AbstractID: 9128 Title: A new self-consistent inverse deformation field generator and its applications

Purpose: To provide a tool to map image intensity, dose, and contours back-and-forth consistently between two images. **Method and Materials:** A new concept, a *self-consistent Inverse Displacement Vector Field (IDVF)* is defined and an algorithm to generate the IDVF is implemented. A deformable image registration (DIR) algorithm was chosen to generate a DVF_{A-B} between reference image ***A*** and study image ***B***. The same DIR algorithm is also used to generate DVF_{B-A} and our IDVF generator is used to create $IDVF_{B-A}$, which is consistent with DVF_{A-B}. To test whether DVF_{B-A} or $IDVF_{B-A}$ better maps information from ***A***-***B*** back to ***A*** for a lung 4D CT dataset, an arbitrary set of points S_A is chosen and are warped to S_B by using DVF_{A-B}. DVF_{B-A} is used to warp S_B back to ***A*** to get S^D_A. Similarly, $IDVF_{B-A}$ is used to warp S_B back to ***A*** to get S^I_A. For each point in S^D_A (or S^I_A), we know its original point in S_A. Hence, one can calculate the Euclidean distance between each point in S^D_A (or S^I_A) and its original point in S_A to quantify the error in the back-and-forth image warping. Similarly, dose on ***A*** is warped to ***B*** and back to ***A***. **Results:** The IDVF warped points from study back to reference with maximum error about 10 times smaller than using DVF_{B-A}. Similarly, the $IDVF_{B-A}$ dose maximum warping error is about 2 times smaller than using DVF_{B-A}. **Conclusion:** This work shows that it is possible to generate self-consistent IDVF with small mapping error. This IDVF is useful to warp contours and dose for IGART. (Work supported by NIH P01CA116602).