AbstractID: 1422 Title: Deformable Image Registration Using Multiresolution B-Splines

Fast and accurate registration of 2-D, 3-D and 4-D image data from different modalities and the same modality over time is an essential component for image guided treatment planning and delivery (IGRT). Mapping information such as tumor volumes, structure outlines and computed doses from one image dataset to another are just a few of the IGRT tasks that depend on robust image registration. In order to handle the broadest range of clinical situations, the registration process must accommodate tissue deformations, be relatively fast and require little or no user supervision. We describe an approach to the image registration problem that uses B-spline basis functions to represent an n-dimensional deformation model as well as intensity-based metrics such as mutual information to drive the registration. The inputs to this process are any two image datasets that have some degree of anatomic overlap. A gradient descent algorithm is used to vary the B-spline coefficients of a regular grid of knots placed across the datasets until the registration metric is minimized. To help avoid local minima, the registration process starts with a coarse grid and subdivides it by a factor of two after convergence. The process is repeated until the knot spacing in each dimension falls below a predefined threshold value. The final B-spline knot spacings and coefficients can then be used to map other geometric and dose information between the two datasets. Details of this approach, validation studies and comparisons to other deformation models will be presented.

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