

AbstractID: 5508 Title: Seed segmentation in C-arm fluoroscopy for brachytherapy implant reconstruction

Purpose: Intra-operative dosimetry in prostate brachytherapy critically depends on discerning the 3-D locations of implanted seeds. The accuracy of 3-D seed reconstruction step is, in turn, limited by the accuracy with which the position and orientation of individual implanted seed in the fluoroscopic images can be found. A method for robustly segmenting the seeds in fluoroscopic images is proposed here.

Methods and materials: The process of determining the locations and orientations of implanted seeds is sub-divided into three main steps. In the first step, the image is segmented by shape-size based morphological approach to eliminate background noise and do away with non-uniform brightness of the image, to get seed-like regions. These regions are either single seeds or overlapping multiple seed clusters. In the second step, the regions are analyzed and classified definitively, in a two-phase statistical process coupled with information extraction from original intensity image, into two classes: single seed and overlapping multiple seed cluster. In the third step, the region belonging to overlapping multiple seed cluster is resolved into its constituent individual seeds through a simple and novel technique.

Results: The proposed algorithm was tested on a set of ten clinical fluoroscopic images. The algorithm correctly determines the seeds with overall average of 99.57%. The clusters are not correctly resolved only in two images (2 clusters each, 1.7% and 1.6% of total seeds in respective implants). One false positive (noise labeled as seed) each is reported in two images, both the cases being where the tip of catheter appears to be of the size and shape of seed.

Conclusions: The algorithm builds on an existing framework of morphological processing and provides further improvements in classification and cluster resolution. The algorithm appears to be robust and accurate despite the poor resolution of clinical images.