Universität Basel

Publication

With Gaze Tracking Towards Noninvasive Eye Cancer Treatment

We present a new gaze tracking-based navigation scheme for proton beam radiation of intraocular tumors and we show the technical integration into the treatment facility. Currently, to treat a patient with such a tumor, a medical physicist positions the patient and the affected eye ball such that the radiation beam targets the tumor. This iterative eye positioning mechanism requires multiple X-rays, and radio-opaque clips previously sutured on the target eyeball. We investigate a possibility to replace this procedure with a noninvasive approach using a 3-D model-based gaze tracker. Previous work does not cover a comparably extensive integration of a gaze tracking device into a state-of-the-art proton beam facility without using additional hardware, such as a stereo optical tracking system. The integration is difficult because of limited available physical space, but only this enables to quantify the overall accuracy. We built a compact gaze tracker and integrated it into the proton beam radiation facility of the Paul Scherrer Institute in Villigen, Switzerland. Our results show that we can accurately estimate a healthy volunteer's point of gaze, which is the basis for the determination of the desired initial eye position. The proposed method is the first crucial step in order to make the proton therapy of the eye completely noninvasive.