Automated Seed Recognition for Intraoperative Prostate Brachytherapy Dosimetry

Post-implant dose computation of prostate brachytherapy requires seed coordinates. Commonly, the seeds are radiographically captured on film and their positions manually entered by digitizing stylus or mouse. However, for the purpose of intraoperative assessment and modification of dose distribution, manual seed recognition is too slow. To accelerate the process, we have developed an automated seed recognition algorithm based on thresholding, morphological processing, and connected component analysis. The program input is the digital implant image obtained with film or fluoroscopy. Output is the end-point coordinates of the seeds.

A method of extracting high contrast markers in relatively uniform background has been previously reported. However, segmentation of implant seeds is complicated by the presence of other high contrast objects such as balloon catheter, radio-opaque markers, and bony structures. The proposed method begins with grayscale thresholding. Since the balloon-occulded region may contain seeds, this solid region is processed separately. To accomplish this, the thresholded image is morphologically processed to generate a mask which is subsequently multiplied by the original image to isolate the seeds within the balloon. Regions inside and outside the balloon are then combined. Residual high frequency pixel fragments are removed by the despeckling operation. Finally, the segmented pixels are logically connected and analyzed for shape and size for the determination of object class and coordinates. The technique was compared with other image segmentation methods including background subtraction and adaptive thresholding and was found to be more robust.