

AbstractID: 14107 Title: A Parallel and Robust Image Registration Algorithm of Consecutive Stained Prostate Specimens for Ultrasound Tissue Characterization of Prostate Cancer

Purpose: To develop a robust and accurate image registration algorithm for the hymatoxylin stained pathology specimens for ultrasound tissue characterization of prostate cancer. **Method and Materials:** A landmark based nonlinear image registration algorithm is proposed. It was shown to be effective and robust under conditions of large deformations. In landmark based registration, the most important step is establishing the correspondence among the selected landmark points. This usually requires an extensive search which is often computationally expensive. We introduced a non-regular data partition algorithm using the K-means clustering algorithm to group the landmarks based on the number of available processing cores. The step optimizes the memory usage and data transfer. We have tested our method using IBM Cell Broadband Engine platform. **Results:** This technology was tested and evaluated on hymatoxylin stained pathology specimens for prostate cancer. The tested data sets consisted of ten patients and each patient had more than 3 sets of image slices: 3-D *in vivo* and *ex vivo* ultrasound images, and 3-D pathology images. The 3-D ultrasound data had a 2mm step size while the 3-D pathology step size was 4mm. Successful register was demonstrated with consecutive slices even though they exhibited significant slice cutting induced deformation and tissue missing. The *ex vivo* ultrasound images served as a verification of our registration technique. Moreover, the parallel algorithm, which is implemented on IBM cell broad band engine, helps us to achieve 10 fold speed-up. **Conclusion:** We have introduced a parallelization of an accurate image registration algorithm. The method is implemented on a IBM Cell/B.E. We have achieved approximately 10 fold speed up compared with its sequential implementation. Our proposed data partitioning approach and the parallelization schema are independent of the parallel platforms and are generic by design, therefore it can be extended to other applications on other parallel platforms.