APPLICATIONS OF COMPUTER IMAGE REGISTRATION TECHNIQUES ON NUCLEAR MEDICINE IMAGES

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Modern medicine has been widely using imaging as a fundamental tool to aid in diagnosis procedures, monitoring the evolution of pathologies and the planning of treatments and surgeries. However, the enhancement of digital medical image acquisition and its analysis cannot be appropriately achieved without a suitable performance of semi- or full automated methods for intra- and inter-modality registration.

Image registration computer techniques enable the integration of different medical image modalities and the easier detection of changes between images acquired from different points of view, different acquisition times or even with subject atlas to attain prior anatomic or functional information. It stresses changes in size, shape or image intensity over time, and relates both preoperative image and surgical plans to the physical reality of patients during intervention and aligns patient's anatomy to a standardized atlas.

Techniques of image registration aim the establishment of spatial correspondence with the goal of find the optimal transformation that best aligns the structures of interest in the input image. The minimization of an error measure, or of a cost function, is the goal of these techniques. Additionally, an optimization algorithm is needed to find the most suitable transformation, and an interpolator is employed to resample the features into the new registered space.

The application of image registration techniques in nuclear medicine includes correlative image interpretation, attenuation correction, scatter correction, correction for limited resolution and improvement of the reconstruction accuracy in emission tomography. These techniques have been also used in the co-registration of serial functional studies, for the transformation to standard spaces for their comparison with both normal studies and data from other modalities, in conformal radiotherapy treatment planning and functionally guided procedures. Besides, have been improving the interpretation of several functional studies based on static images, including brain, breast, chest, liver, kidneys and colon images, or on the motion analysis as in cardiac and lung studies.

Here, computer techniques of image registration are reviewed, including their classification and main steps. Usual transformation, optimization and interpolator algorithms are described and discussed. Clinical applications are also reported giving emphasis to the nuclear medicine area.

Keywords: medical image, image registration, nuclear medicine imaging

References

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