

An Inspiring Title for the MELBA Journal Sample Article

Adrian V. Dalca
EECS, Massachusetts Institute of Technology, Cambridge, MA, USA

adalca@mit.edu

Mert R. Sabuncu
School of Electrical and Computer Engineering, Cornell University, Ithaca, NY, USA

msabuncu@cornell.edu

Abstract

We develop a learning framework for building deformable templates, which play a fundamental role in many image analysis and computational anatomy tasks. Conventional methods for template creation and image alignment to the template have undergone decades of rich technical development. In these frameworks, templates are constructed using an iterative process of template estimation and alignment, which is often computationally very expensive. Due in part to this shortcoming, most methods compute a single template for the entire population of images, or a few templates for specific sub-groups of the data. In this work, we present a probabilistic model and efficient learning strategy that yields either universal or *conditional* templates, jointly with a neural network that provides efficient alignment of the images to these templates. We demonstrate the usefulness of this method on a variety of domains, with a special focus on neuroimaging. This is particularly useful for clinical applications where a pre-existing template does not exist, or creating a new one with traditional methods can be prohibitively expensive. Our code is available at <http://yoururl.com>.

Keywords: Machine Learning, Image Registration

1. Introduction

A deformable template is an image that can be geometrically deformed to match images in a dataset, providing a common reference frame. Templates are a powerful tool that enables the analysis of geometric variability. They have been used in computer vision, medical image analysis, graphics, and time series signals.

2. Related Works

Spatial alignment, or registration, between two images is a building block for estimation of deformable templates. Alignment usually involves two steps: a global affine transformation, and a deformable transformation (as in many optical flow applications).

Use `\cite{}` for reference that is part of the sentence, and `\citep{}` for references in parenthesis. For example, Viola and Wells III (1997) is awesome. Also, this is a citation (Viola and Wells III, 1997).

3. Methods

3.1 Equations

We estimate the deformable template parameters θ_t and the deformation fields for every data point using maximum likelihood. Letting $\mathcal{V} = \{\mathbf{v}_i\}$ and $\mathcal{A} = \{a_i\}$,

$$\begin{aligned}\hat{\theta}_t, \hat{\mathcal{V}} &= \arg \max_{\theta_t, \mathcal{V}} \log p_{\theta_t}(\mathcal{V} | \mathcal{X}, \mathcal{A}) \\ &= \arg \max_{\theta_t, \mathcal{V}} \log p_{\theta_t}(\mathcal{X} | \mathcal{V}; \mathcal{A}) + \log p(\mathcal{V}),\end{aligned}\tag{1}$$

where the first term captures the likelihood of the data and deformations, and the second term controls a prior over the deformation fields.

Proof Awesome proof. ■

3.2 Math styles

Different font styles can be used for equations:

- $\$a b c A B C 1 2 3\$$: $abcABC123$
- $\$\mathbf{a b c A B C 1 2 3}\$$: $\mathbf{abcABC123}$
- $\$\mathbf{a b c A B C 1 2 3}\$$: $\mathbf{abcABC123}$
- $\$\mathbf{a b c A B C 1 2 3}\$$: $\mathbf{abcABC123}$
- $\$\mathcal{A B C}\$$: \mathcal{ABC}
- $\$\mathbb{A B C}\$$: \mathbb{ABC}

Text and names in equations should be dealt with the `\text` command, for instance:

$\$\mathcal{L}_{\text{SuperLoss}}\$$ and not $\mathcal{L}_{SuperLoss}$.

4. Section

4.1 Subsection

4.1.1 SUBSUBSECTION

Paragraph Ex culpa ut commodo proident esse excepteur mollit in sed aliqua fugiat sed cupidatat dolor sint quis veniam amet aute ea fugiat quis do excepteur sunt commodo magna cupidatat veniam minim anim mollit do enim et nostrud ad esse velit nisi est dolor do ut dolore excepteur nulla ex sunt exercitation consequat ullamco ad in fugiat ut ut enim adipisicing cillum nisi anim ullamco ullamco nisi esse aute dolore amet nisi adipisicing dolor dolore do ut aliqua in sunt aliqua tempor dui amet ut non adipisicing nostrud ex ullamco excepteur culpa anim est minim fugiat laborum ex irure consectetur eu in reprehenderit sint magna ut consequat laborum ex minim laboris culpa amet incididunt laborum laborum dolore nulla cupidatat dolore in aliqua ut eu in magna sunt eiusmod est labore sit eu incididunt fugiat in culpa pariatur voluptate dui id velit sunt reprehenderit pariatur amet esse dolore minim non fugiat fugiat amet incididunt commodo sit dolor.

57 5. Table and Figures

Table 1: By convention, Table caption goes on top.

Left	center	right
111	222	333
444	555	666

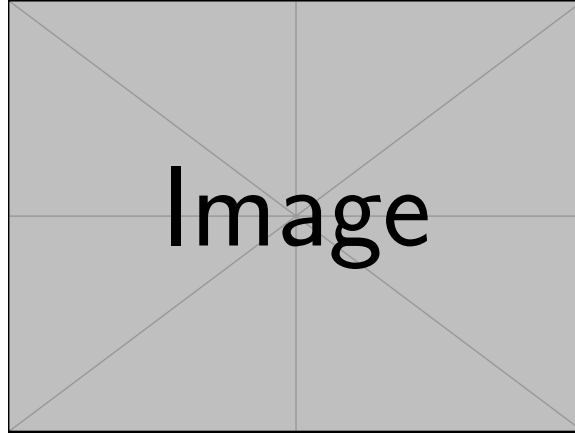


Figure 1: Example figure. Notice that the caption goes below.

58 Acknowledgments

59 This work was supported by grants X, Y and Z. We also acknowledge important conversa-
60 tions with our colleagues A, B and C.

61 Ethical Standards

62 The work follows appropriate ethical standards in conducting research and writing the
63 manuscript, following all applicable laws and regulations regarding treatment of animals or
64 human subjects.

65 Conflicts of Interest

66 The conflicts of interest have not been entered yet.

67 References

68 Paul Viola and William M Wells III. Alignment by maximization of mutual information.
69 *International journal of computer vision*, 24(2):137–154, 1997.

70 **Appendix A. Proof of the central theorem**

71 In this appendix we prove the central theorem and present additional experimental results.
 72 *Remainder omitted in this sample.*

73 **Appendix B. Section**

74 **B.1 Subsection**

75 B.1.1 SUBSUBSECTION

76 **Paragraph** Lorem ipsum dolor sit amet, consectetur adipisicing elit, sed do eiusmod
 77 tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis
 78 nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat. Duis aute
 79 irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur.
 80 Excepteur sint occaecat cupidatat non proident, sunt in culpa qui officia deserunt mollit
 81 anim id est laborum.