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Design and Use of Aatomical Atlases for Radiotherapy

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Acknowledgments

Last thing to do :-)

Contents

Chapter 1

Introduction

Contents

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

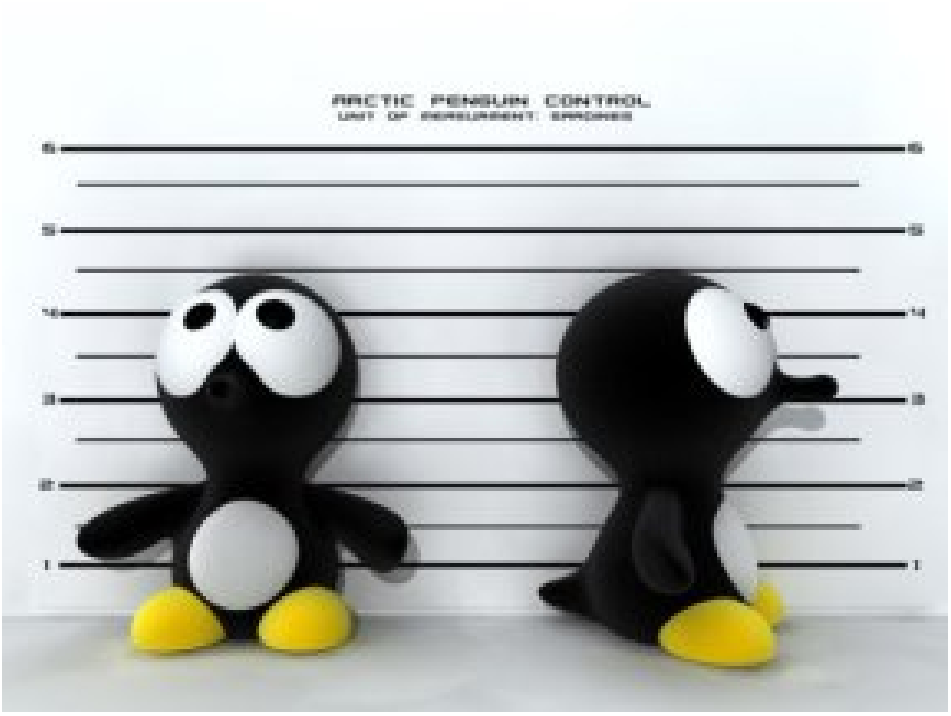

Figure 1.1: A nice image...

Chapter 2

No-name yet

2.1 Query taxonomy and re-usability formalization

A query is defined as a n-tuple as follows:

$$Q := \langle A, P_s, P_c, DS, R, r \rangle$$

where:

A is a set of abstract services defining the query Q.

P_s is a set of user preferences over the data services that will be selected to potentially answer the query Q.

P_c is a set of user preferences over the composition of data services that potentially can answer the query Q.

DS is a set of data services that were selected satisfying the restrictions defined by P_s to potentially rewrite the query Q.

R is a set of rewritings produced using the data services in DS and satisfying the restrictions defined by P_c that potentially can answer the query Q.

r is the rewriting that were selected and executed to answer the query Q.

The query taxonomy presented below is defined according to the relation that can be established between two queries. Considering two queries Q_1 and Q_2, the taxonomy specifies thirteen types of query classified in four groups:

1. Q_1 and Q_2's answer expect the same data. For example, Q_1 and Q_2 retrieve patients that were infected by pneumonia.

2. The data denoted by the answer of Q_1 is a subset of the data denoted by the answer of Q_2. For example, Q_2 retrieves patients that were infected by pneumonia and Q_1 retrieves patients that were infected by pneumonia and treated by the doctor Lucas.

3. The data denoted by the answer of Q_1 is a superset of the data denoted by the answer of Q_2. For example, Q_2 retrieves patients that were infected by pneumonia and treated by the doctor Lucas, and Q_1 retrieves patients that were infected by pneumonia.

4. The data denoted by the answer of Q_1 is different of the data denoted by the answer of Q_2. For example, Q_2 retrieves patients that were infected by pneumonia and treated by the doctor Lucas, and Q_1 retrieves patients that were infected by pneumonia with admission in the hospital Edouard Herriot.

The types of queries are described below and organized by their groups.

Query type 1 (Group 1): Q_1 is equivalent to Q_2.
This is the simplest case. Two queries are equivalents when:

1. They expect the same data as answer, which means they cover the same abstract services. The set of abstract service of Q_1, denoted as $Q_1.A$, is equals to the set of abstract services of Q_2, denoted as $Q_2.A$.

$$Q_1.A = Q_2.A$$

2. For each user preference over data services p_{si} defined in $Q_1.P_s$, there is a user preference p_{sj} equivalent defined in $Q_2.P_s$ such that the evaluation of p_{si} is equal to the evaluation of p_{sj}. Consequently, the score of $Q_1.P_s$ is equals to the score of $Q_2.P_s$.

3. For each user preference over composition p_{ci} defined in $Q_1.P_c$, there is a user preference p_{cj} equivalent defined in $Q_2.P_c$ such that the evaluation of p_{ci} is equal to the evaluation of p_{cj}. Consequently, the score of $Q_1.P_c$ is equals to the score of $Q_2.P_c$.

In the re-usability point of view, the data services that were selected to answer the query Q_1, denoted by $Q_1.DS$, could be used to answer the query Q_2 assuming that they are available in the moment. In other words, $Q_1.DS$ is equivalent to $Q_2.DS$. Moreover, the rewritings produced to the query Q_1 could also be used to answer the query Q_2 assuming that the data services are available.

Definition 1 *Teste*

Appendix A

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 7.)

[Guimond 2000] A. Guimond, J. Meunier and J.-P. Thirion. *Average Brain Models: A Convergence Study.* Computer Vision and Image Understanding, vol. 77, no. 2, pages 192–210, 2000. (Cited on page 7.)

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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