



Unification of Appearance Models and Non-rigid Registration

Abstract: Statistical models of appearance possess the ability to faithfully describe shape variation, as well as the variation in pixel intensities. Nonetheless, in order for such models to synthesise valid full appearances, it is essential that landmarks can be consistently identified in the training sets defining these models. One way of automatically achieving data landmarking is to establish an overlap across the training set, much as is already done in image registration.

We contend that the task of registration should seek a globally correct answer, rather than applying transformations that are reliant on the choice of a single reference image. The intrinsic power of appearance models, as well as Minimum Description Length considerations, allow us to define a fully automatic group-wise non-rigid registration scheme.

Various observations motivated us to investigate the innate bonds between non-rigid image registration and appearance models. Unification of the two will be mutually beneficiary and can entail a novel image analysis and alignment framework.

A complex and highly flexible application we constructed and called AART (Autonomous Appearance-based Registration Test-bed) provides proof of the premise above. It benchmarks genuine registration algorithms against other well-performing pair-wise algorithms and newly-conceived methods to illustrate the advantages gained by unifying registration and statistical modeling.

Keywords: *Novel Applications (primary keyword)*

Atlases
Morphometry - Other
Registration
Statistical Analysis

Submission in PDF format (212 Kb)

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Submission Type

8 page paper - (poster or oral - let committee choose presentation method)

Student Competition

Eligible for the Student Competition

Most important contribution

The most prominent contribution is the unprecedented unification of statistical models and image registration which increases the power of both, thereby making this contribution twofold.

Clinical relevance

The techniques under investigation have become commonplace in medical image analysis. Statistical models of deformation are used to describe biological variation and registration is frequently used to enable inter-subject comparison of data. Of particular interest is the application of our work to detection of atrophies in the brain.

Most closely related work by others

Successful work on image registration has for long been published by numerous groups. David Hawkes and his group presently work on the registration of brain images, but limitations seem inevitable due to the sparse transformations. We also find that a pair-wise methodology, most ordinarily one which is based on one reference or mean image, is taken by most groups. Our new methods present a robust group-wise optimisation whose outcomes are impressive and our application provides a benchmark of many existing and newly-conceived registration schemes.

Relation to Your Previous Work

This paper presents an innovative approach that has not yet been published.

[Back to previous page](#)