

One Page Summary: Information-Theoretic Unification of Groupwise Non-Rigid Registration and Model Building.

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Summary of the Contribution of this Work

This paper outlines a principled approach to groupwise non-rigid registration of sets of images. It is based on the Minimum Description Length (MDL) objective function, as previously used for solving the correspondence problem in shape modeling. MDL has been previously used in image registration; the main contribution of this paper is in showing how a groupwise model of shape and appearance can be included as an integral part of the registration algorithm. The earlier MDL approach hence becomes in effect the initialisation stage for the full algorithm.

The paper presents the theoretical background to the algorithm, including pseudo-code showing the detailed structure. The algorithm is then demonstrated using a set of 104 2D MR images extracted from 3D images of normal human brains. The results are quantitatively compared with other groupwise and pairwise registration methods, showing that groupwise registration offers a statistically-significant improvement over pairwise methods.

Technical Contribution

The MDL objective function used here is not new. However, what is new is the algorithmic framework, showing how the groupwise model is included in the MDL framework, how the model is initialised, and how the model is continuously updated during the course of the registration.

Relation to Previously Published Research

The MDL approach to groupwise image registration was introduced in:

C. J. Twining, S. Marsland, and C. J. Taylor. Groupwise non-rigid registration: The minimum description length approach. In *Proceedings of the British Machine Vision Conference (BMVC)*, volume 1, pages 417–426, 2004.

The current paper is a shortened version of the paper:

C.J. Twining, Tim Cootes, Stephen Marsland, Vladimir Petrovic, Roy Schestowitz, and Chris J. Taylor. A Unified Information-Theoretic Approach to Groupwise Non-Rigid Registration and Model Building. In *Proceedings of the 19th International Conference on Information Processing in Medical Images (IPMI'05)*, volume 3565 of Lecture Notes in Computer Science, pages 1-14. Springer, 2005.