

AbstractID: 8831 Title: A Data Structure for B-Spline Registration

Purpose: To design a better data structure for B-spline registration.

Method and Materials: We have designed a grid alignment technique and a data structure that greatly improves the computation speed of B-spline registration. The basic idea is to align the B-spline grid with the voxel grid, so that the volume is partitioned into tiles of equal size. The use of equal sized tiles is important for this approach, because it allows the coefficient multipliers used for B-spline interpolation to be precomputed. A data structure consisting of four tables is used to provide fast access to precomputed index and multiplier values used for interpolation and gradient computations. Voxel indices are decomposed into tile and offset values which are accumulated in a single loop for each voxel.

Results: We have implemented the aligned B-spline registration method, and compared its performance against ITK B-splines and demons registration. Aligned B-splines with a mean-squared error cost function was found to be roughly equivalent in speed to the demons algorithm, and considerably faster than ITK B-splines. Running times were found to depend only on the image size, and not on the B-spline control point spacing.

Conclusion: When possible, an aligned grid should be used for B-spline registration.