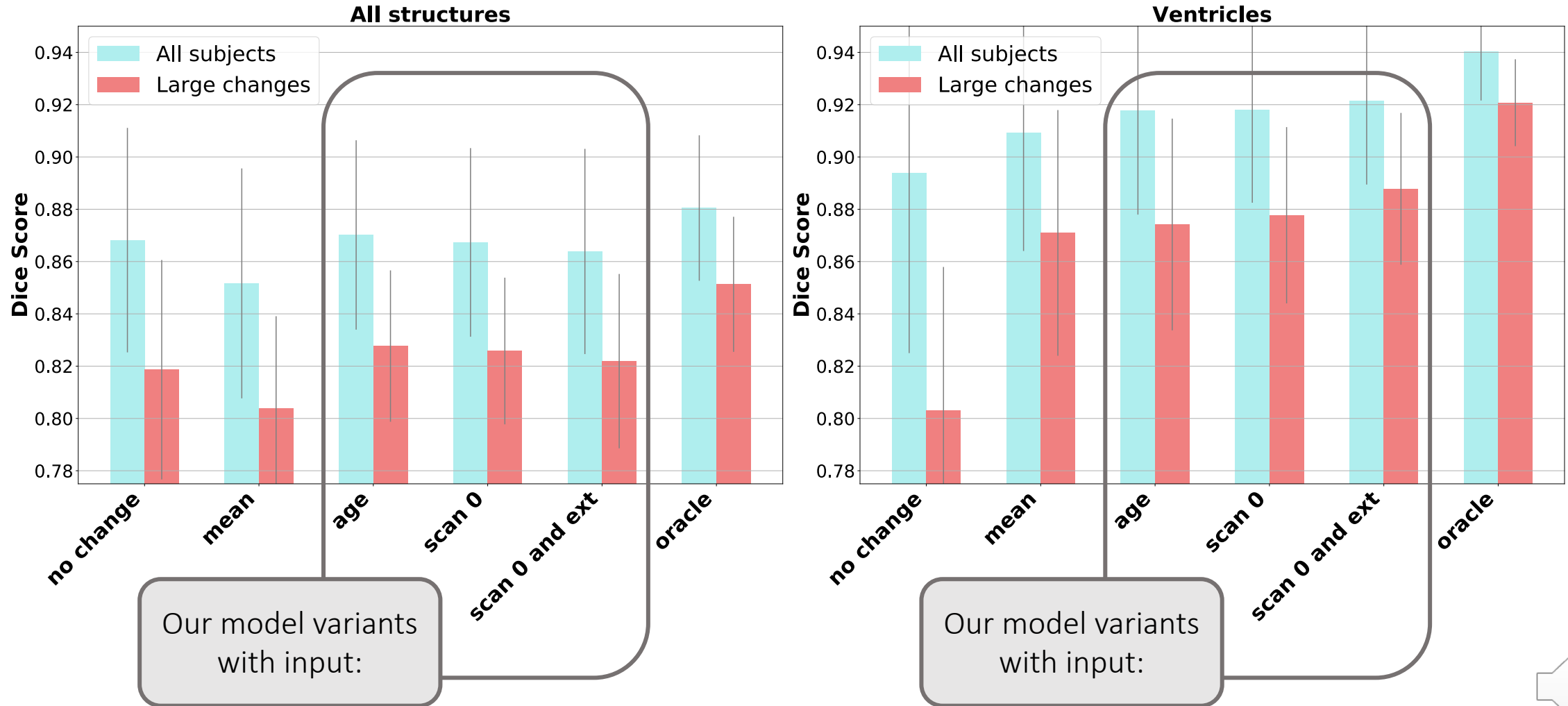
Large variation among subjects

Baseline scan, x_0

Follow-up scan, x_t

Predicted scan, $\hat{x}_t$
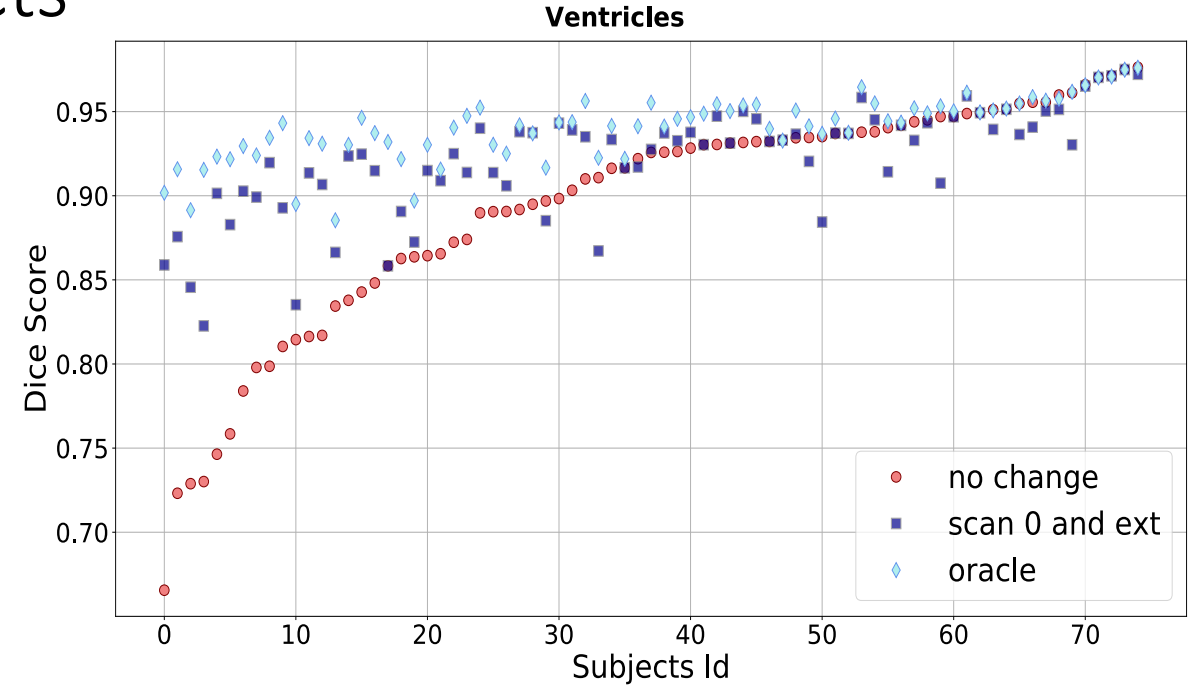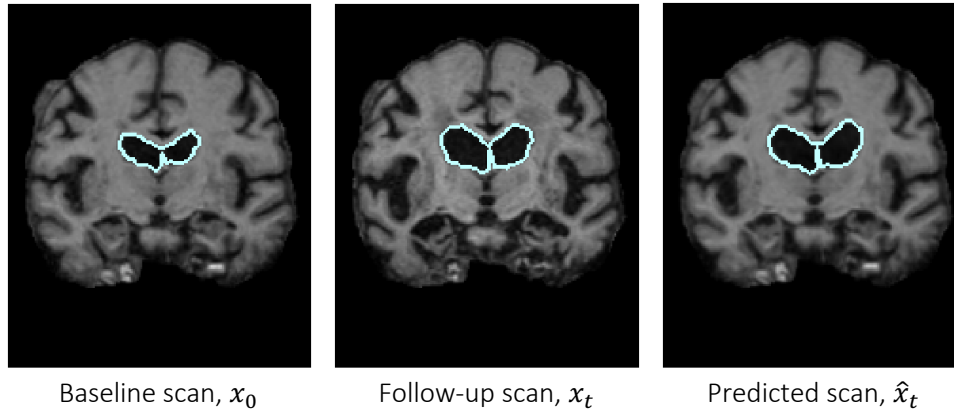
Conclusion

- It is possible to predict anatomical changes
- Adding non image information helps
- In recent work, we have improved results
- Paper available at https://arxiv.org/abs/20 00 0