

An Inspiring Title for the MELBA Journal Sample Article

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Abstract

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

15 **Keywords:** Machine Learning, Image Registration

16 1. Introduction

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

21 2. Related Works

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

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

27 3. Methods

28 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 $\mathcal{A} = \{a_i\}$,

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

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

31 **Proof** Awesome proof. ■

33 Acknowledgments

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35 roNex grant 1707312.

36 Appendix A.

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