

A fully automatic medical image registration algorithm based on mutual information

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Image registration is a fundamental task in digital image processing used to match two independently acquired images. These images are taken at different times, from different viewpoints or even from different imaging devices. To register images, the geometrical relationship between them is to be determined.

Image registration is an important area of medical image processing. Matching all the geometric data available for a patient provides better diagnostic capability, better understanding of data, and improves surgical and therapy planning and evaluation.

A registration problem is unimodal, if the images are from the same imaging device and multimodal using images taken by different devices.

We developed a fully automatic registration algorithm capable of solving both unimodal and multimodal registration problems. The images can be 2D or 3D. We assume that a rigid-body transformation is to be found which is the case in most applications of brain image registration. We use mutual information as similarity measure which is the most successfully applied measure in multimodal registration.

We validated our algorithm using the image database of Vanderbilt University, Nashville, TN, USA. The results show that our algorithm can be successfully used to register MR-CT and MR-PET images. The description of the Retrospective Registration Evaluation Project can be found at <http://www.vuse.vanderbilt.edu/~image/registration>.