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Design and Use of Aatomical Atlases for Radiotherapy

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prepared at INRIA Sophia Antipolis, Asclepios Team

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Acknowledgments

Last thing to do :-)

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1.1 Illustration Example

1.1.1 A subsection just for fun

Sorry I won't write your PhD here ;) This small text just to mention that this style supports writing with accents such as in french words (thèse, définir, ...). Also I put here a simple way to include an image. This is standard latex. For pdflatex compilation, the extension of the images is jpg. For latex compilation, this is ps or eps. The base folder containing images is set in formatAndDefs.tex, as well as the default extensions added to the image names.

1.2 An equation

Just to show argmin and partial derivative commands.

$$T = \arg\min_{T} E(T, R, F) \tag{1.1}$$

Regularization:

$$\frac{\partial T}{\partial t} = \Delta T \tag{1.2}$$

1.3 An other section

Showing a great bullet list environment:
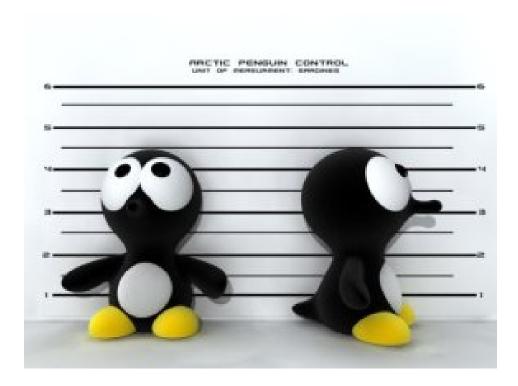
- First point

- Second point

Figure 1.1: A nice image...

Appendix Example

A.1 Appendix Example section

And I cite myself to show by bibtex style file (two authors) [Commowick 2007].

This for other bibtex stye file : only one author [Oakes 1999] and many authors [Guimond 2000].

Bibliography

[Commowick 2007] Olivier Commowick and Grégoire Malandain. *Efficient Selection of the Most Similar Image in a Database for Critical Structures Segmentation.* In Proceedings of the 10th Int. Conf. on Medical Image Computing and Computer-Assisted Intervention - MICCAI 2007, Part II, volume 4792 of *LNCS*, pages 203–210. Springer Verlag, 2007. (Cited on page 3.)

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[Oakes 1999] David Oakes. *Direct Calculation of the Information Matrix via the EM Algorithm.* J. R. Statistical Society, vol. 61, no. 2, pages 479–482, 1999. (Cited on page 3.)

Design and Use of Numerical Anatomical Atlases for Radiotherapy

Abstract: The main objective of this thesis is to provide radio-oncology specialists with automatic tools for delineating organs at risk of a patient undergoing a radiotherapy treatment of cerebral or head and neck tumors.

To achieve this goal, we use an anatomical atlas, i.e. a representative anatomy associated to a clinical image representing it. The registration of this atlas allows to segment automatically the patient structures and to accelerate this process. Contributions in this method are presented on three axes.

First, we want to obtain a registration method which is as independent as possible w.r.t. the setting of its parameters. This setting, done by the clinician, indeed needs to be minimal while guaranteeing a robust result. We therefore propose registration methods allowing to better control the obtained transformation, using outlier rejection techniques or locally affine transformations.

The second axis is dedicated to the consideration of structures associated with the presence of the tumor. These structures, not present in the atlas, indeed lead to local errors in the atlas-based segmentation. We therefore propose methods to delineate these structures and take them into account in the registration.

Finally, we present the construction of an anatomical atlas of the head and neck region and its evaluation on a database of patients. We show in this part the feasibility of the use of an atlas for this region, as well as a simple method to evaluate the registration methods used to build an atlas.

All this research work has been implemented in a commercial software (Imago from DOSIsoft), allowing us to validate our results in clinical conditions.

Keywords: Atlas-based Segmentation, non rigid registration, radiotherapy, atlas creation