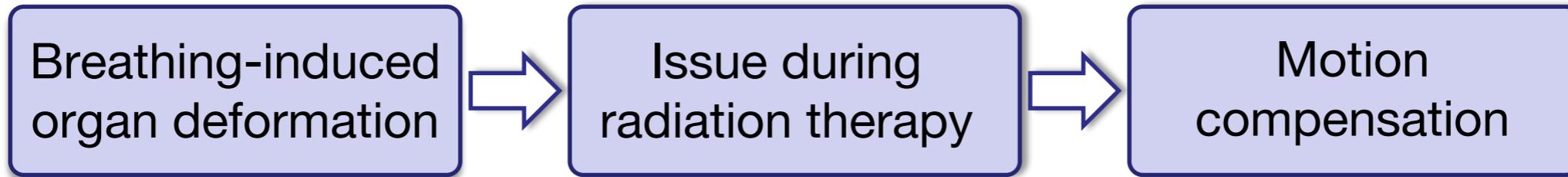# Spatio-temporal motion prediction in free-breathing liver scans via a recurrent multi-scale encoder decoder

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Context

Breathing-induced organ deformation → Issue during radiation therapy → Motion compensation

- Technological advances in image-guided radiotherapy have motivated the use of image surrogates to drive motion models

- Motion extrapolation is essential to cope with system latencies

Goal: To propose a classification-based multi-scale (MS) model for spatio-temporal 2D motion prediction
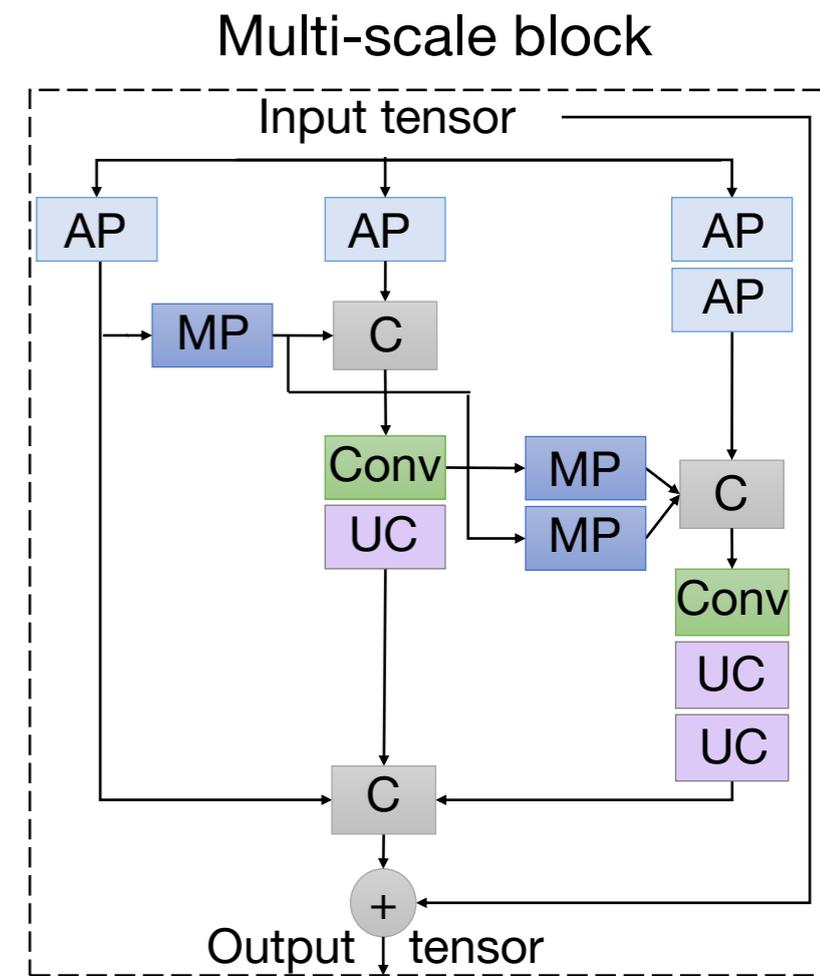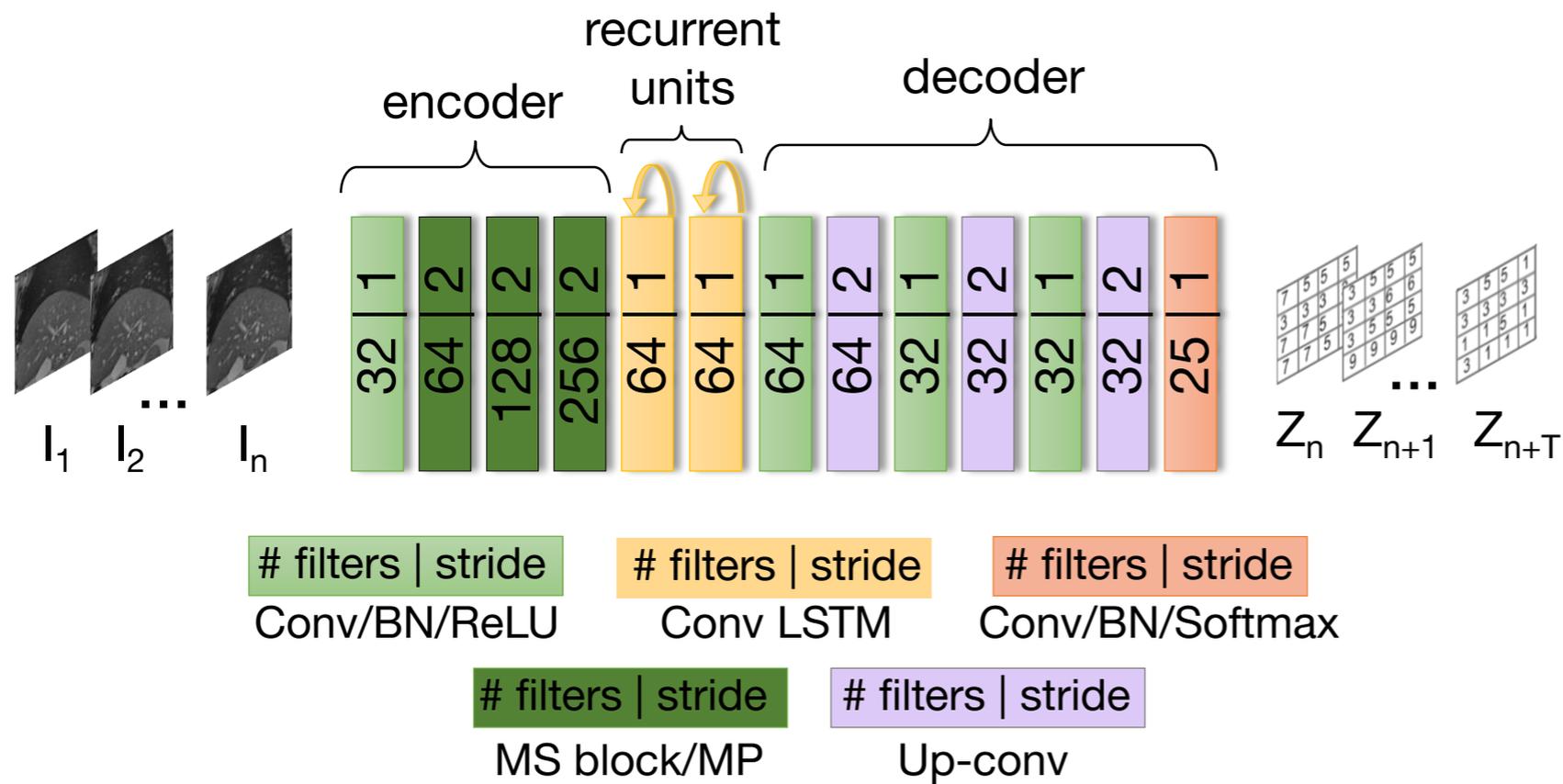
Overall pipeline

Sagittal slices 12 volunteers
Spatial resolution 1.7×1.7 mm^2
Temporal resolution 320 ms
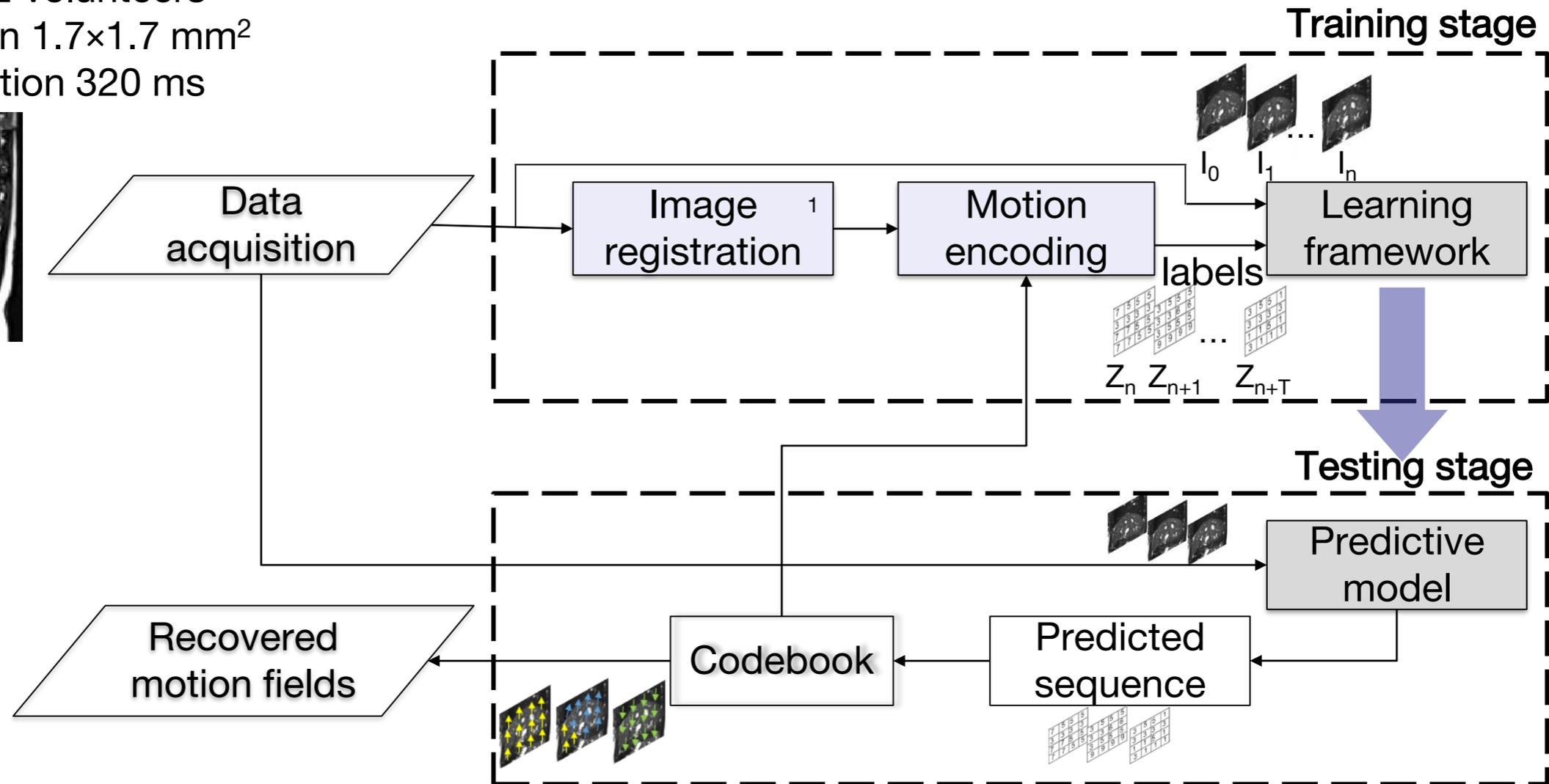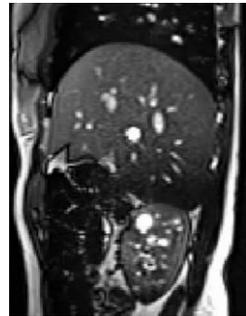
Proposed model

Conv: Convolution BN: Batch normalization AP: Average pooling
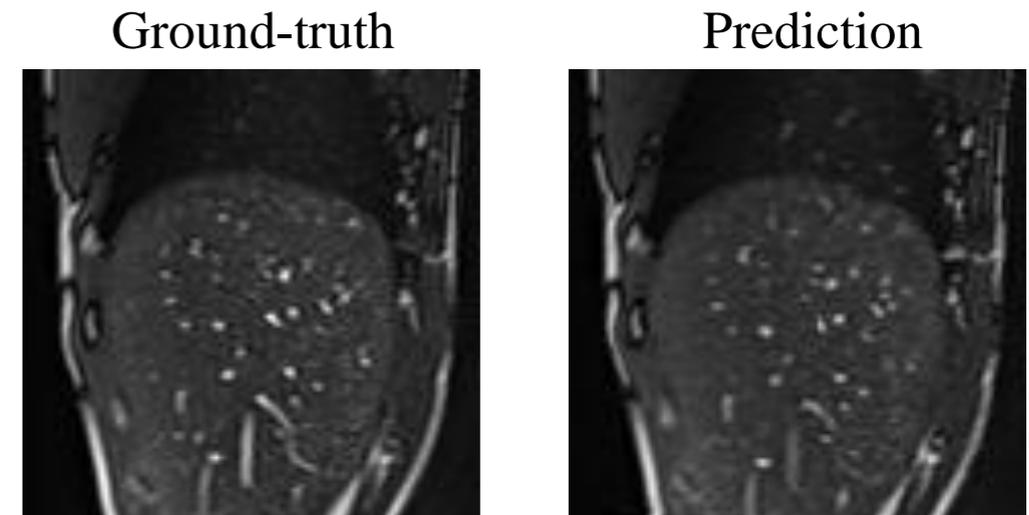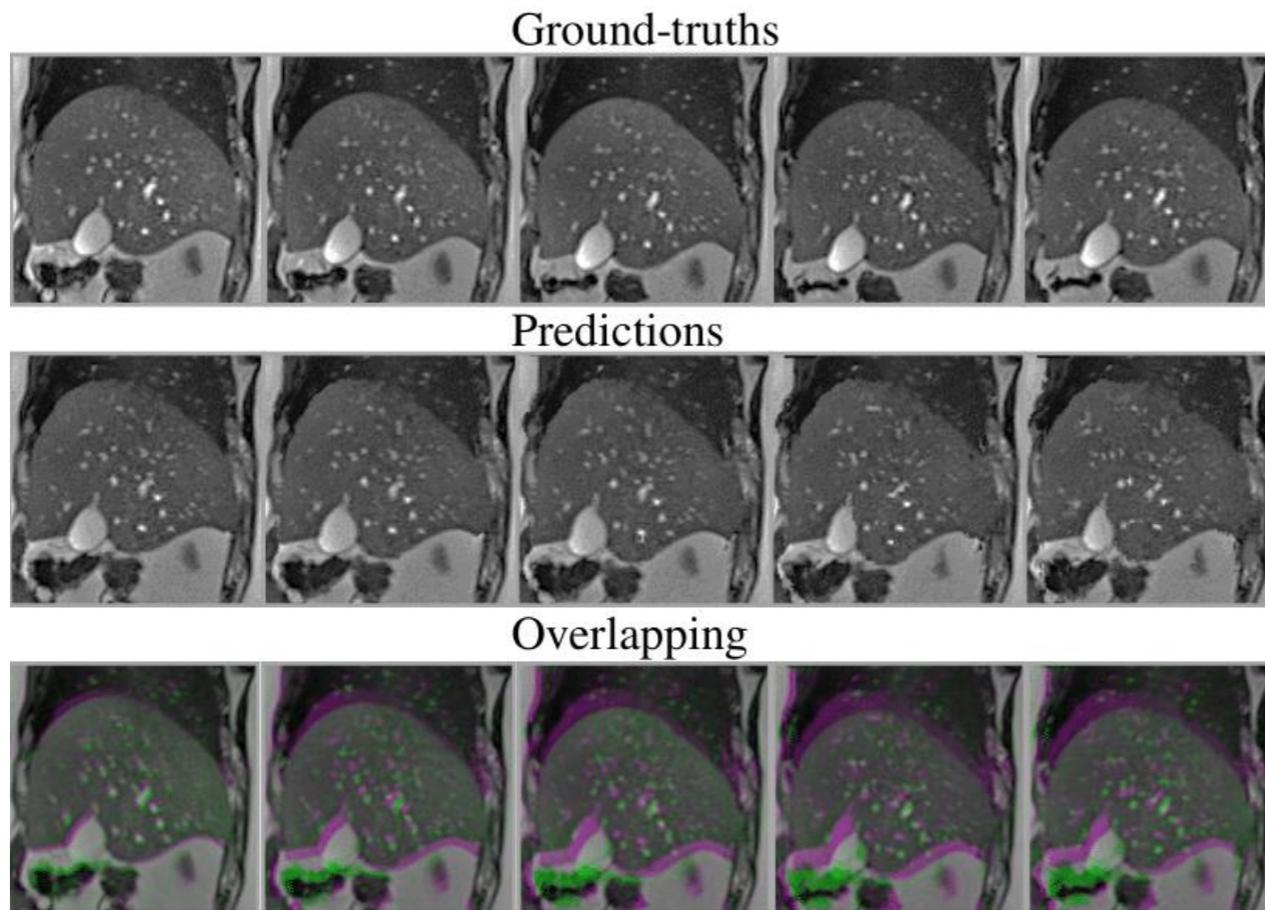MP: Max pooling UC: Up-convolution C: Concatenation

Table 1: Vessel tracking error position (in mm) for each predicted time (mean ± std).

Model	t=1 (320 ms)	t=2 (640 ms)	t=3 (960 ms)	t=4 (1280 ms)	t=5 (1600 ms)
PCA	2.25 ± 3.46	2.49 ± 3.76	3.45 ± 4.20	3.96 ± 4.42	4.39 ± 4.01
Enc-Dec	2.71 ± 3.21	3.41 ± 3.40	3.98 ± 4.17	4.41 ± 3.65	4.87 ± 4.11
Proposed	2.07 ± 2.95	2.24 ± 3.16	2.91 ± 3.52	3.11 ± 3.42	3.81 ± 3.63

Ground-truths

Predictions

Overlapping

Ground-truth
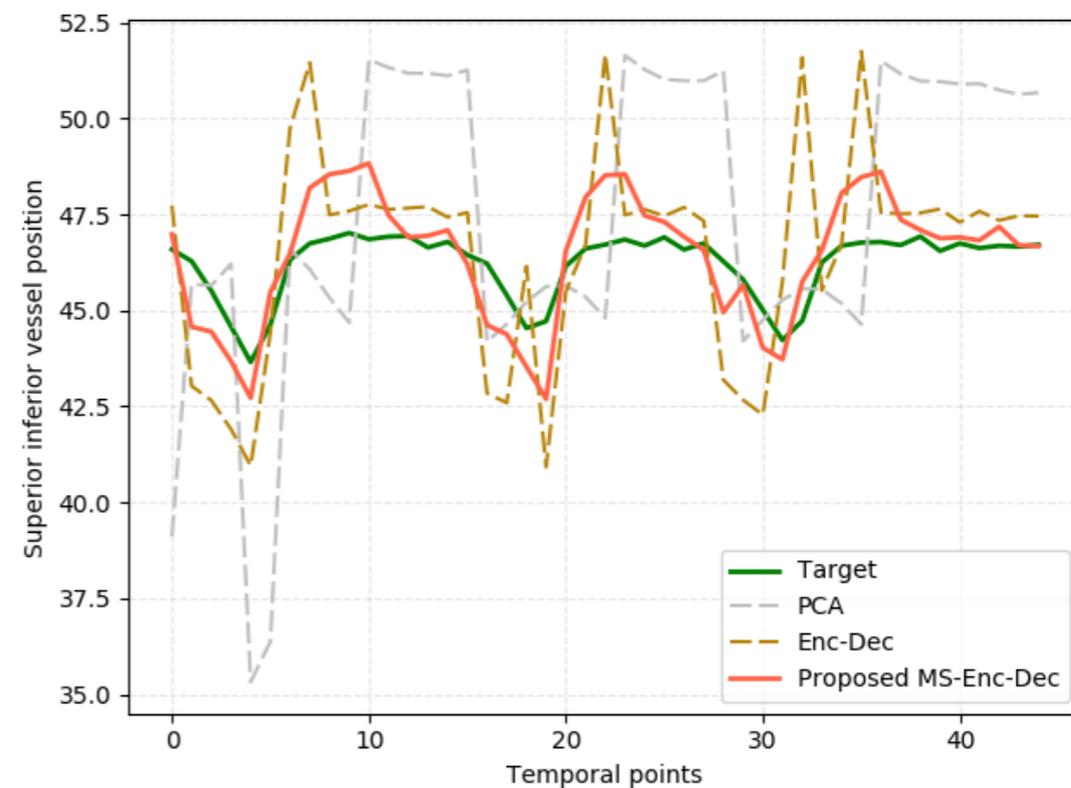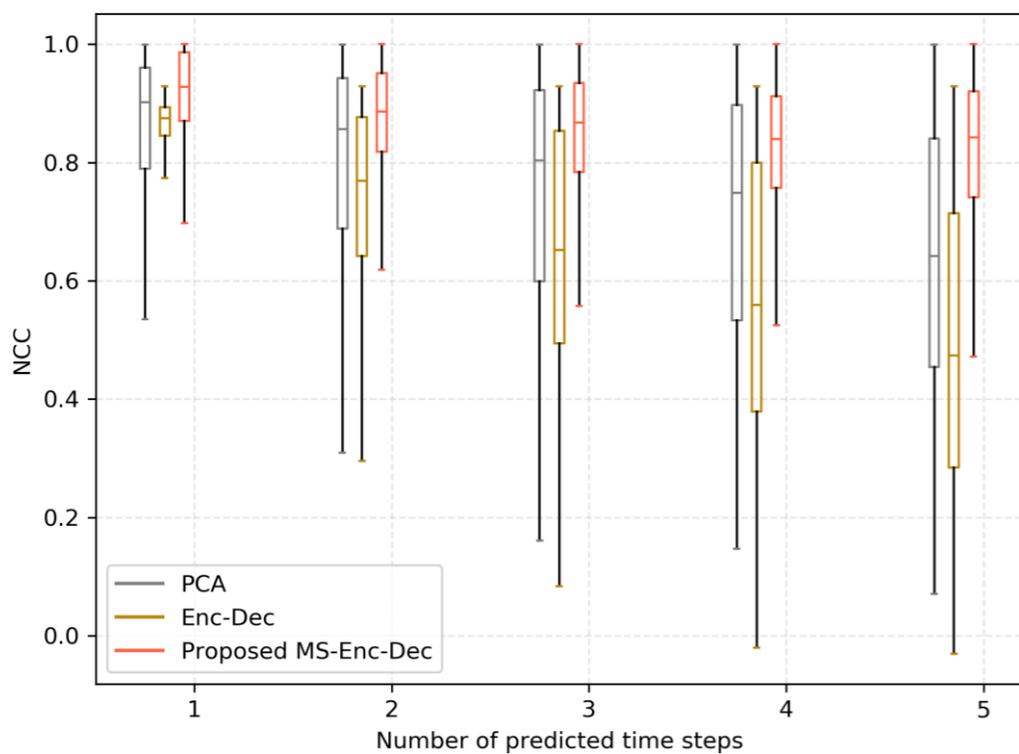
Prediction

- Limitations: inability to cope with out-of-plane motion

- Future work: regularization on predicted displacement fields

Thanks for your attention

Acknowledgments to: