Public Abstract

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Graduation Term:FS 2017
Department:Nuclear Engineering
Degree:PhD
Title:3D IMAGING FOR BRACHYTHERAPY PATIENT AND MOLD APPLICATOR POSITIONING

We developed a stereo vision method for 3D imaging of HDR brachytherapy skin cancer applicator positioning and tracking with respect to patients' anatomical features. The setup consists of two high-resolution scientific scan cameras (3840 x 2748 pixels) mounted on high-precision 4D of freedom optical mounts for submillimeter and sub degree positioning. A Rando phantom was used as a surrogate for patients' skin cancer and keloid treatments using a 3D printed applicator. Stereo images were recorded and analyzed using an in-house developed LabVIEW interface to determine the relative position of the applicator with respect to skin reference markers. Oncentra treatment planning system was used to perform reference applicator positioning in X, Y and Z coordinate to evaluate the stereo system accuracy and resolution. Calibration of the system spatial resolution shows optimal performance at 1000mm from the camera imaging plane to the imaged object. Calibrated screen target measurements show that positional error in the XY-plane is less than 0.39±0.21mm and a discrepancy in depth measurement within 0.48±0.32mm. Rando phantom experiments were performed to mimic skin cancer facial treatments. Tracking several reference points at the applicator we validate an average localization precision of 0.41±0.32mm, 0.46±0.38mm, and 0.3±0.21mm for the X, Y, and Z coordinates respectively. Applicator misplacement was simulated to determine dosimetric errors originated by applicator positioning inaccuracies. Misalignment of applicator by 5mm caused dosimetric shift up to 2.6% for overall PTV and 6.45% in reference points in treated region. The developed 3D imaging system was validated as a high-resolution and accurate stereo vision solution capable of submillimeter pre-treatment, intra and inter-fraction applicator positioning, and repeatability. This system can be used to continuously track the intra-fraction motion of the skin applicator with respect to the patient's anatomical surface to enhance treatment accuracy, safety, and quality.