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BEYOND THE FUTURE!
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Predicting Lung Tumor Shrinkage During Radiotherapy Seen in a Longitudinal MR Imaging Study Via a Deep Learning Algorithm

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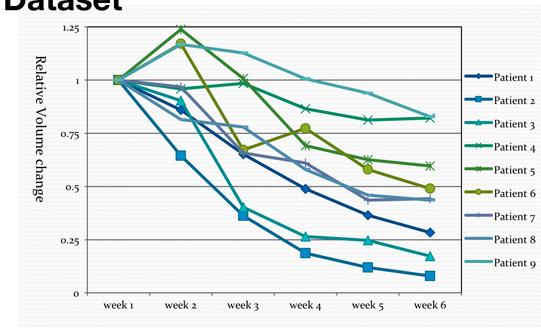
Purpose: to develop a deep learning algorithm and predict the trajectory of lung tumor shrinkage during RT monitored via a longitudinal MRI study.

Dataset



Patient	Vol_{w1} (cc)	Vol_{w6} (cc)	Shrinkage (%)
# 1	15.7	4.4	72.0
# 2	4.8	0.4	91.7
# 3	257.2	43.8	83.0
# 4	5.2	4.1	21.2
# 5	116.6	53.2	54.4
# 6	113.7	17.8	84.3
# 7	89.1	38.6	56.7
# 8	131.8	55.4	58.0
# 9	58.4	48.3	17.3

Relative tumor shrinkages during radiotherapy of 9 locally advanced non-small cell lung cancer patients monitored via a longitudinal weekly MRI study.

Methodology

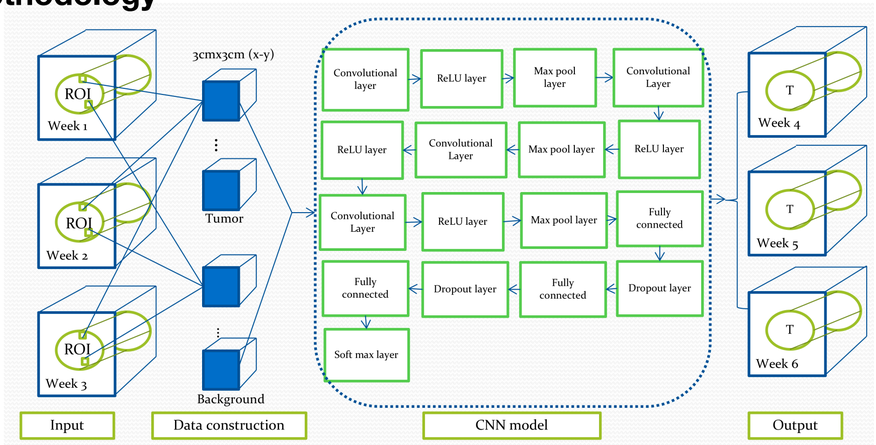
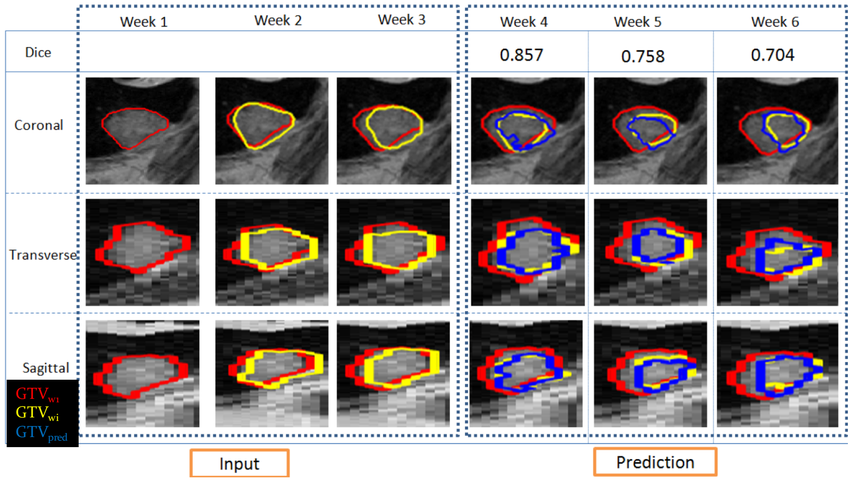


Diagram of the predictive algorithm. The convolutional neural network (CNN) was implemented by MatConvNet on the Matlab platform.

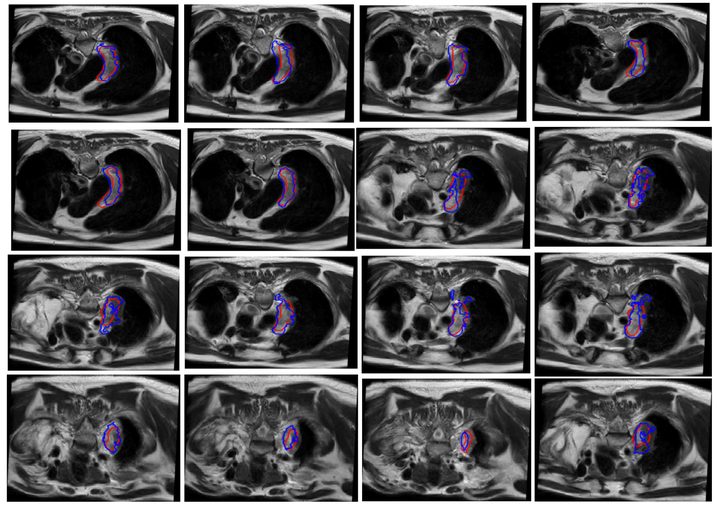
Results



A typical example (patient #1) of predicted GTV on week 4, 5 and 6.

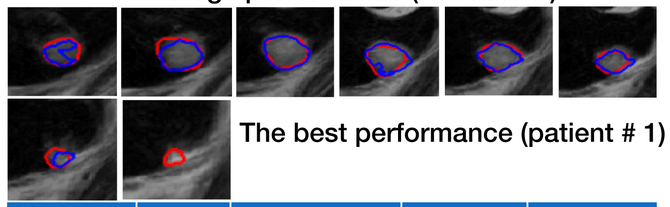
	Dice	RSMSD (mm)	Sens.	Prec.
Week 4	0.81±0.06	1.8±0.8	0.85±0.06	0.78±0.09
Week 5	0.73±0.05	2.1±0.7	0.79±0.10	0.69±0.10
Week 6	0.73±0.06	2.0±0.9	0.83±0.14	0.67±0.06

The overall prediction performance for week 4, 5, and 6 by using the leave-one-out strategy, respectively.



	Dice	RSMSD (mm)	Sens.	Prec.
Week 6	0.71	2.0	0.76	0.67

Average performance (Patient # 3)



The best performance (patient # 1)

	Dice	RSMSD (mm)	Sens.	Prec.
Week 4	0.86	1.3	0.81	0.91

Conclusion: The deep learning algorithm can capture and predict the spatial shrinkage patterns of the tumor along the course of radiotherapy. It can be integrated into the clinical workflow of adaptive radiotherapy.

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