Ultrasound-based motion management is a promising approach to cope with **inter-fractional motions** in **proton therapy**.

Inter-fractional Respiratory Motion Modelling from Abdominal Ultrasound: A Feasibility Study

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Introduction

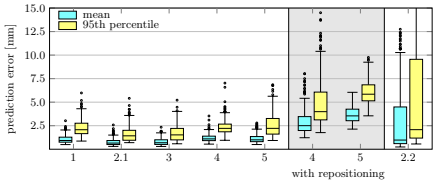
- Motion management is crucial for proton therapy of tumours prone to respiratory movement.
- We present an inter-fractional motion management pipeline for the lungs based on abdominal ultrasound (US).

Methods

- Hybrid US/MR acquisitions of 5 healthy volunteers; subject repositioning in 2 cases
- Time-resolved 4D MRI
- Low-dimensional respiratory motion surrogate using PCA
- Autoregressive model for time series forecasting (p=5, n=2)
- Cubic polynomial regression model for motion prediction

Results

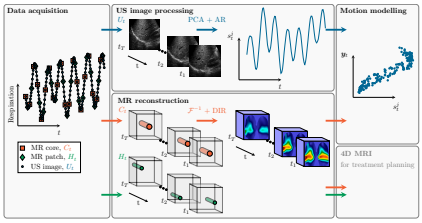
- The overall mean prediction error is 2.9 mm and 3.4 mm after repositioning.

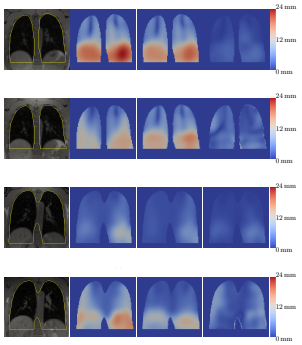


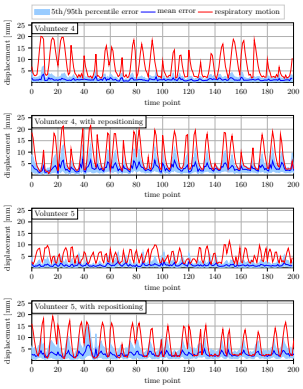
Discussion

- Motion prediction remains challenging if the respiratory motion varies substantially between two fractions.
- Further work is needed to investigate the effect of dense motion prediction on treatment plan adaptations and dose distribution in proton therapy.

Additional figures







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