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ABSTRACT

Uptake of PET tracers in the prostate gland and the size of the gland may serve as guidance for management of patients with prostate cancer. A fast automated analysis of PET/CT studies providing imaging biomarkers reflecting both pathophysiology and anatomy may potentially improve diagnostic accuracy and treatment efficacy.

We aimed to develop and validate a deep learning-based method for analysis of PET/CT studies of the prostate gland.

METHODS

Deep Learning Method

Convolutional neural network

Training dataset

150 patients, prostate and urinary bladder manually segmented in PET/CT scans

Study group

52 prostate cancer patients;

18F-Choline PET/CT prior to radical prostatectomy.

45 patients with PET/CT 3< months prior to surgery.

Validation of Deep Learning Method

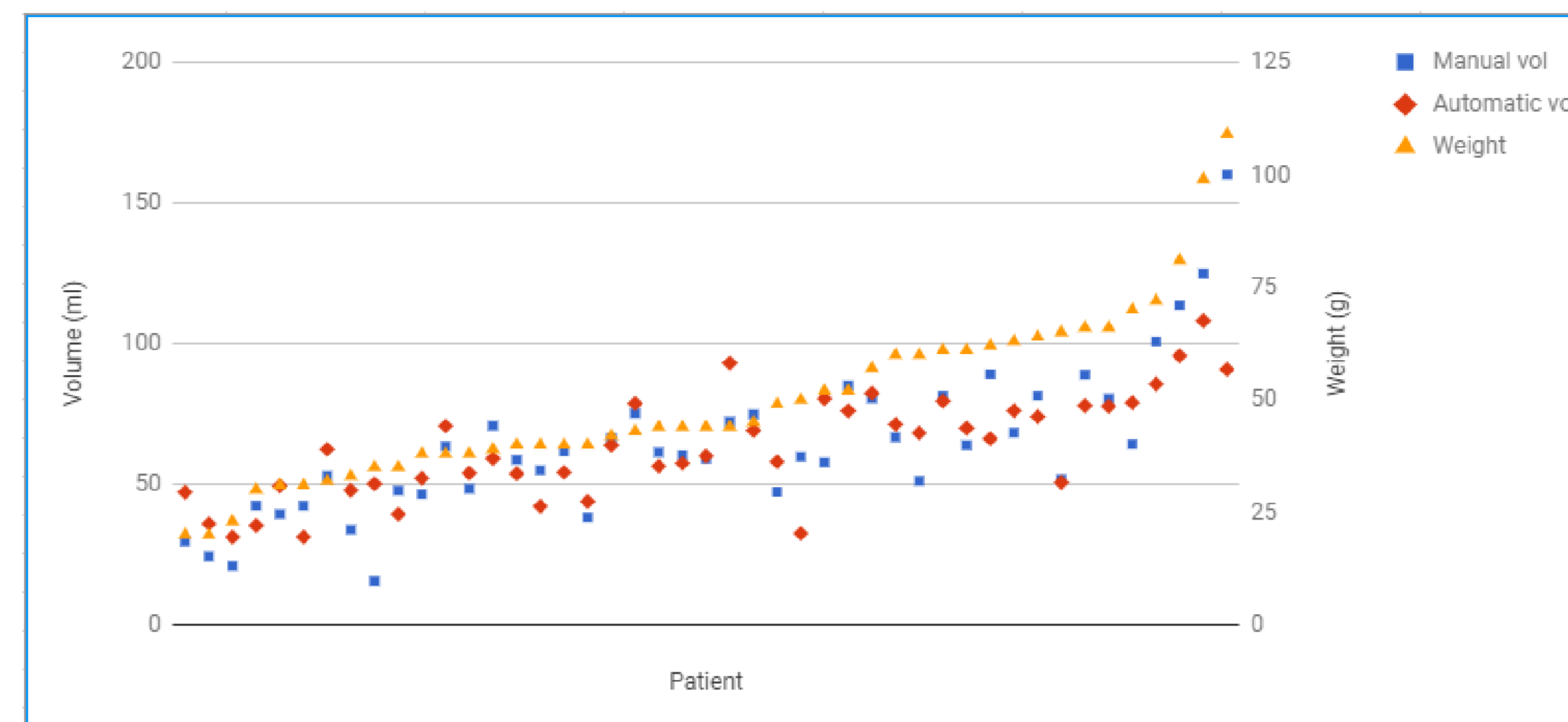
1. Prostate weight (without seminal vesicles) was compared to automatically measured prostate gland volume in CT.

2. SUVmax of the tumor volume defined by a nuclear medicine specialist and automatically calculated was compared.

Automated analysis was performed in **less than a minute** (avg. 45 sec.) for a PET/CT scan.

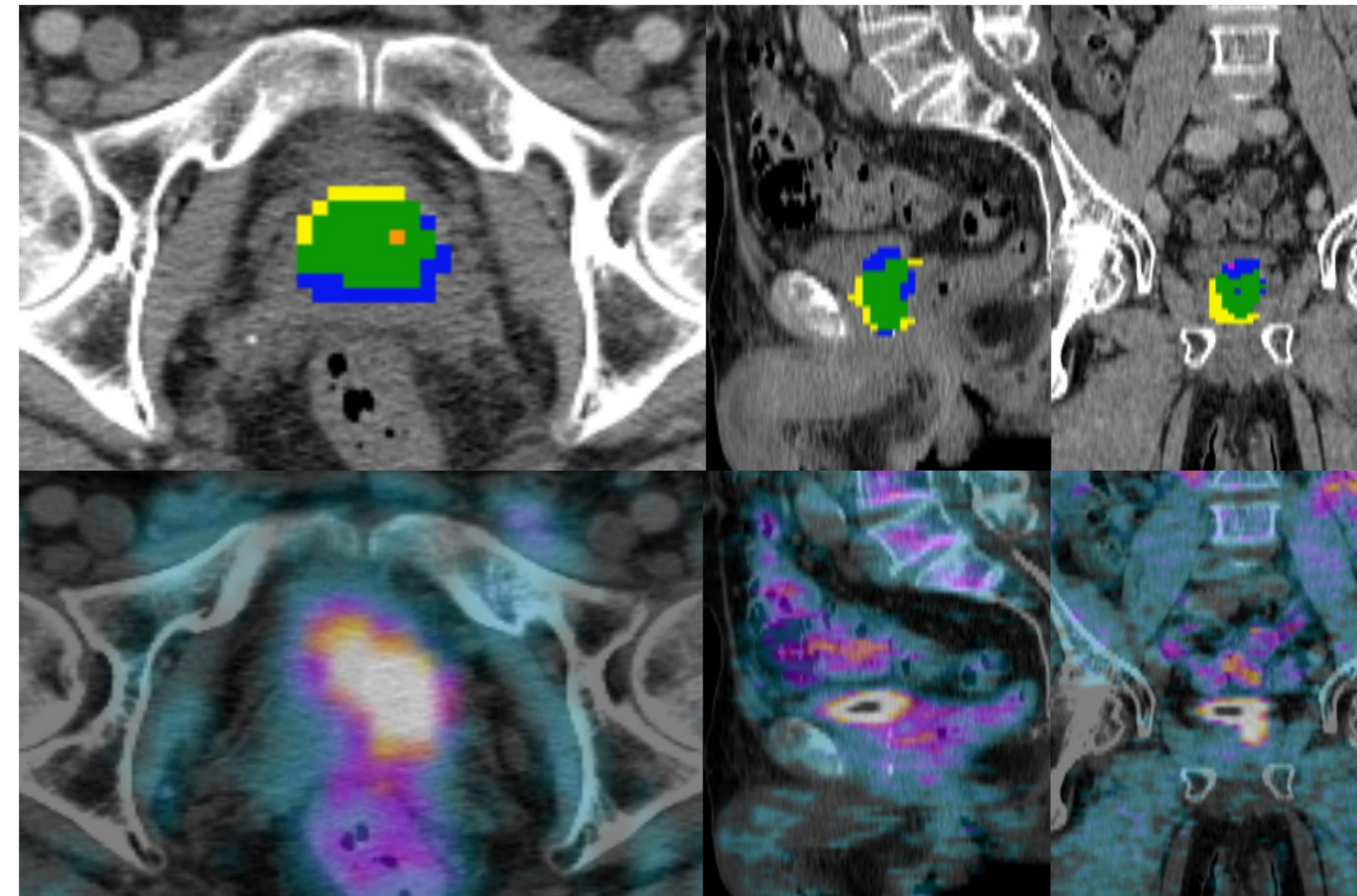
RESULTS

Fig. 1



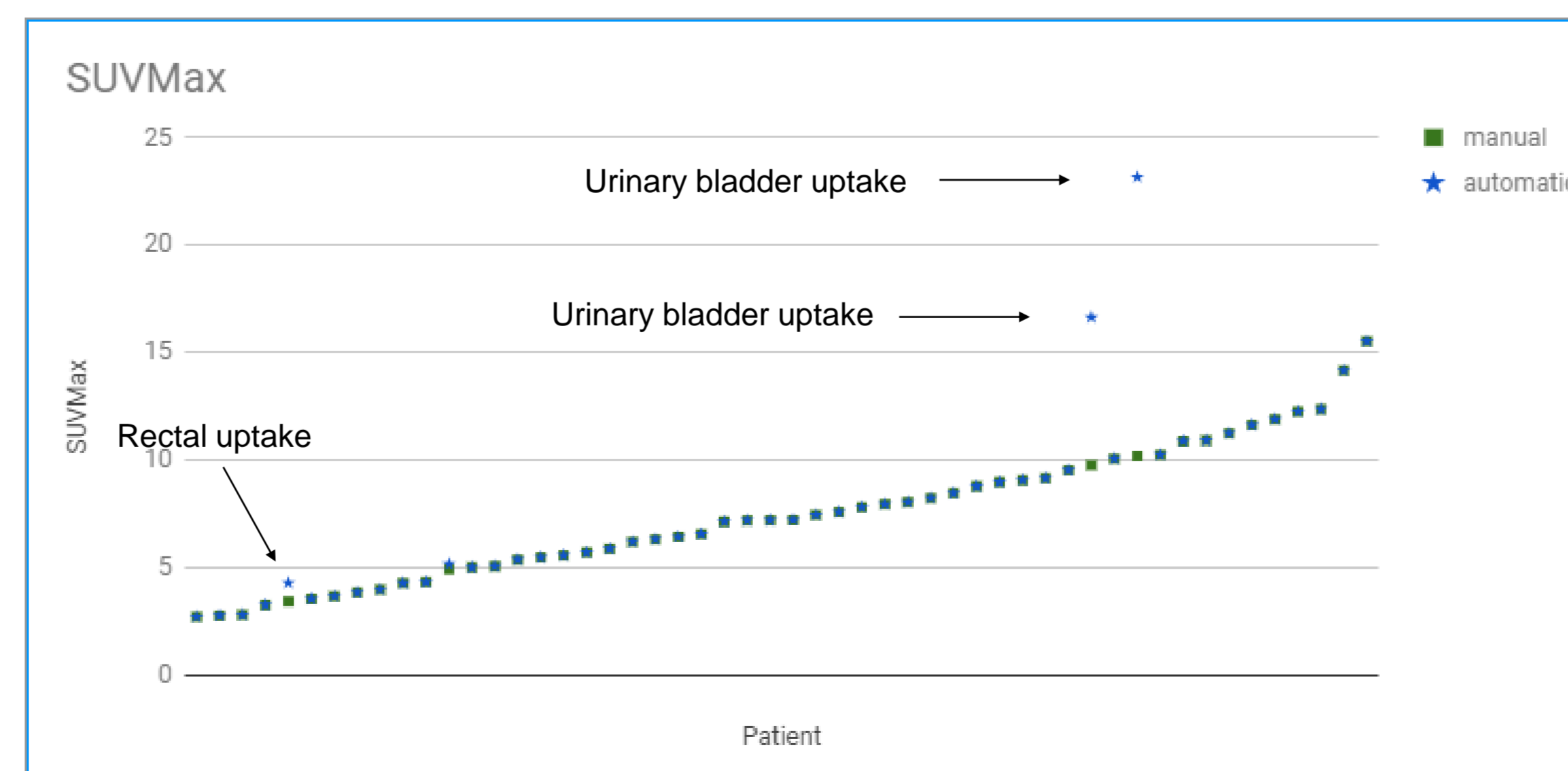
Prostate gland volume measurements: manual CT (blue), automatic method (red) and specimen weight after surgery (orange).

Fig. 2



Upper: CT fused with manual segmentation (yellow), automatic (blue) and agreement between automatic and manual (green)
Lower: 18F-FDG Choline PET/CT

Fig. 3



Prostate gland tumor SUVmax: manual measurement (green) and automatisk measurement (blue).

RESULTS

1. SUVmax avg.: 7,5 (range 2,7 to 15,5)

- Identical in 49 patients.
- Mismatch in 3 patients.
 - Urinary bladder 2 patients
 - Rectum 1 patients
- (Fig.3)

2. Prostate weight avg. 50 gr (range 20 to 109) in 45 patients.

3. Volume automatically measured avg. 51 ml (range 27 to 75).

4. Correlation between prostate weight and volume automatically measured 0,77.

CONCLUSIONS

Our deep learning based method for fast automated analysis of the prostate gland in PET/CT studies showed good agreement with manually obtained measurements and pathology-derived weight of the prostatectomy specimens suggesting that this approach may become a promising adjunct to quantitative assessment of PET/CT studies in prostate cancer patients. The method is now open for validation in future prospective clinical trials.

If you are interested in our project

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