UNIVERSITÄTS KLINIKUM FREIBURG

Klinik für Strahlenheilkunde

Clinical evaluation of a fully automatic body delineation algorithm for radiotherapy

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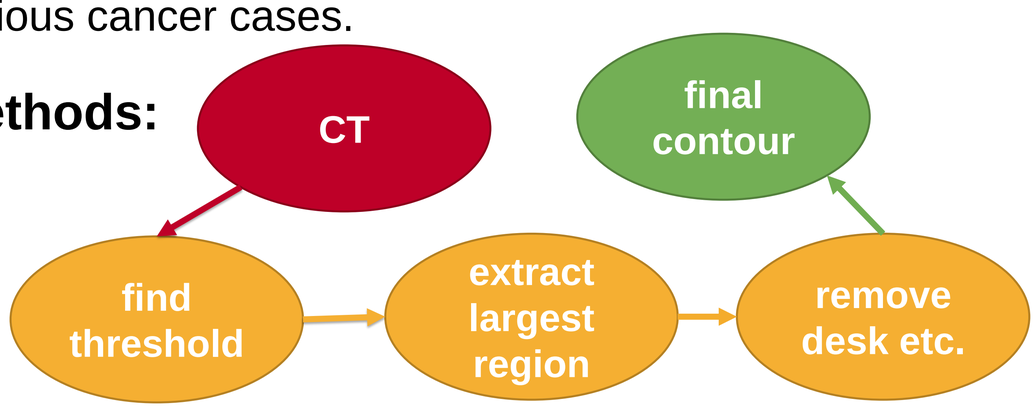
Purpose:

The aim of radiotherapy is to deliver the highest possible dose to the tumour and spare surrounding healthy tissue. For **high efficacy** an **accurate delineation** of the body outline on planning CT is crucial. However, depending on the tumour and treatment type, positioning markers, implanted catheters (brachytherapy), air bellow belt, fixation mattress, table and/or blankets are directly adjacent to the patient' skin. Algorithms currently employed in clinical settings often cannot distinguish those devices and include them in the body segmentation which requires **tedious manual corrections**. In this work, a fully automatic algorithm for body delineation which can handle structures adjacent to the patient is clinically evaluated for various cancer cases.

Methods:



For testing a MITK platform implementation of the previously published algorithm [1] was used. For evaluation purposes, segmentation was performed on the planning CT of **30 patients**:

- 10 lung cancer patients,
- 10 patients with a prostatic lesion and
- 10 rectum carcinoma patients.

CT scans were acquired on different scanners with highly varying image features. Body delineations used for real treatment planning served as reference contours.

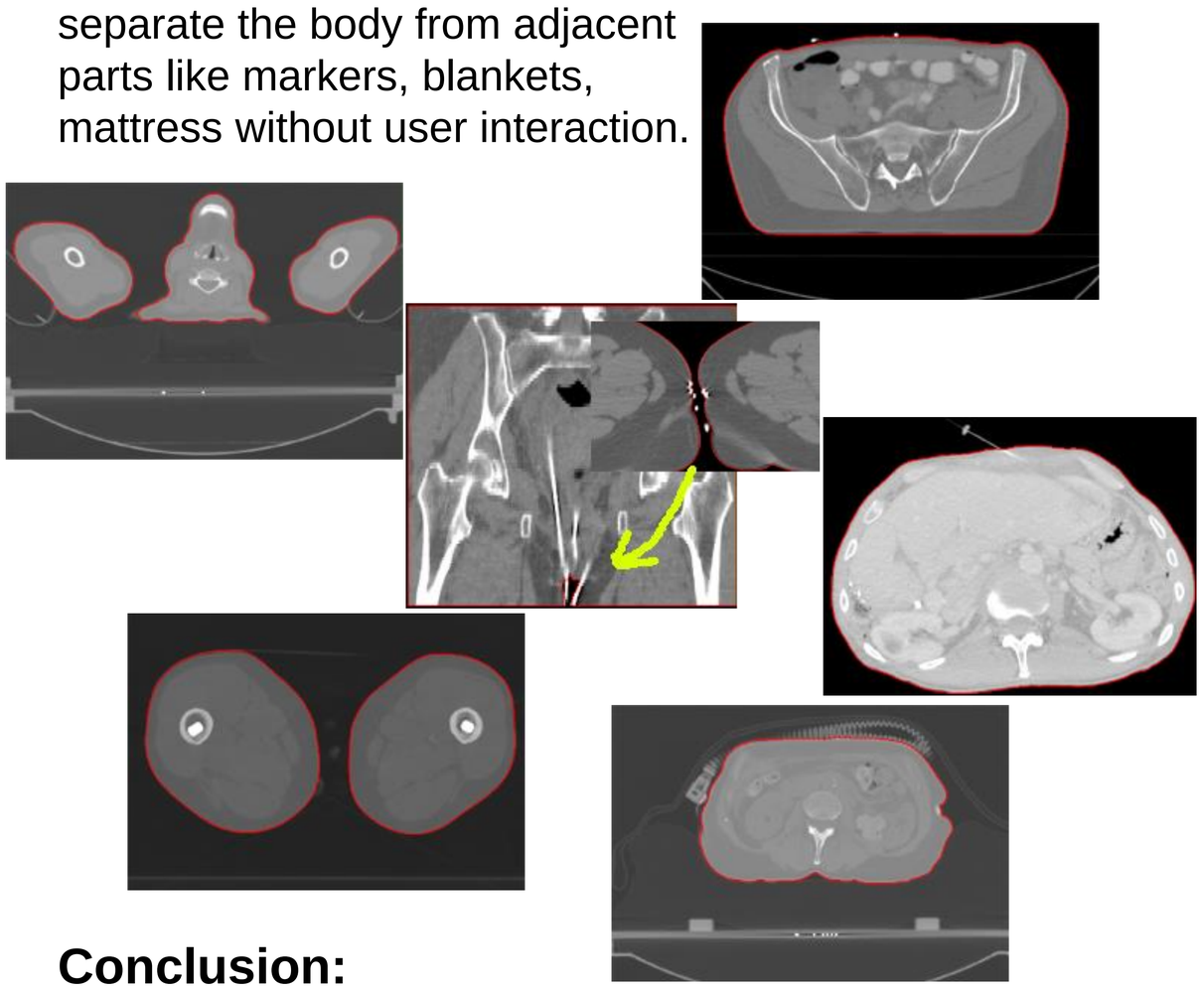
[1] Fechter T, Dolz J, Chirindel A, Schlachter M, Carles M, Adebahr S, Mix M, Nestle U. "Fully Automatic Danger Zone Determination for SBRT in NSCLC". Journal of Radiation Oncology Informatics, 7(1): 1-27, July 2015.

Results:

The following figures of merit were obtained:

volume ratio	0.99 ± 0.006
falsely classified pixels	0.28 ± 0.18 %
Dice's coefficient	0.99 ± 0.002
Hausdorff distance	6.02 ± 3.42 mm
runtime	16.8 ± 6.23 seconds

For all cases the algorithm was able to successfully separate the body from adjacent parts like markers, blankets, mattress without user interaction.



Conclusion:

We have presented a **fully automatic** algorithm for body delineation that can handle structures adjacent to the patient. Evaluation on 30 clinical cases demonstrated **a very good performance** and an **excellent agreement** with respect to reference contours. Results suggest the suitability of the algorithm for clinical use with cases of the tested region between thorax and pelvis. Future work will explore the use of the algorithm for other body regions.