Integrating Automated and Manual Multimodal Data Registration

The ability to register multimodal imaging data has been declared essential to modern three-dimensional radiation treatment planning (Int. J. Radiation Oncology, 40:1, 1998). We have combined a robust automated registration technique, the Maximization of Mutual Information (MMI), with an intuitive visualization and manual registration system. The MMI algorithm utilizes the information theoretic parameter, mutual information, as a measure of the goodness-of-fit of two different volume data sets related by a three-dimensional rigid transform. This measure is used as the objective function in a Powell direction-set optimization over the parameter space of rigid transforms. MMI has been demonstrated to be an effective automated registration for multimodal medical imagery (Medical Image Analysis, 1:3, 1996). However, the complexities of human anatomy prevent any automated method from being fail-safe, so a method is needed to visualize and verify the result of the automated registration, as well as modifying the registration by hand if needed. This is handled by an intuitive Graphical User Interface (GUI), which combines an orthogonal plane viewer with a simple manual registration mechanism. The orthogonal plane viewer allows the user to examine the automated registration progress interactively as the optimization proceeds. Once the automated registration converges, the user can manually adjust the transform, if necessary, using mouse drags. We have developed a fast integer-based affine resampling algorithm that contributes both to the responsiveness of the GUI and the speed of the automated MMI registration.

* Supported by Computerized Medical Systems, Inc.