

Efficient Selection of the Most Similar Image in a Database for Critical Structures Segmentation

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Introduction

Goal: Automatic segmentation of critical structures in the head and neck region for radiotherapy planning.

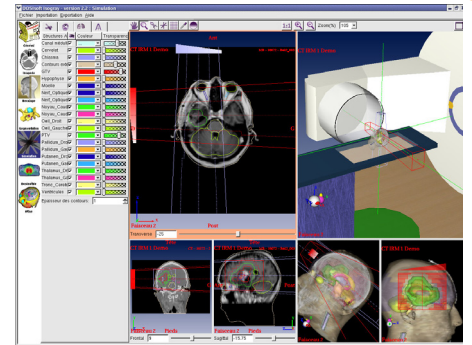
Our method: Creation and non linear registration of an atlas on the patient [1].

Problem: High anatomic variability between the patients of the database.

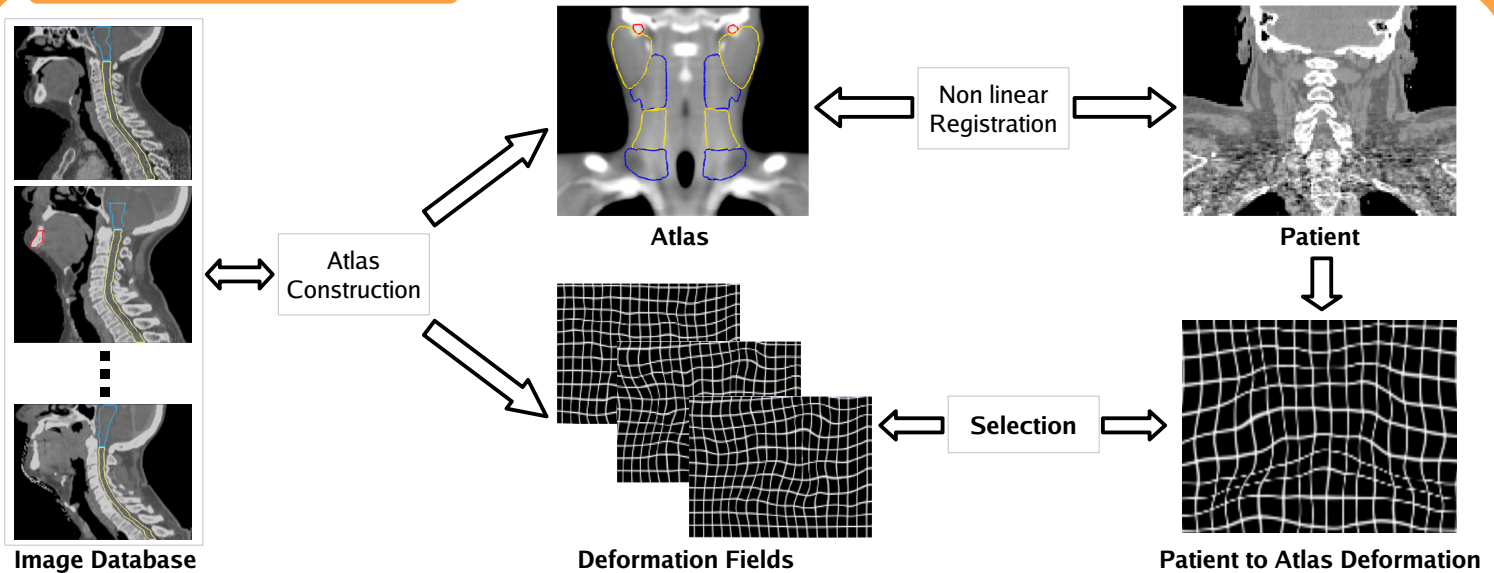
⇒ Leads to registration discrepancies and to over-segmented structures in the atlas.

Approach:

- Select the most similar image among a database to the patient to be delineated
- Register the selected image on the patient image and warp the segmentations on it.



Most Similar Image Selection



Database of 45 manually delineated images: I_k

Results of Atlas Construction (precomputed):

- Average Image M
- Non linear transformations $T_{M \rightarrow I_k}$

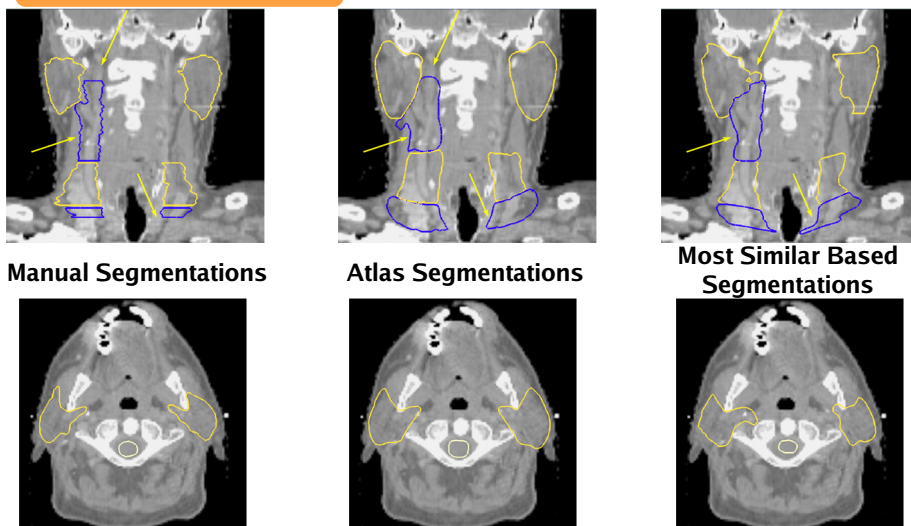
Most Similar Patient Based Segmentation:

- Registration of patient on the atlas: transformation $T_{M \rightarrow P}$
- Selection of the closest transformation in the database

$$\tilde{I} = \operatorname{argmin}_i \sum_t \|T_{M \rightarrow I_k} \circ T_{M \rightarrow P}^{-1} - Id\|$$

- Atlas-based registration using \tilde{I} as the atlas

Results



Conclusion

- Efficient method: only one more non linear registration compared to atlas segmentation
- Leave-One-Out Evaluation on 12 patients:
 - Increased specificity: less over-segmentation
 - High variability of delineation among the patients of the database

Perspectives:

- Constrain the registration using the available manual segmentations
- Use of several atlases: provides a way to select the closest atlas to a patient

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[1] O. Commowick and G. Malandain. "Evaluation of Atlas Construction Strategies in the Context of Radiotherapy Planning". In Proc. of the SA2PM Workshop, October 2006. Note: Held in conjunction with MICCAI 2006.