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| Title: | Real Time External Surrogate Visual Tracking of Lung Tumours for Effective Radiotherapy |
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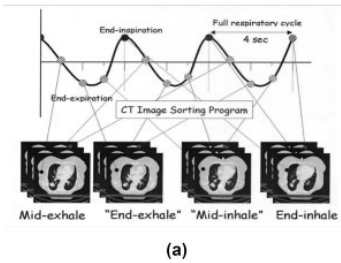
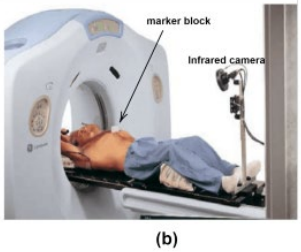
| Keyword(s): | External Surrogate, Radiotherapy, Lung Tumour<br>Internal Tumour Motion, Non-invasive, Visual Markers<br>Multiple Webcameras, Visual Tracking, External Chest Surface Movement<br>Respiratory Trace, Correspondence Model |
| Subject(s): | Computer vision, Biomedical |
| Abstract: | Radiotherapy is a common recourse for treating lung tumours. Due to respiratory action, the tumour inside the thorax region moves dynamically. If such movement is ignored, the surrounding healthy tissue gets exposed to a substantial dose of unintended radiation. The tumour motion is highly complex due to variation in the breathing pattern of the patient. In order to accommodate the tumour motion, surrogate-based techniques are employed to model the tumour motion during simulation and to localize the tumour motion during therapy. Internal surrogates, by implanting ducial marker near the tumour site gives good accuracy, however, the bene ts of accuracy are diminished by the risk and cost of invasive procedures, and additional dose. The external surrogates practised currently do not model the complex tumour motion and suffer from poor localization. Also, during therapy, it is important to align the patient on the couch at the beginning of every session, and monitor the position throughout the session. Traditionally, the patient setup is carried out manually using an orthogonal laser system. To overcome the above limitations, we propose a robust non-invasive external surrogate system to model the complex tumour motion, and automate the patient setup process. The proposed system is vision-based, observes the displacement of the multiple visual markers placed on the patient's thorax/abdominal surface, and simultaneously internal tumour motion captured using the CT scanner machine. The estimated 3D coordinate of the visual markers mapped to the tumour position using a point-based correspondence model. Our system provides dynamic visual registration of the patient at the beginning and throughout the therapy session. The aim of the thesis is to design, develop the proposed surrogate system and perform the experiment to estimate the precision of the system. The experimental results show that the proposed system is remarkably precise in localizing the marker positions, and amount of marker displacement, having a mean error 0.5mm. Overall, the experiment with the proposed system has produced acceptable results. |

Figure 4.5: The checkerboard pattern images captured for calibration




(a)




(b)